Service Forester's Handbook 2016

In Cooperation with Southern Regional Extension Forestry and the Southern Group of State Foresters

R8-MR 11 July 1986

United States
Department of Agriculture

Forest Service
Southern Region

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About the Service Forester's Handbook

The Service Forester's Handbook of the United States Forest Service was last updated in 1986 and underwent extensive review in 2012 and 2013. This publication reflects recent updates and is intended for use as a printable, portable resource. The handbook is available in both html and pdf form at http://handbook.sref.info. The online handbook is designed for user input and frequent updates. The associated mobile app, *The Service Forester's Toolkit App*, is available for free download from the Apple Store and the Google Play Store and includes major peer-reviewed additions to the online version of the handbook.

Credits

This publication is based on an extensive update of the *Service Forester's Handbook*, Miscellaneous Report, R8-MR 11., July 1986. USDA Forest Service Southern Region in Cooperation with Southern State Foresters, USDA Forest Service Southern Region, State & Private Forestry, 1720 Peachtree Road, NW, Atlanta, GA 30367.

Production support is provided by the staff of the University of Georgia (UGA) College of Agricultural and Environmental Sciences (CAES) Office of Communications and Technology Services (OIT) in partnership with the Southern Regional Extension Forestry (SREF) Office. Financial support provided by a grant through the USDA Forest Service, Region 8, State & Private Forestry, Dr. George Hernandez, Regional Reforestation Specialist.

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General Measurements

Area of Circles in Acres and Square Feet Equivalents

Area in Acres	Square Dimension		Radius of Circle		
	Feet	Meters	Feet	Meters	Chains
1/1,000	6.6	2.1	3.73	1.14	0.056
1/100	20.88	6.36	11.76	3.59	0.18
1/20	46.67	14.2	26.33	8.03	0.40
1/10	66.0	20.1	37.23	11.35	0.56
1/5	93.34	28.5	52.66	16.05	0.80
1/4	104.36	31.8	58.88	17.95	0.89
1	208.71	63.6	117.75	35.89	1.78

Basal Area Table

Area of Circle in Square Feet, Diameter in Tenths of Inches

Diameter										
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
Inches	- - - - - - Area in Square Feet - - - - - -									
1	0.005	0.007	0.008	0.009	0.011	0.012	0.014	0.016	0.018	0.020
2	.022	.024	.026	.029	.031	.034	.037	.040	.043	.046
3	.049	.052	.056	.059	.063	.067	.071	.075	.079	.083
4	.087	.092	.096	.101	.106	.110	.115	.120	.126	.131
5	.136	.142	.147	.153	.159	.165	.171	.177	.183	.190
6	.196	.203	.210	.217	.223	.230	.238	.245	.252	.260
7	.267	.275	.283	.291	.299	.307	.315	.323	.332	.340
8	.349	.358	.367	.376	.385	.394	.403	.413	.422	.432
9	.442	.452	.462	.472	.482	.492	.503	.513	.524	.535
10	.545	.556	.567	.579	.590	.601	.613	.624	.636	.648
11	.660	.672	.684	.696	.709	.721	.734	.747	.759	.772
12	.785	.799	.812	.825	.839	.852	.866	.880	.894	.908
13	.922	.936	.950	.965	.979	.994	1.009	1.024	1.039	1.054
14	1.069	1.084	1.100	1.115	1.131	1.147	1.163	1.179	1.195	1.211
15	1.227	1.244	1.260	1.277	1.294	1.310	1.327	1.344	1.362	1.379
16	1.396	1.414	1.431	1.449	1.467	1.485	1.503	1.521	1.539	1.558
17	1.576	1.595	1.614	1.632	1.651	1.670	1.689	1.709	1.728	1.748
18	1.767	1.787	1.807	1.827	1.847	1.867	1.887	1.907	1.928	1.948
19	1.969	1.990	2.011	2.032	2.053	2.074	2.095	2.117	2.138	2.160
20	2.182	2.204	2.226	2.248	2.270	2.292	2.315	2.337	2.360	2.382
21	2.405	2.428	2.451	2.474	2.498	2.521	2.545	2.568	2.592	2.616
22	2.640	2.664	2.688	2.712	2.737	2.761	2.786	2.810	2.835	2.382
23	2.885	2.910	2.936	2.967	2.986	3.012	3.038	3.064	3.089	3.115
24	3.142	3.168	3.194	3.221	3.247	3.274	3.301	3.328	3.355	3.382

Conversion Factors

Area Conversion

1cm²	0.1550 sq. inches	**sq. inch**	6.4516 cm^2
1m²	10.7639 sq. feet	**sq. foot**	0.0929 m^2
1m²	1.1960 sq. yards	**sq. yard**	0.8361 m^2
1ha	2.4710 acres	**acre**	0.4047 ha
1km²	0.3861 sq. miles	**sq.mile**	2.5900 km^2
1m²/ha	4.356 sq. ft./ac.	**sq.ft./ac.**	0.2296 m^2/ha

Capacity Conversion

liter	61.0²50 cu. in.	**cu. in**	0.0164 liter
liter	0.0353 cu. ft.	**cu. ft.**	28.3162 liters
liter	0.0284 bu. (U.S.)	**bu.**	35.2383 liters
liter	0.264² gal. (U.S.)	**gal. (U.S.)**	3.7853 liters
	1000.027 cm		
liter	1.0567 qt. (liquid) or 0.9081 qt. (dry)		
	2.2046 lb. of pure water at 4 c = 1 kg.		

Length Conversion

cm	0.3937 inches	**inch**	2.5400 cm
meter	3.2808 feet	**foot**	0.3048 m
meter	1.0936 yards	**yard**	0.9144 m
km	0.6214 miles	**mile**	1.6093 km

Volume Conversion

cm^3	0.0610 cu. in.	$in.^3$	16.3872 cm^3
m^3	35.3145 cu. ft.	$ft.^3$	0.0283 m^3
m^3	1.3079 cu. yd.	$yard^3$	0.7646 m^3
m^3/ha	14.291 cu. ft./acre	cu. ft./ac.	0.06997 m^3/ha

Weight Conversion

gram	15.4324 grains	grain	0.0648 g
gram	0.0353 oz.	oz.	28.3495 g
kg	2.2046 lb.	pounds	0.4536 kg
kg	0.0011 ton (sht)	Ton (sht)	907.1848 kg
Ton (met.)	1.1023 ton (sht)	Ton (sht)	0.9072 ton (met.)
Ton (met.)	0.9842 ton (1g)	Ton (lg)	1.0160 ton (met.)
metric ton	2204.6 lbs	cwt. I	45.36 kg

Surveying Corrections

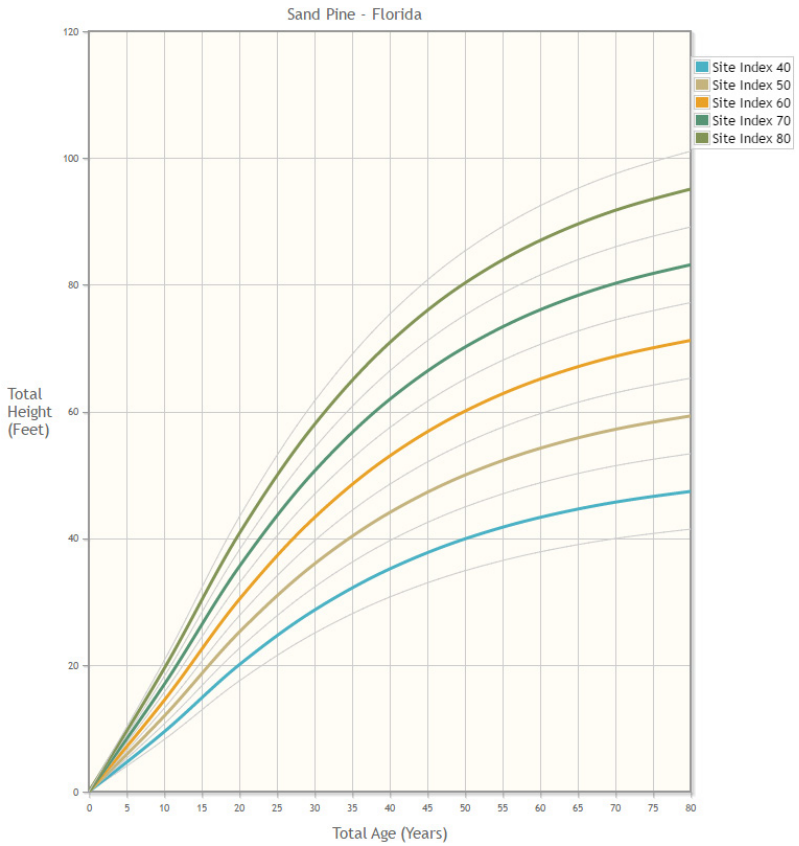
Difference in Bearing or Elevation for a Distance of One Mile			
Angle	Difference (Feet)	Angle	Difference (Feet)
1°	92.16	8°	742.06
2°	184.38	9°	836.27
3°	276.71	10°	931.01
4°	369.21	11°	1026.33
5°	461.94	12°	1122.30
6°	554.95	13°	1218.95
7°	648.30	14°	1316.45

NOTE: One minute of angle makes a difference of 1.536 feet per mile.

Site Index

Conifers

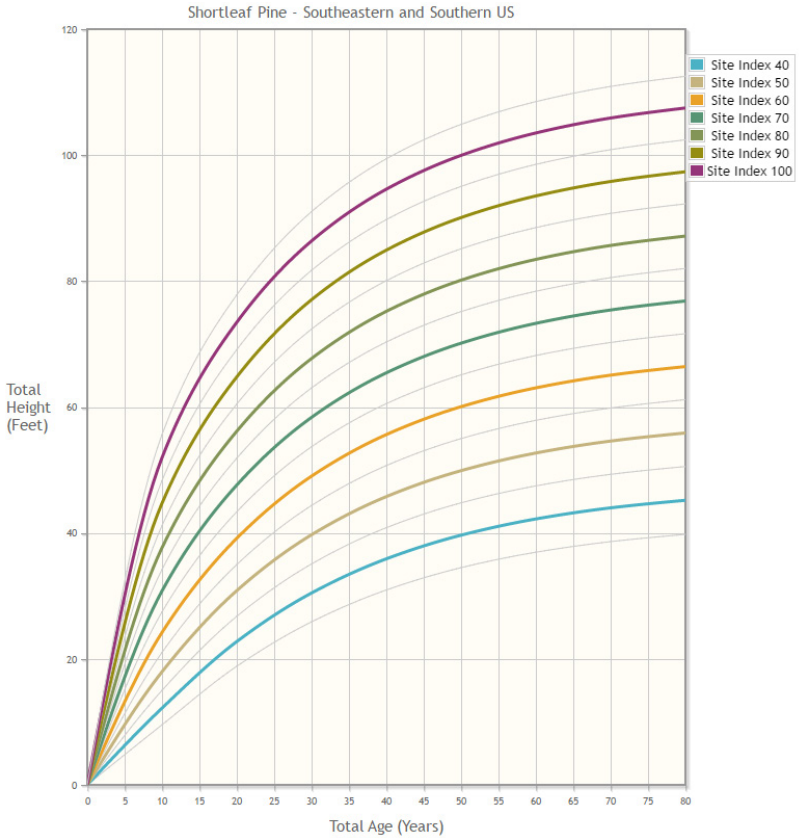
Sand Pine



Sand pine (Schumacher and Coile 1970), Florida–Ocala National Forest
54 plots having 8 dominant and codominant trees on each plot
Total height and total age, anamorphic, logarithm equation
Add 5 years to d.b.h, age to obtain total age (BH = 0.0)

Source: Site Index Curves for Forest Tree Species in the Eastern United States
Willard H. Carmean, Jerold T. Hahn and Rodney D. Jacobs
United States Department of Agriculture Fores Service
North Central Forest Experiment Station General Technical Report NC-128

Shortleaf Pine

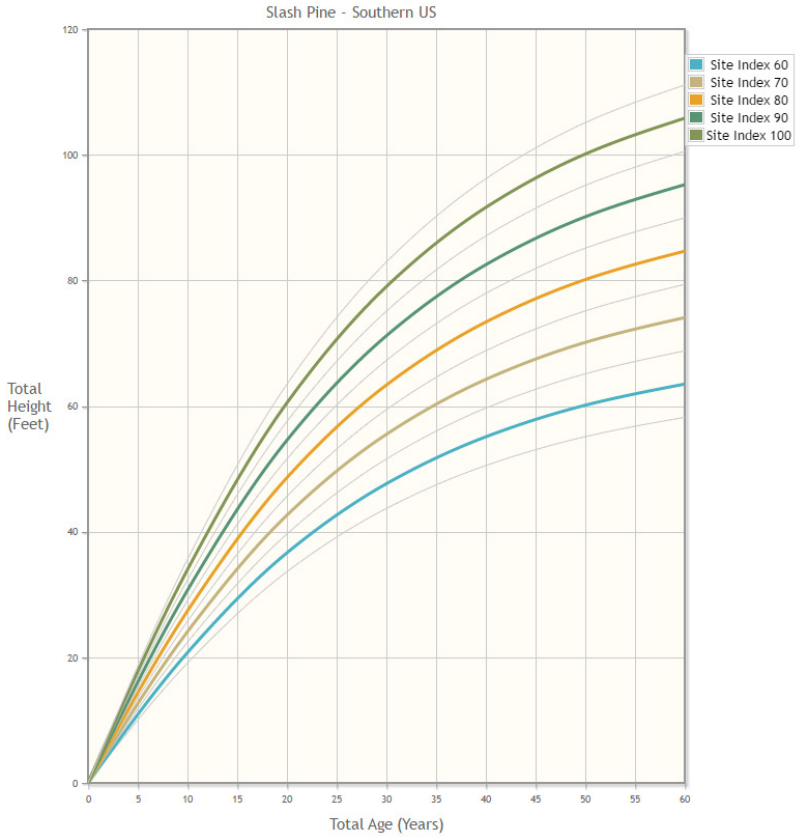


Shortleaf pine (Schumacher and Coile 1960,Coile and Schumacher 1964)
Southeastern and Southern States
231 plots having 8 dominant and codominant trees on each plot
Total height and total age, anamorphic, logarithm equation
Convert d.b.h, age to total age by adding years according to
site index (BH = 0.0):

SI	50-75	76+
Years	3	2

Source: Site Index Curves for Forest Tree Species in the Eastern United States
Willard H. Carmean, Jerold T. Hahn and Rodney D. Jacobs
United States Department of Agriculture Fores Service
North Central Forest Experiment Station General Technical Report NC-128

Slash Pine

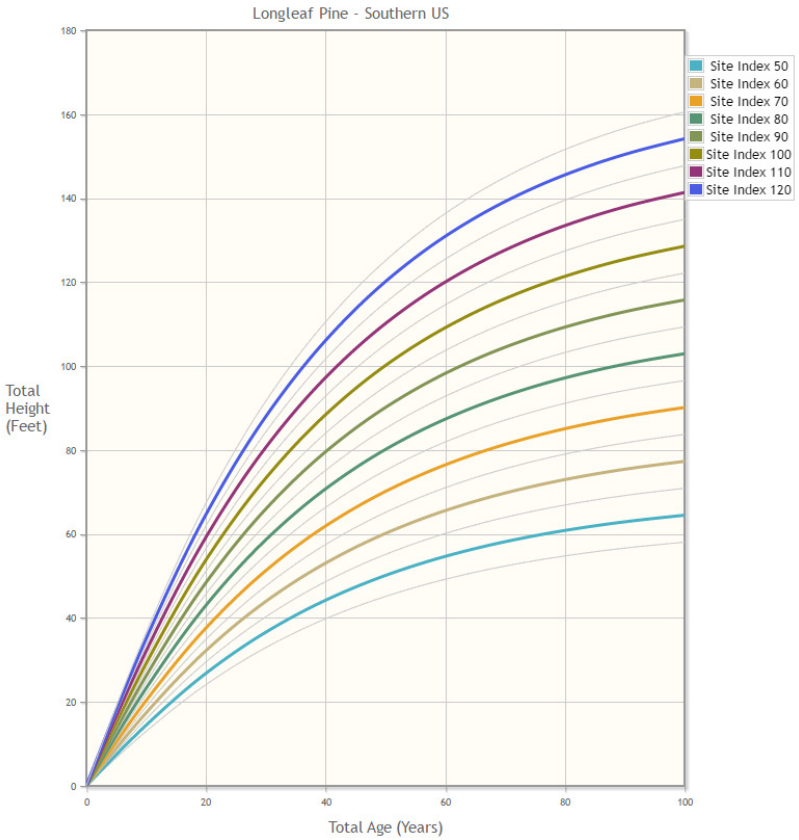


Slash pine (USDA 1929)
Southern States
124 plots, number of dominant trees not given
Total height and total age, anamorphic, equation not given
Convert d.b.h, age to total age by adding years according to
site index (BH = 0.0):

SI	60-75	75+
Years	3	2

Source: Site Index Curves for Forest Tree Species in the Eastern United States
Willard H. Carmean, Jerold T. Hahn and Rodney D. Jacobs
United States Department of Agriculture Fores Service
North Central Forest Experiment Station General Technical Report NC-128

Longleaf Pine

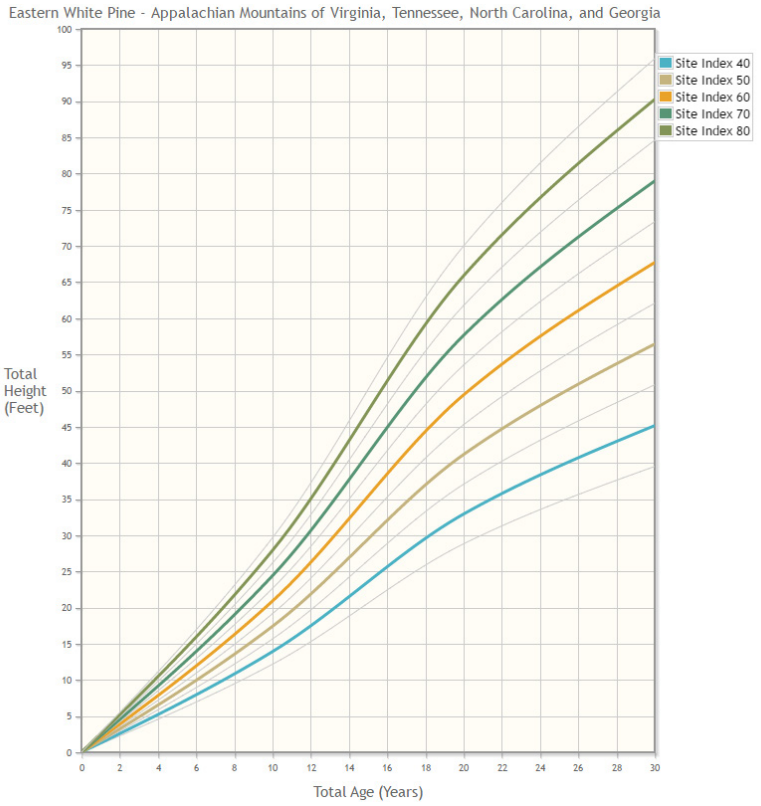


Longleaf pine (USDA 1929), Southern States
244 plots, number of dominant trees not given
Total height and total age, anamorphic, equation not given
Convert d.b.h, age to total age by adding years according to
site index (BH = 0.0):

SI	40	50	60	65-95	96+
Years	10	8	6	5	4

Source: Site Index Curves for Forest Tree Species in the Eastern United States
Willard H. Carmean, Jerold T. Hahn and Rodney D. Jacobs
United States Department of Agriculture Fores Service
North Central Forest Experiment Station General Technical Report NC-128

Eastern White Pine

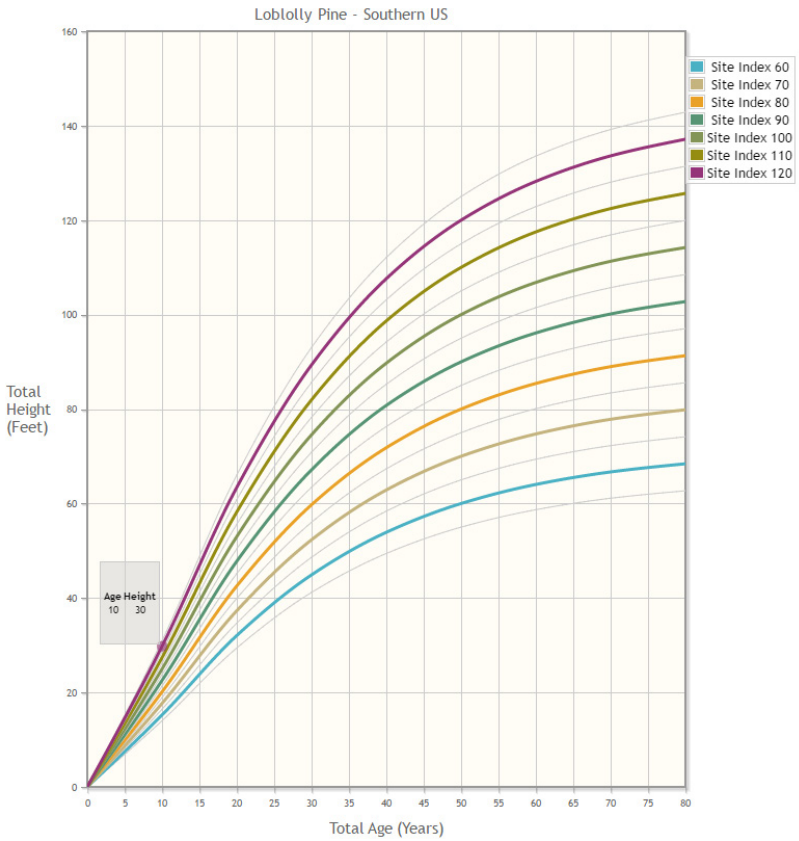


Eastern white pine (Beck 1971a, 1971b)
Appalachian Mountains of Virginia, Tennessee, North Carolina, and Georgia
42 plots having 3 dominant and codominant trees on each plot
Stem analysis, polymorphic, nonlinear regression
Convert d.b.h, age to total age by adding years according to
site index (BH = 0.0):

SI	50-65	66-80	81-95	96-110	111+
Years	7	6	5	4	3

Source: Site Index Curves for Forest Tree Species in the Eastern United States
Willard H. Carmean, Jerold T. Hahn and Rodney D. Jacobs
United States Department of Agriculture Fores Service
North Central Forest Experiment Station General Technical Report NC-128

Loblolly Pine



Loblolly pine (USDA 1929), Southern States
146 plots, number of dominants not given
Total height and total age, anamorphic, equation not given
Convert d.b.h, age to total age by adding years according to
site index (BH = 0.0):

SI	60-75	76+
Years	4	3

Source: Site Index Curves for Forest Tree Species in the Eastern United States
Willard H. Carmean, Jerold T. Hahn and Rodney D. Jacobs
United States Department of Agriculture Fores Service
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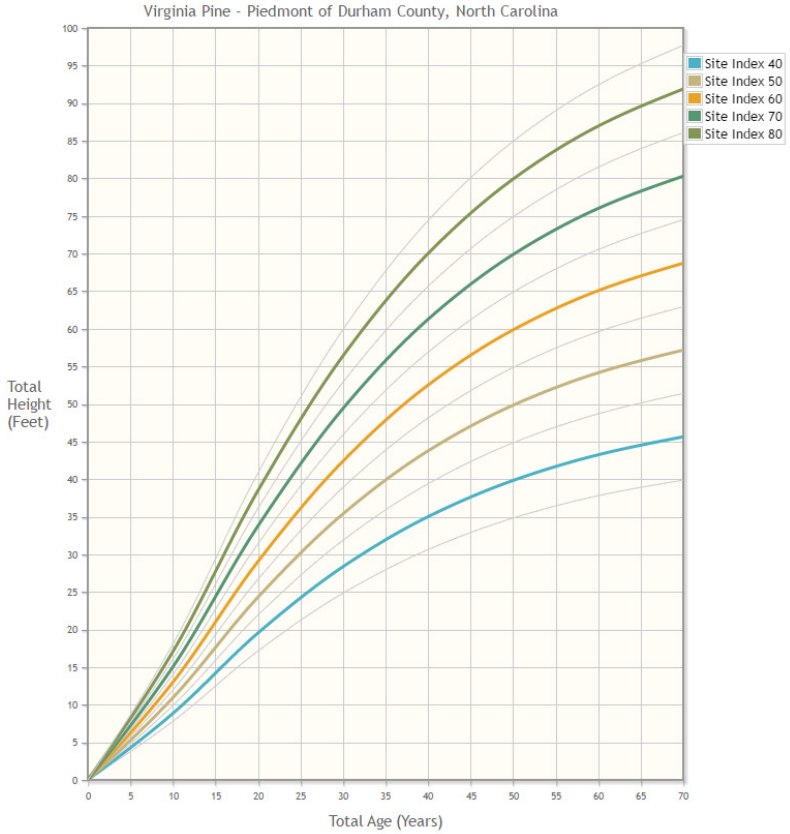
Virginia Pine



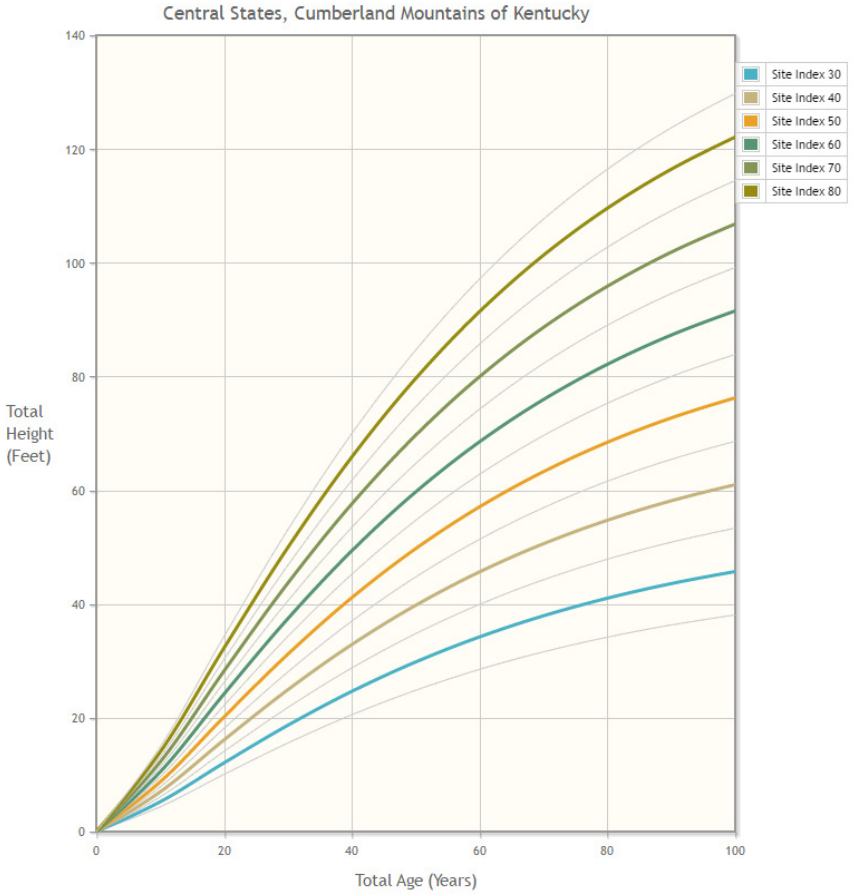
Virginia pine (Slocum and Miller 1953)
Piedmont of Durham County, North Carolina
116 plots, number of dominant and codominant trees not given
Total height and total age, anamorphic, equation not given
Convert d.b.h, age to total age by adding years according to
site index (BH = 0.0):

SI	<45	45-75	>75
Years	6	5	4

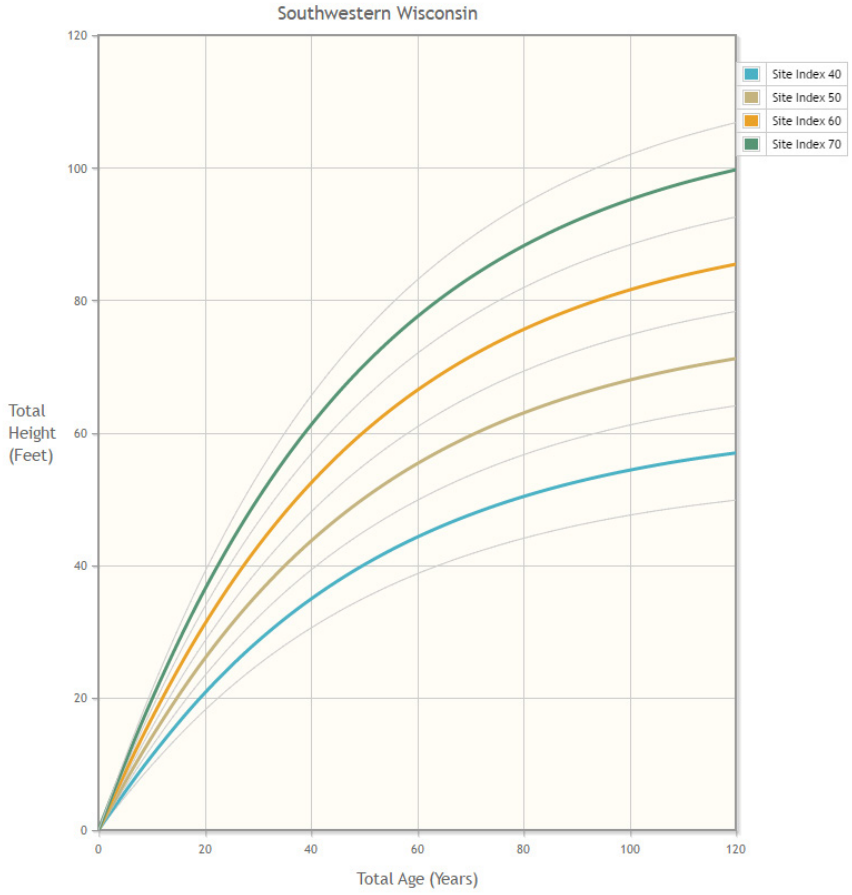
Source: Site Index Curves for Forest Tree Species in the Eastern United States
Willard H. Carmean, Jerold T. Hahn and Rodney D. Jacobs
United States Department of Agriculture Fores Service
North Central Forest Experiment Station General Technical Report NC-128

Hardwoods

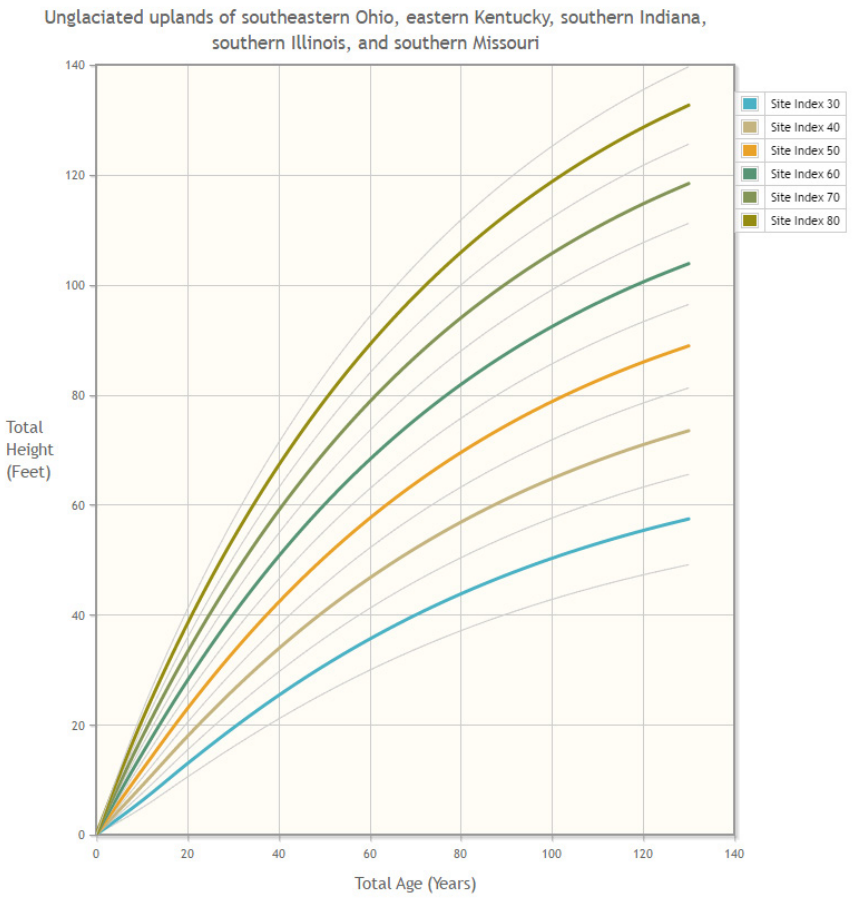
Hickories



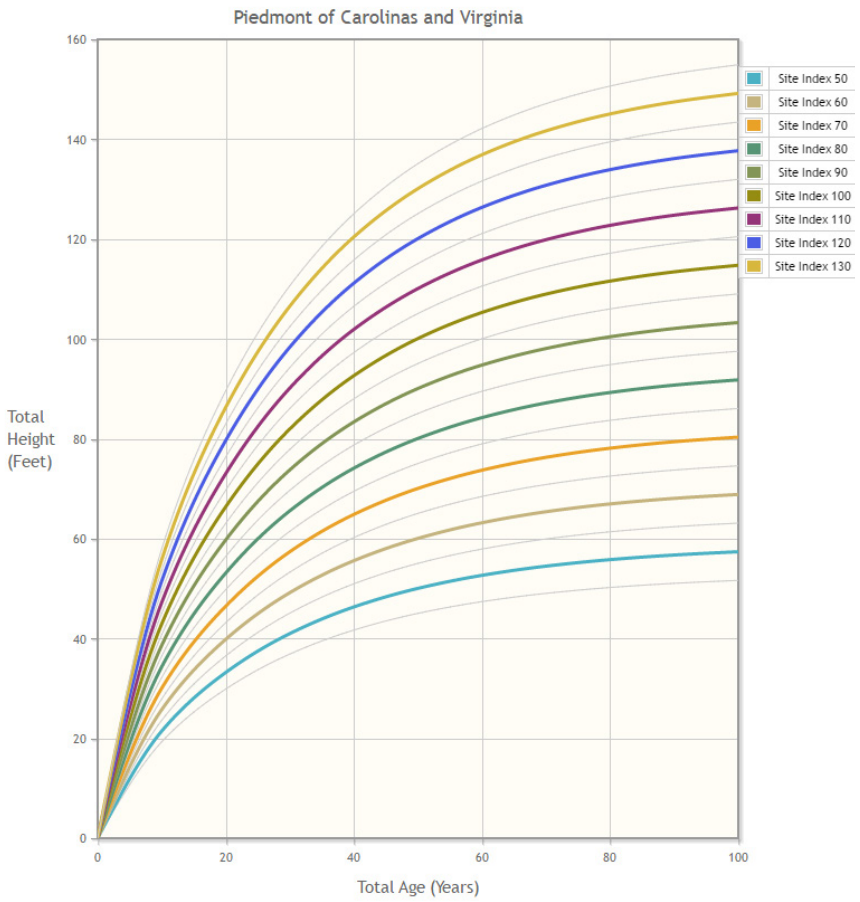
Northern Red Oak



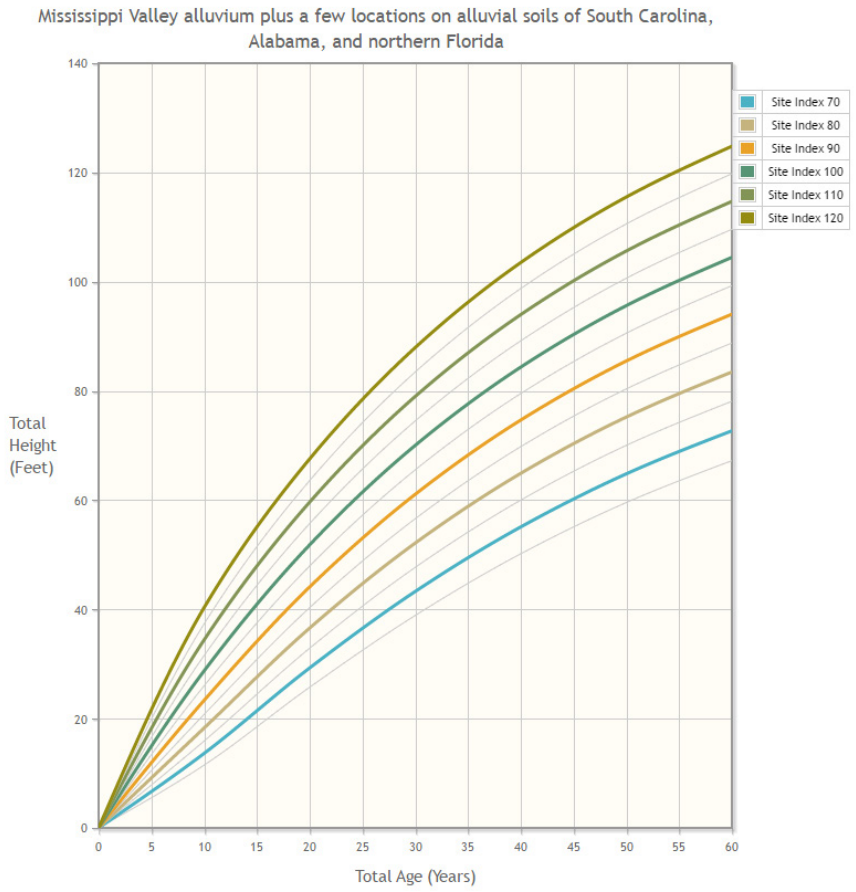
White Oak



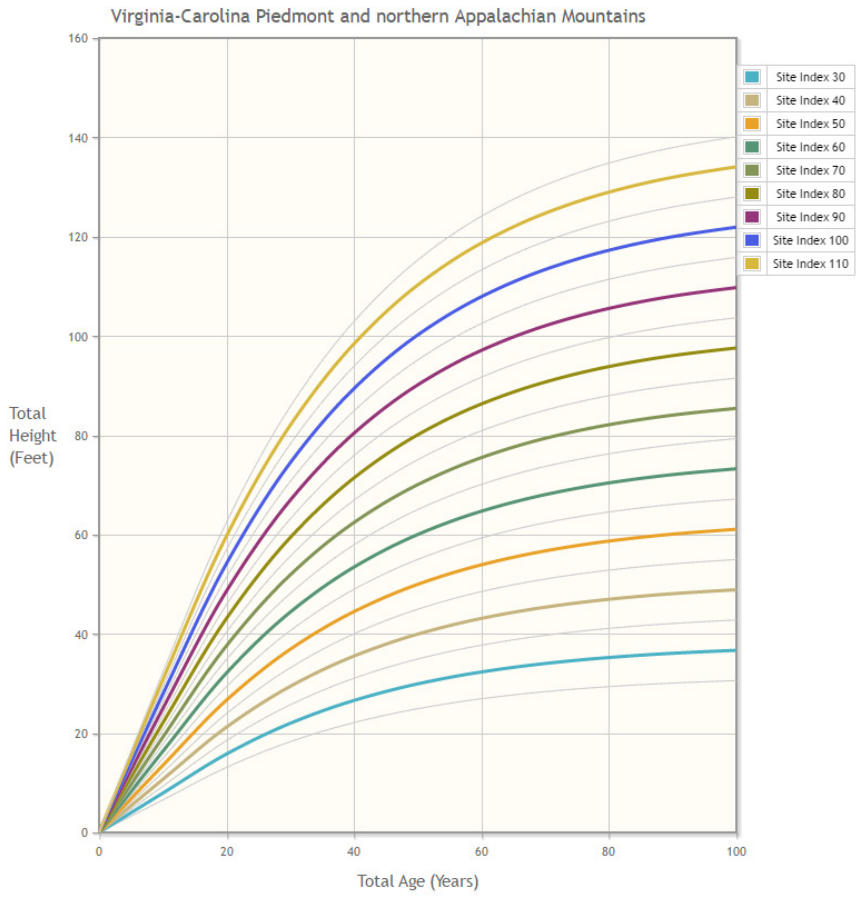
Yellow Poplar



Sweetgum



Upland Oak



Stand Measurements

Comparison of Site Indices, Basal Area and Volume

Species	Site Index	Basal Area per Acre		Volume per acre*	
	Feet	Square Feet	Cubic Feet	Cords	Bd. Ft.
Poor Site					
Shortleaf and pitch pine	50	159	3970	46.7	9,900
Yellow Poplar	50	90	1700	20.0	3,500
White Oak	52	90	1726	20.3	3,860
Other Oaks+	57	94	2041	24.0	5,385
Virginia Pine	59	162	4180	49.2	20,000
White Pine	66	190	5312	62.5	23,920
Medium Site					
Shortleaf and pitch pine	65	166	5665	66.6	22,750
White Oak	66	100	2590	30.5	8,370
Other Oaks	72	103	2954	34.8	10,550
Virginia Pine	74	180	5440	64.0	28,840
White Pine	75	132	3138	36.9	14,510
Yellow Poplar	82	201	6976	82.1	35,964
Good Site					
White Oak	79	106	3388	39.9	13,350
Shortleaf and pitch pine	81	170	7487	88.1	36,465
Other Oaks	86	108	3870	45.5	16,300
Virginia Pine	88	188	6040	71.1	39,116
White Pine	98	205	8256	97.1	45,328
Yellow Poplar	100	172	5330	62.7	32,150

50 years for 10 Southern Appalachian species on 3 sites (From Doolittle 1958).

*Conversion factor for cordwood was 85 cubic feet per cord. Board-foot volumes are international 1/8 inch rule.
+Includes scarlet, black, northern red, and chestnut oaks.

Growth Calculation & Projection

Use the following method to determine the growth percent using basal area. This method can also be used to project basal area, diameters, and volume.

Procedure: Use a prism, bark gauge and a diameter tape to obtain growth information from a representative sample of trees (preferably all the trees within prism range at pre-selected points; for examle, every fifth point).

The following information is obtained from each tree:

a. Radial bark thickness
b. Diameter at breast height (D.B.H. outside bark)
c. Radial growth during the last 5 years (have the data or estimate it)

D.I.B. (D. Without bark) = D.O.B (D. With bark) - 2 X radial bark thickness.

d.i.b. = D.I.B. - 2 X radial growth during last 5 years

The term: Σ(d.i.b./D.I.B.)2 is the ratio of basal area 5 years ago to the present basal area.

Example:

Tree No.	D.O.B	D.I.B	d.i.b	d.i.b/D.I.B	$(d.i.b./D.I.B.)^2$
1	8.4	7.6	5.8	.763	.582
2	6.7	6.0	4.0	.667	.445
3	10.2	9.3	7.8	.839	.704
4	12.0	11.0	9.6	.873	.762
5	9.6	8.7	6.8	.782	.612
Total					**3.105**

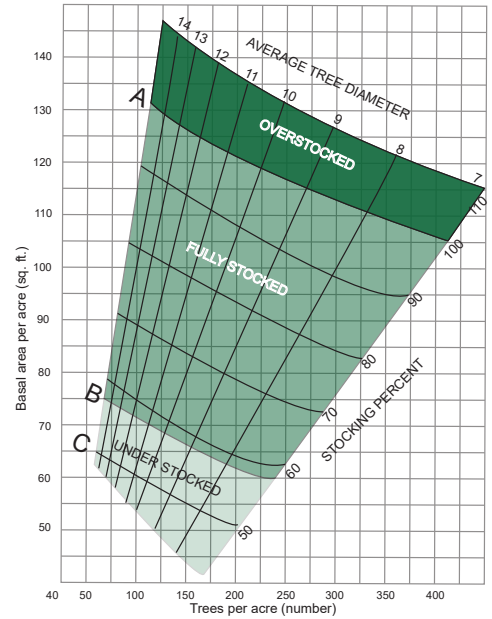
% growth = 1 - (Σ(d.i.b./D.I.B.)2 /total trees in sample)
% = 1 - (3.105/5) = 1-.621 = .379
% = .379 or 37.9% (for 5 years)
% annual growth = 37.9/5years = 7.58%

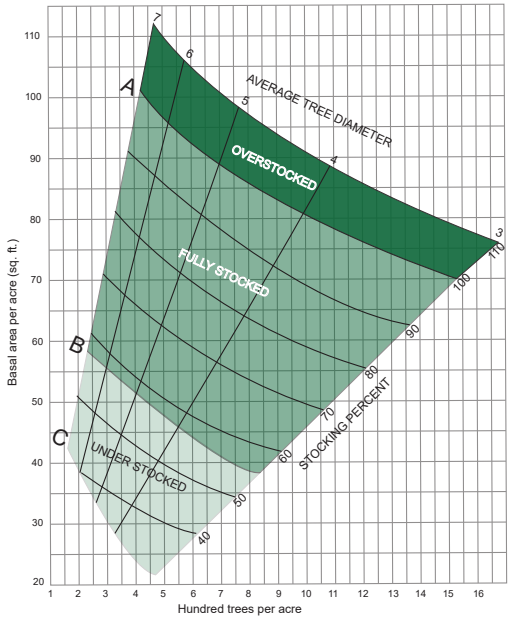
Present	Projected to Next 5 Years
(Basal Area)	(Basal Area Increase)
(Volume) X 37.9% =	(Volume Increase)
(Average Diameter)	(Average Diameter Increase)

Example: Estimated volume at end of 5 years:

Present volume/acre = 1450 board feet
% growth in 5 years = 37.9%
Increase in volume in 5 years = 550 board feet
Present volume/acre +1450 board feet
Volume/acre at end of 5 years =2000 board feet

Hardwood Stocking Charts





Relation of basal area, number of trees, and average tree diameter to stocking percent for upland central hardwoods. Tree-diameter range 7-15 (left), 3-7 (right). The area between curves A and B indicates the range of stocking where trees can fully utilize the site. Curve C shows the lower limit of stocking necessary to reach the B level in 10 years on average sites. (Average tree diameter is the diameter of the tree of average basal area.)

Procedure for Using Hardwood Stocking Charts

1. Use Prism to determine basal area on 5 to 10 sample points (or more if conditions are not uniform).
2. At each sample point, count all trees 2 inches DBH and over- using 1/20th acre plot (26 1/3 ft. radius).
3. Then, knowing the B.A. and the number of trees per acre, read the “average tree diameter” and the “stocking percent” directly from the charts.
4. Next, follow down the line of “Average Tree Diameter” (parallel to the nearest LOWER average diameter line) to line B; then follow the horizontal line from this point to find what the basal area should be for the stand (at intersection with B.A. Axis).

Example

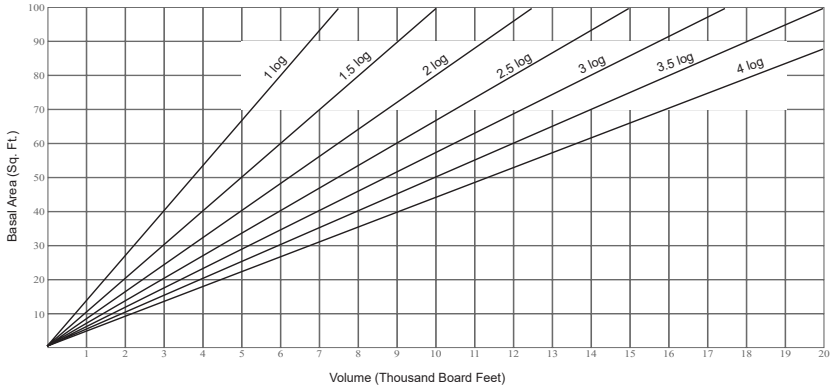
For a stand with B.A. of 90 and 220 trees per acre, the average DBH is about 8.7 inches and the stand is 81% stocked. The B-level B.A. is 65 and the C-level is 51.

if the B.A. of the stand exceeds C-level requirements, the stand is worth managing. If worth managing, deduct B-level B.A. from the total B.A. to find the sq.ft. that may be cut (25 sq. ft. for this stand). Let stand grow up to 85%-90% stocking, and thin again to near the B-level.

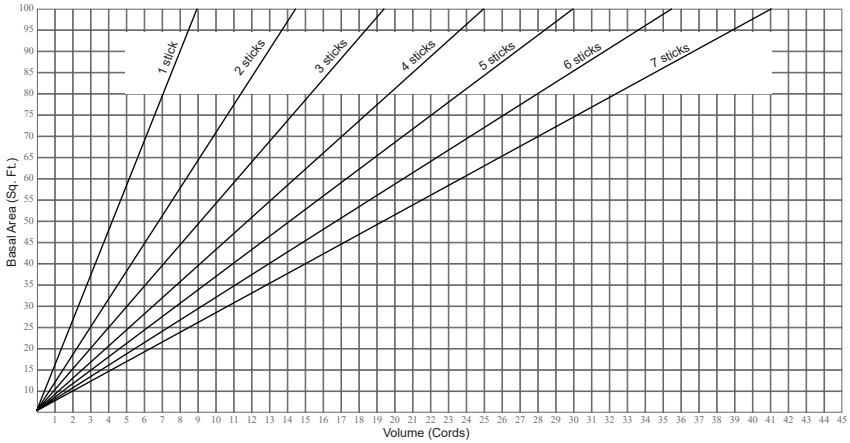
Foresters Field Handbook, North Carolina Forest Service, (Agriculture Handbook 355 Forest Service).

Quick Cruise Computers

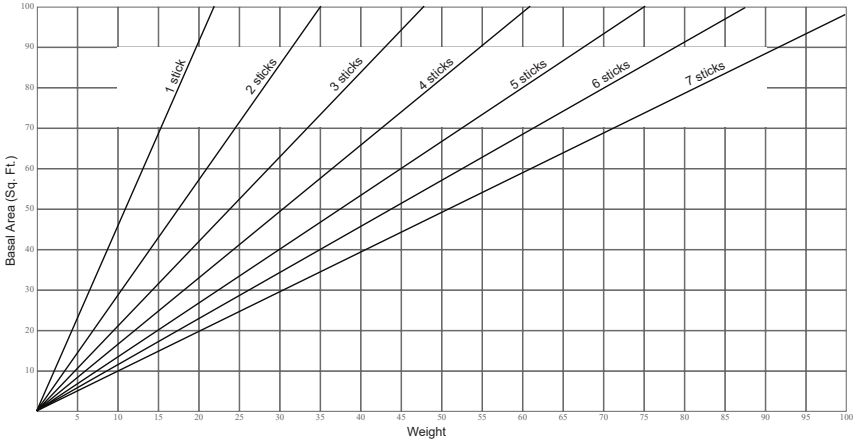
Board Foot Int. 1/4



Cords



Weight



Seed Tree Spacing

Spacing Between Trees

Seed Trees		Spacing Between Trees		
Acre	Hectare	Chains	Feet	Meters
4	10	1.58	104	31
5	12	1.41	93	28
6	15	1.29	85	26
7	17	1.20	79	24
8	20	1.12	74	23
9	22	1.05	69	21
10	25	1.00	66	20
11	27	0.95	63	19
12	30	0.91	60	18
15	37	0.82	54	16
20	49	0.71	47	14
25	62	0.64	42	13

Minimum Recommended Number of Seed Trees

DBH	Shortleaf	Loblolly	Slash	Longleaf[2]	Virginia
9					6
10	20	12	12	55	5
12	14	9	9	38	4
14	12	6	6	28	4
16+	12	4	4	21	4

1 Needed for satisfactory regeneration
2 Shelterwood - 30 square feet basal area

Shortleaf/Loblolly Thinning Guides

Shortleaf Pine Thinning Guide - Trees 4” D.B.H. & Over Leave Basal Area (Sq.ft.) for Site Index

Age	40	50	60	70	80	90
20				58	70	80
25		55	69	82	88	91
30	55	72	85	92	93	95
35	68	83	92	94	96	97
40	77	89	93	95	97	98
45	82	90	93	95	97	98
50	84	91	93	96	97	99
60	86	91	94	96	97	99

Loblolly Pine-Thinning Guide- Trees 4” D.B.H & Over Leave Basal Area (Sq.ft.) for Site Index

Age	60	70	80	90	100	110
15					58	63
20		61	67	72	76	81
25	66	73	78	82	85	89
30	74	80	83	87	90	95
35	79	84	87	89	93	98
40	83	86	89	92	96	100
45	85	88	91	94	97	102
50	87	89	92	95	99	104
55	88	91	93	96	100	105
60	89	92	95	97	101	106

Leave tables are 57% of normal (Misc.Pub.50). Thin at 80% or over of B.A. of fully stocked stand. To determine time for thinning- assume that the stand will approach normal at the rate of 4% per year, i.e. 68% Normal basal area- thin three years hence. (80-68)/(4) = 3.

Virginia Division of Forestry.

Statistics for Prescription

Statistics are numerical data about a subject or a name applied to analysis of the reliability of statistical information by sampling.

The person who analyzes the forest land statistics commonly needs only 6 items - Mean, Standard Deviation, Standard Error, Limit of Error, Coefficient of Variation, and Number of Plots to Sample a Stand to a Desired Accuracy.

Mean- M or Average

A total of all sample counts divided by the number of samples.
M = (sum of sample counts)/(number of samples)

Standard Deviation- SD

A statistician's measure of the spread between the individual sample from the mean. The SD is just a tool in calculating error, CV and N.
SD = $\sqrt{[(\sum(Dev)2)/(n-1)]}$

Standard Error- SE

A statistician's stepping stone toward determination of LE.
SE = (SD)/$\sqrt{N}$)

Limit of Error- LE

We cannot calculate the actual volume and cannot know the exact error. We calculate a LE or a selected probability. We might say "using gambling odds of 67 out of 100, (2 out of 3), we have a mean volume of 20 cords per acre, plus or minus 2 cords." The mean is 20, the Standard Error is ±2, and the Limit of Error is .10 or 10%. Increasing the gambling odds to 95 out of 100 doubles the LE. (20%). For odds of 99 out of 100 the LE triples (30%).
LE = (SE)/(M)

Coefficient of Variation- CV

This describes the relative uniformity of he stand. The CV is our most important statistical term. For planted stands the CV may vary .10 to .30 (10%-30%). Natural stands may vary from about .30 to over 1.00. Different stands with the same CV require the same number of samples to produce means of equal accuracy, regardless of the areas of these stands. The CV comes from the SD and the calculated average or mean.
CV = SD/M

Plots Needed to Sample a Stand to a Desired Accuracy

The number of samples (N) has a basic relationship with CV, LE, and the probability.
N = (t)2(CV)2/(LE)2
"t" is the probability or gambling odds. Use "l" or "t" for one SD where values involved in the cruise are low and when we can be satisfied with a 2 times out of 3 chance of arriving at a figure that will vary within one SD plus or minus from the Mean.

Use "2" for "t" for more accuracy. This variation of 2 SD's plus or minus makes gambling odds of 95 in 100 that we'll not exceed 2 Standard Deviations. This will take 4 times as many samples as for 1 SD. Here's and example:

–To make a cruise of ±10% LE with a gambling chance of ± 2 SD (95 times in 100) CV = 30%.

Use:
N = (22×.302)/(.102) = (4(.09))/(.01) = 36 plots
For 1 SD, (t)2 = 1 and N would be 9 plots.
For 3 SD, (t)2 = 9 and N would be 81 plots.
If CV were 15%, N would be one-quarter as many.
If SD were 1 and LE were .20, N would be 9 plots.

Example: Tree counts on 9 sampling points–

Point No.	Tree Count	Deviation from Mean	(dev)	2
1	3	2	4	
2	3	2	4	
3	10	5	25	
4	5	0	0	
5	5	0	0	
6	4	1	1	
7	3	2	4	
8	5	0	0	
9	8	3	9	
n=9	**9/46**		**∑(D)**	**2=47**

M = 5.1 (call it 5)
SD(Std. Dev) = $\sqrt{(\sum(D)2)/(n-1)}$ = $\sqrt{(47/8)}$ = 2.42

SE(std. Error) = SD/$\sqrt{n}$ = 2.42/$\sqrt{9}$ = .81

LE (Limit of Error) = SE/M = .081/5 = .16 = 16%

CV (Coef. of Var.) = SD/M = 2.42/5 = .48 = 48%

N (No of plots):
N (For 1 SD) = (1)2(CV)2/(% Acc)2 = (.48)2/(.10)2 = 23 plots
N (For 2 SD) = (2)2(CV)2/(% Acc)2 = (4×.23)2/(.01)2 = 92 plots
N (For 1 SD ±20%)= (CV)2/(% Acc)2 = .23/.04 = 6 plots.

No. of Samples to be Taken from Infinite Population = N

CV%	Specified % Limit - SE			
	±1-1 1/2%	±5%	±10%	±20%
	N			
10	45	4	1	1
20	178	16	4	1
30	400	36	9	3
40	712	64	16	4
50	1,112	100	25	7
60	1,600	144	36	9
70	2,178	196	49	13
80	2,845	256	64	16
90	3,600	324	81	21
100	4,445	400	100	25
150	10,000	900	225	57

Trees Per Acre By Diameter at Breast

Height and Basal Area

Basal Area (Square Feet)										
	20	30	40	50	60	70	80	90	100	110
DB (Inches)	Trees Per Acre									
5	146	220	293	367	440	513	587	660	733	806
6	102	153	204	255	306	357	408	458	509	560
7	75	112	150	187	224	262	299	337	374	412
8	57	86	115	143	172	201	229	258	286	315
9	45	68	91	113	136	158	181	204	226	250
10	37	55	73	92	110	128	147	165	183	202
11	30	45	61	76	91	106	121	136	152	167
12	25	38	51	64	76	89	102	115	127	140
13	22	33	43	54	65	76	97	98	108	119
14	19	28	37	47	56	65	75	84	94	103
15	16	24	33	41	49	57	65	73	81	90
16	14	21	29	36	43	50	57	64	72	79
17	13	19	25	32	38	44	51	57	63	70
18	11	17	23	28	34	40	45	51	57	62
19	10	15	20	25	30	36	41	46	51	56
20	9	14	18	23	28	32	37	41	46	50

Trees Per Acre By Spacing

Spacing		Trees		Spacing		Trees	
Feet	Meters	Acre	Ha.	Feet	Meters	Acre	Ha.
5 x 5	1.5 x 1.5	1,742	4,304				
5 x 6	1.5 x 1.8	1,452	3,588	12 x 12	3.7 x 3.7	302	746
5 x 7	1.5 x 2.1	1,245	3,076	12 x 15	3. 7 x 4.6	242	598
5 x 8	1.5 x 2.4	1,089	2,691	12 x 18	3. 7 x 5.5	202	499
5 x 9	1.5 x 2.7	968	2,392	12 x 20	3. 7 x 6.1	182	448
5 x 10	1.5 x 3.0	871	2,153	12 x 25	3. 7 x 7.6	145	358
6 x 6	1.8 x 1.8	1,210	2,990	13 x 13	4.0 x 4.0	258	638
6 x 7	1.8 x 2.1	1,037	2,562	13 x 15	4.0 x 4.6	223	551
6 x 8	1.8 x 2.4	908	2,244	13 x 20	4.0 x 6.1	168	415
6 x 9	1.8 x 2.7	807	1,994	13 x 25	4.0 x 7.6	134	331
6 x 10	1.8 x 3.0	726	1,794				
6 x 12	1.8 x 3.7	605	1,495	14 x 14	4.3 x 4.3	222	549
6 x 15	1.8 x 4.6	484	1,196	14 x 15	4.3 x 4.6	207	511
				14 x 20	4.3 x 6.1	156	385
7 x 7	2.1 x 2.1	889	2,197	14 x 25	4.3 x 7.6	124	306
7 x 8	2.1 x 2.4	778	1,922				
7 x 9	2.1 x 2.7	691	1,707	15 x 15	4.6 x 4.6	194	479
7 x 10	2.1 x 3.0	622	1,537	15 x 20	4.6 x 6.1	145	358
7 x 12	2.1 x 3.7	519	1,282	15 x 25	4.6 x 7.6	116	287
7 x 15	2.1 x 4.6	415	1,025				
				16 x 16	4.9 x 4.9	170	420
8 x 8	2.4 x 2.4	681	1,683	16 x 20	4.9 x 6.1	136	336
8 x 9	2.4 x 2.7	605	1,495	16 x 25	4.9 x 7.6	109	269
8 x 10	2.4 x 3.0	544	1,344				
8 x 12	2.4 x 3.7	454	1,222	18 x 18	5.5 x 5.5	134	331
8 x 15	2.4 x 4.6	363	897	18 x 20	5.5 x 6.1	121	299
8 x 25	2.4 x 7.6	218	539	18 x 25	5.5 x 7.6	97	240
9 x 9	2.7 x 2.7	538	1,329	20 x 20	6.1 x 6.1	109	269
9 x 10	2.7 x 3.0	484	1,196	20 x 25	6.1 x 7.6	87	215
9 x 12	2.7 x 3.7	403	996				
9 x 15	2.7 x 4.6	323	798	25 x 25	7.6 x 7.6	70	173

Dichotomous Key for Field Identification of Soil Texture

A. Soil when pinched between the thumb and finger, crumbles, will form no ‘ribbon.’

B. Soil squeezed in hand when dry, falls apart readily: squeezed when moist, forms a cast that breaks if not handled carefully. Individual sand grains can be readily seen and felt....Sandy Loam

B. Soil, squeezed in hand when dry, forms cast that bears careful handling; squeezed when moist, forms a cast that can be handled quite freely without breaking. Soil smooth. Sand grains not readily evident.

C. Soil slightly plastic when moist, but not greasy. Gritty when dry, not floury Color brown or dark gray.....Loam.

C. Soil Greasy when moist, floury when dry. On wetting it runs together and puddles. Color light gray or nearly white.....Silt Loam.

A. Soil When Pinched between the thumb and finger, forms a ‘ribbon’ at least barely sustaining its own weight.

D. Ribbon breaks easily, barely sustains own weight.

E. Individual sand grains can readily be seen and felt. Moist soil friable. Color usually brownish yellow to brownish red.....Sandy Clay Loam.

E. Soil smooth. Sand grains not evident. Moist soil somewhat plastic.

F. Soil heavy and greasy when moist. Color dully gray, sometimes containing iron concentrations.....Silty Clay Loam.

F. Soil Mellow and loose when moist. Color usually yellowish brown to reddish brown....Clay Loam

D. Ribbon is long and flexible, strong.

G. Individual sand grains can readily be seen and felt. Moist soil somewhat friable. Color usually bright red or yellow.....Sandy Clay.

G. Sand not evident. Moist soil plastic.

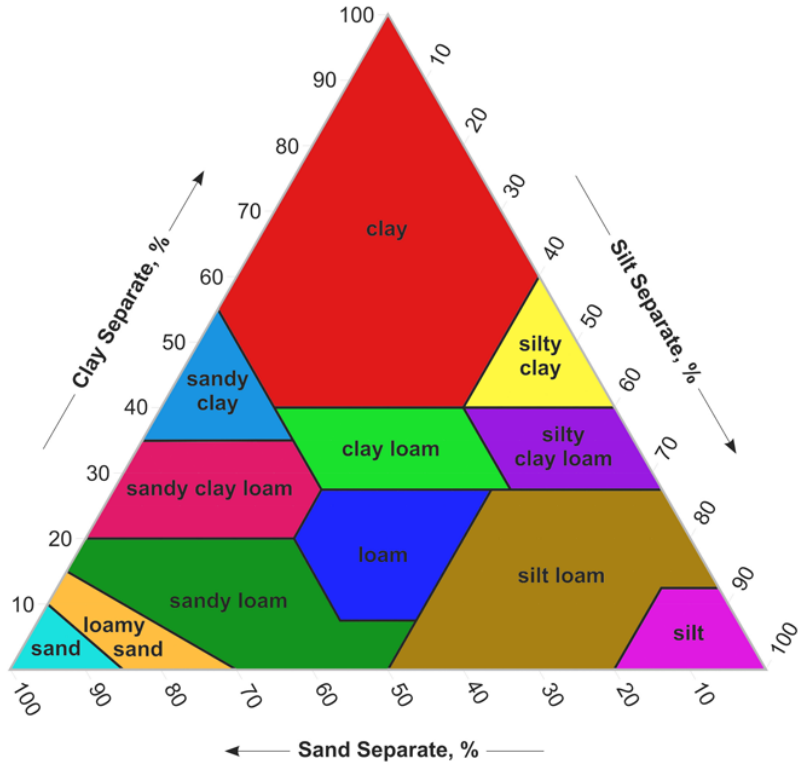
H. Color usually gray, sometimes containing iron concentrations.....Silty Clay

H. Color usually dark red, often mottled with gray or yellow.....Clay.

Texture Classification of Soils

Soil texture refers to the relative proportions of sand, silt, and clay particles which make up the soil mass. Figure 6 shows the percentages these soil fractions in the basic textural grades; definitions and discussion of this subject may be found in the Soil Survey Manual (Agriculture Handbook 18, U.S. Department of Agriculture, 503 pp., 1951).

Soil texture can be found exactly in a laboratory analysis. It can also be adequately classified in the field, after some experience, by sight and feel. On the opposite page is a key to the important textural grades. The first three – sandy loam, loam, and silt loam– are common surface soils, and may occur as subsoils. The rest are subsoils.



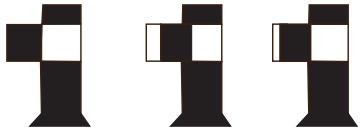
Use of Wedge Prism

The prism is a piece of a wedge-shaped rectangular glass which causes a distortion of light, displacing the image towards the thinner edge. It is used to estimate the basal area of a stand.

Basal Area

1. Hold prism (not your eye) over the selected point at a comfortable distance from the eye, with the long side horizontal. Hold prism with right hand by lower part of the thicker edge.

2. With one eye closed, point with the upper part of the prism so as to divide the tree in question at breast height. Refraction of light through the prism will cause the portion of the tree below breast height to appear separated. Count as 1 all of the trees whose figures are superimposed, as 1/2, or measure for accuracy those which touch only at the edge. If they do not touch each other they are not counted.



3. Turn in a circle, checking each visible tree, making sure not to count the same tree twice.

4. The number of trees counted, multiplied by basal area conversion factor of prism gives us the basal area per stand acre.

BA/Acre = (Total number of trees counted X BAF of prism)/(Number of samples)

Basal Area Factor:

Set up a target exactly one foot wide. Fro an approximate 10 BAF prism, sight about 33 feet from target. Move toward or away from target until right edge of target (as seen in prism) jibes with the left edge of target (just above prism). Measure exact distance prism to target. Take several readings and use average.

Calculate BAF by formula:
BAF = (43560)/[(1+4)(D/W)2]
D is distance prism to target
W is width of target
or: BAF = (43560)/[(1+4)(D)2]
Where target “W” is exactly 1 foot wide
or: BAF = 10890(W/D)2
A close approximation

Plot Radius Factor

The distance from a sampling point to the borderline tree equals DBH times PRF. For a BAF 10.0 prism the PRF is 2.75. A 10-inch tree times 2.75 gives a critical distance of 27.5 feet, a 14-inch tree is 38.5 feet, etc. The number of trees per acre that each tallied 10-inch tree represents 18.35; each 14-inch tree is 9.35, etc. The basic formula: PRF = √(75.625/BAF)

Borderline Trees

Always measure borderline trees more than a casual check on basal area. A short cut method counts borderline trees as 1/2.

1. Measure horizontal distance from sample point to center of tree at BH.
2. Get DBH.
3. Multiply DBH by prism PRF. When this product is more than taped distance, the tree is “In”.

Example: (PRF is 2.75, DBH 10.0)
2.75 X 10.0 = 27.5 feet, taped distance is 27.2 feet; tree is “In”.

Precautions

1. Prism must be in center of plot, not the eye. Walk around the prism; do not stand in one place and move the prism around you.
2. Always hold the face of the prism at right angel to eyesight, horizontally and vertically. (Except for leaning trees and when correcting for slopes).
3. For leaning trees move prism forward then backward on its vertical axis according to the inclination of the tree trunk.
4. Correct for slope by rotating prism to the same amount of slope between the prism and the tree, but at right angles to the eye.
5. If there is an object between you and the tree to be checked, move one step sideways, keeping a constant distance between you and the tree.
6. In dense strands be careful not to confuse or incorrectly associate the trunks. (If a tree is “In” above the brush, it is “In” at BH).
7. Remember that each diameter size has its own plot radius, the radius varies directly with the tree diameter. Therefore, the largest and most valuable trunks are usually sampled more intensely than the smaller trunks.

--The prism helps to train the eye to estimate the basal area of stands, use it.

Volume Per Acre

Volume: Volume is related to basal area and merchantable or total tree height. The average basal area per acre in each height class multiplied by the volume factor gives us the volume per acre. The factors can be for any scale- board feet by any rule, cubic feet, or cords. If the available factors cannot be relied upon, they can be developed as necessary.

Volume Factors

Estimate the volume per acre by multiplying the number of trees measured in each length class by the following factors:*

Pulpwood			Sawlogs				
Merchantable height	Cubic Vol. (w/ bark)	Cords (w/ bark)	Merchantable height1/	Int. 1/4	Scribner	Doyle	Cubic (w/o bark)
10	7	.08	1	7	6	4	1.2
20	14	.16	2	13	11	8	2.0
30	20	.22	3	18	16	12	2.7
40	26	.29	4	23	20	15	3.4
50	31	.34	5	28	25	21	4.0
60	36	.40					
70	39	.43					
v = 10 (sum of products/number of points)			v = 100 (sum of products/number of points)				

* For a 10 factor prism 1/ Merchantable height is in 16 foot logs

Local Volume Factors

Pulpwood factors are fairly consistent. Sawlog factors are not very reliable in different localities. The procedure to prepare local factors is as follows:

1. Write down the sample trees according to diameter class and number of logs. (The total trees
tallied divided by the number of points or samples.)
2. Obtain the number of plots per acre from the table at page 54.
3. Multiply in order to obtain trees per acre.
4. Write down volume for each tree.
5. Multiply to obtain volume per acre.
6. Total volume per acre for each length class.
7. Write down the basal area per acre (trees per plot for each length class multiplied by the basal area factor).
8. Volume factor is the volume per acre divided by basal area per acre.

Refer to following example

Basal Area Factor: 10 Board Foot Int. 1/4

Dbh Class	Trees Per Point			Plots Per Acre	Trees Per Acre			Volume Per Acre			Volume Per Tree		
	1-log	2-log	3-log		1-log	2-log	3-log	1-log	2-log	3-log	1-log	2-log	3-log
10	0.136	0.136		18.349	2.5	2.5		40	60	70	100	150	
12	0.785	0.628	0.157	12.739	10.0	8.0	2.0	50	90	120	500	720	240
14	0.428	0.534	0.107	9.355	4.0	5.0	1.0	80	130	170	320	650	170
16	0.140	0.419	0.140	7.163	1.0	3.0	1.0	100	170	230	100	510	230
Total	1.489	1.717	1.404		Boardfeet Per Acre						1020	2030	640
					Basal Area Per Acre						14.89	17.17	4.04
					Volume Factor						68.5	118.2	158.4

Value & Tolerance to Competition of Bottomland Hardwoods

Very Intolerant	Intolerant	Intermediate	Tolerant	Very Tolerant
Highest Value				
Cottonwood	Cherrybark Oak	Swamp Chestnut Oak		
	Shumard Oak	White Oak		
	White Ash	Delta Post Oak		
	American Sycamore	Green Ash		
	Sweetgum	Bald Cypress		
	Yellow-Poplar	Pumpkin Ash		
	Black Walnut			
Intermediate Value				
	Silver Maple	Bur Oak	Magnolia	Hackberry
	Nuttall Oak	Southern Red Oak		Sugarberry
	Water Oak	Pond Cypress		
	Swamp Tupelo	Laurel Oak		
	Pecan			
	Kentucky Coffeetree			
	Water Tupelo			
Low Value				
Willow	Willow Oak	Post Oak	American Elm	Cedar Elm
	Water Hickory	Overcup Oak	Winged Elm	American Beech
	River Birch	Blackgum	Red Maple	Hickory spp.
	Pin Oak	Waterlocust		Red Mulberry
	Swamp Cottonwood	Persimmon		
	Sweetbay			
Weed Species				
	Sassafras	Planertree	Boxelder	American Holly
		Buttonbush	Privet	American Hornbeam
			Possumhaw	American Hophornbeam
			Rough Leaf Dogwood	Hawthorn spp.

Source: Adapted from McDermott, 1954b; Putnam, 1951b; Hosner, 1957b; and Putnam et al. 1960. Regional Silviculture of the United States; Edited by John W. Barrett; The Ronald Press Company, New York.

Watershed Management

Distances Between Water Bars

Road Grade %	Distance	Road Grade %	Distance
2	250’	20	45’
5	135’	25	40’
10	80’	30	35’
15	60’	40	30’

Lay out your bars at 45° to 60° angle from road center line, and at least 18” deep. Check with State Forester’s office Best Management Practices (BMP’s) developed in the State Water Quality Management Plan for Forestry. If BMP’s are not available, use this information as a guide.

Factors

1 acre-foot = 43,560 cu.ft. = 325,825 gals.
1 cu. ft. = 7.48 gals = 62.427 lbs.
1 U.S. Gallon = 0.1337 cu. ft. = 8.330 lbs.
1-1/2 cu. ft./sec. = approx. 1,000,000 gals/day.
Average rainfall for U.S. = 30”/year.
Evapo-transpiration is approx 2/3 annual rainfall.

Stream Crossing Structures

Size Required Culvert Dia (in)	Area (ft^2)	Area Above Crossing Acres
18	1.76	7 or less
21	2.40	12
24	3.14	16
30	4.90	27
36	7.06	47
42	9.62	64
48	12.56	90
54	15.90	120
60	19.63	160
66	23.75	205
72	28.75	250
78	33.18	350

Tree Measurements

Specific Gravity by Species

			Specific Gravity	
Pine Species	Mean Age (years)	Mean d.b.h (inches)	Range	Mean
Loblolly	47	14.8	.38 to .68	.51
Longleaf	50	11.7	.40 to .75	.57
Shortleaf	58	12.2	.37 to .72	.52
Slash	30	11.0	.41 to .70	.53
Sand	48	9.1	.41 to .65	.48
Virginia	44	9.8	.40 to .60	.50
White	48	15.6	.25 to .54	.35

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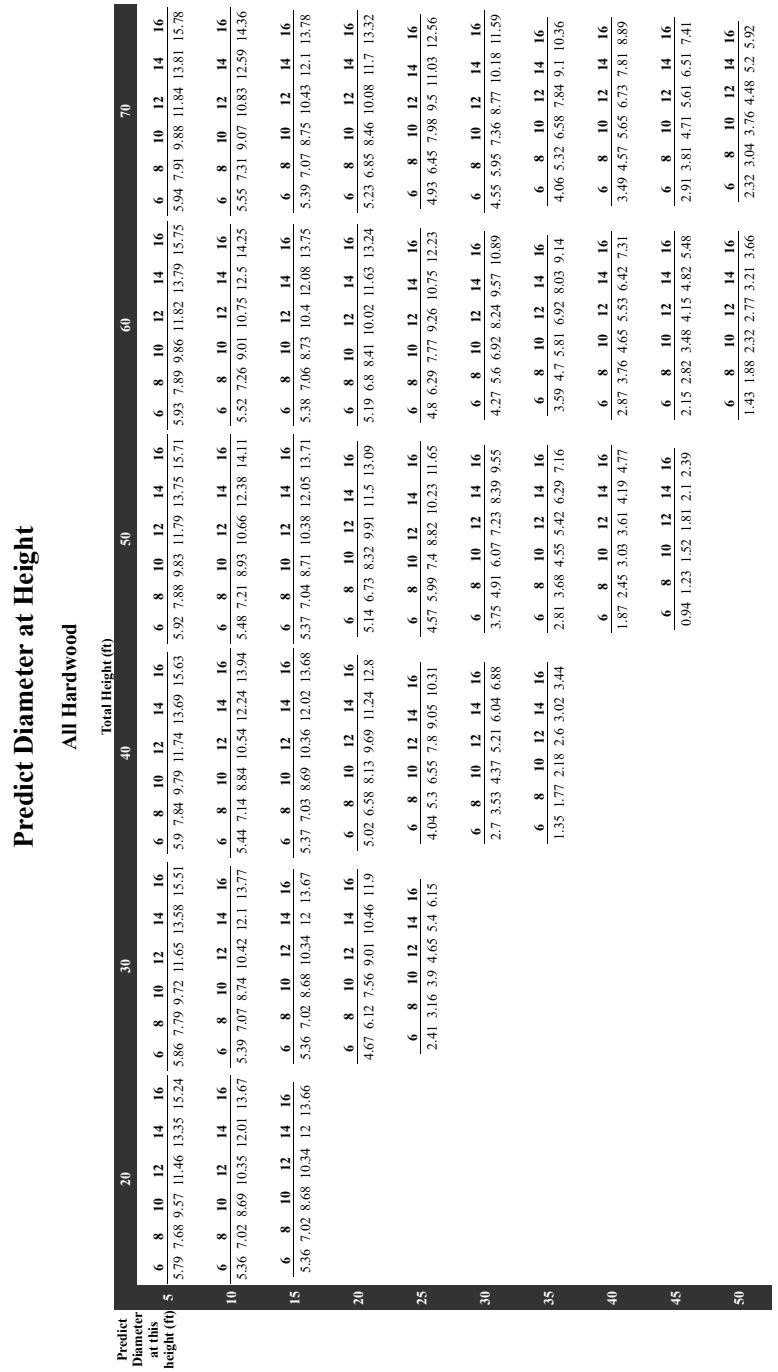
Tree Diameter in Relation to Stump Diameter

Tree diameter outside bark at 4.5 feet above ground in relation to stump diameter at various heights

Stump Diameter (in)	Yellow Pine Species				Hardwood Species			
	Stump Height (in)				Stump Height (in)			
	6	12	18	30	6	12	18	30
	D.b.h	D.b.h	D.b.h	D.b.h	D.b.h	D.b.h	D.b.h	D.b.h
6	4	5	5	6	4	5	5	5
7	5	6	6	6	5	5	6	6
8	6	7	7	7	6	7	7	8
9	7	7	8	8	6	7	7	8
10	8	8	9	9	7	8	8	9
11	8	9	10	10	7	8	9	10
12	9	10	10	11	8	9	10	11
13	10	11	11	12	9	10	11	12
14	10	11	12	13	9	11	11	13
15	11	12	13	14	10	11	12	14
16	12	13	14	15	11	12	13	14
17	13	14	15	16	11	13	14	15
18	14	15	16	17	12	14	15	16
19	14	16	16	18	13	14	15	17
20	15	16	16	18	13	15	16	18
21	16	17	18	19	14	16	17	19
22	16	18	19	20	15	17	18	20
23	17	19	20	21	15	17	19	21
24	18	20	21	22	16	18	20	22
25	19	20	22	23	17	19	20	23
26	20	21	22	24	17	20	21	23
27	20	22	23	25	18	20	22	24
28	21	23	24	26	19	21	23	25
29	22	24	25	27	19	22	24	26
30	22	25	26	28	20	23	24	27
Basis Number of Trees	1296	1320	380	943	557	620	259	421

Predict Diameter at Height - All Hardwood



Predict Diameter at Height - All Pines

Predict Diameter at Height

All Pines

Total Height (ft)

Predict Diameter at this height (ft)	20						30						40						50						60						70					
	6	8	10	12	14	16	6	8	10	12	14	16	6	8	10	12	14	16	6	8	10	12	14	16	6	8	10	12	14	16	6	8	10	12	14	16
5	5.86	7.79	9.72	11.65	13.58	15.5	5.91	7.87	9.82	11.78	13.73	15.69	5.93	7.9	9.87	11.83	13.8	15.76	5.95	7.92	9.89	11.86	13.83	15.81	5.95	7.93	9.9	11.88	13.85	15.83	5.96	7.93	9.91	11.89	13.87	15.85
10	5.38	7.05	8.73	10.4	12.07	13.75	5.46	7.17	8.89	10.6	12.32	14.03	5.52	7.27	9.02	10.77	12.53	14.28	5.57	7.34	9.12	10.89	12.67	14.44	5.6	7.39	9.18	10.97	12.76	14.55	5.62	7.42	9.22	11.02	12.83	14.63
15	5.36	7.02	8.68	10.34	12	13.67	5.37	7.03	8.7	10.36	12.03	13.69	5.38	7.06	8.73	10.41	12.08	13.75	5.4	7.08	8.76	10.44	12.13	13.81	5.41	7.1	8.79	10.48	12.17	13.85	5.42	7.11	8.81	10.5	12.19	13.89
20							4.83	6.33	7.83	9.33	10.82	12.32	5.09	6.66	8.24	9.82	11.39	12.97	5.17	6.78	8.38	9.99	11.59	13.2	5.22	6.84	8.46	10.08	11.69	13.31	5.25	6.87	8.5	10.13	11.76	13.38
25							3.15	4.13	5.11	6.09	7.06	8.04	4.42	5.79	7.16	8.53	9.9	11.27	4.76	6.24	7.72	9.19	10.67	12.15	4.92	6.45	7.98	9.5	11.03	12.56	5.02	6.57	8.13	9.68	11.24	12.79
30													3.43	4.49	5.56	6.62	7.69	8.75	4.23	5.54	6.86	8.17	9.48	10.79	4.56	5.98	7.39	8.81	10.23	11.64	4.75	6.22	7.69	9.16	10.63	12.1
35													1.81	2.38	2.94	3.5	4.06	4.62	3.53	4.63	5.72	6.81	7.91	9	4.13	5.41	6.69	7.97	9.24	10.52	4.43	5.8	7.18	8.55	9.93	11.3
40																			2.52	3.3	4.08	4.86	5.64	6.42	3.58	4.69	5.8	6.91	8.02	9.13	4.06	5.32	6.58	7.83	9.09	10.35
45																			1.26	1.65	2.04	2.43	2.82	3.21	2.87	3.76	4.65	5.54	6.43	7.32	3.61	4.73	5.85	6.97	8.09	9.21
50																									1.93	2.53	3.12	3.72	4.32	4.92	3.06	4.01	4.96	5.91	6.86	7.81

Predict Stem Wood Volume - All Hardwood

DBH = 20-40

Predict Stem Wood Volume Between Two Heights

All Hardwood

DBH

Total Height (ft)

DBH	20										30										40									
	5	10	15	20	25	30	35	40	45	50	5	10	15	20	25	30	35	40	45	50	5	10	15	20	25	30	35	40	45	50
6	5	1	1	1	1	1	1	1	1	1	10	1	1	1	1	1	1	1	1	1	15	1	1	1	1	1	1	1	1	1
	10	1	1	1	1	1	1	1	1	1	15	1	1	1	1	1	1	1	1	1	20	1	1	1	1	1	1	1	1	1
	15	1	1	1	1	1	1	1	1	1	20	1	1	1	1	1	1	1	1	1	25	1	1	1	1	1	1	1	1	1
	20	1	1	1	1	1	1	1	1	1	25	1	1	1	1	1	1	1	1	1	30	1	1	1	1	1	1	1	1	1
	25	1	1	1	1	1	1	1	1	1	30	1	1	1	1	1	1	1	1	1	35	1	1	1	1	1	1	1	1	1
	30	1	1	1	1	1	1	1	1	1	35	1	1	1	1	1	1	1	1	1	40	1	1	1	1	1	1	1	1	1
	35	1	1	1	1	1	1	1	1	1	40	1	1	1	1	1	1	1	1	1	45	1	1	1	1	1	1	1	1	1
	40	1	1	1	1	1	1	1	1	1	45	1	1	1	1	1	1	1	1	1	50	1	1	1	1	1	1	1	1	1
	45	1	1	1	1	1	1	1	1	1	50	1	1	1	1	1	1	1	1	1										
	50	1	1	1	1	1	1	1	1	1																				
8	5	1	1	1	1	1	1	1	1	1	10	1	1	1	1	1	1	1	1	1	15	1	1	1	1	1	1	1	1	1
	10	1	1	1	1	1	1	1	1	1	15	2	1	1	1	1	1	1	1	1	20	3	2	1	1	1	1	1	1	1
	15	2	1	1	1	1	1	1	1	1	20	3	2	1	1	1	1	1	1	1	25	4	3	2	1	1	1	1	1	1
	20	3	2	1	1	1	1	1	1	1	25	4	3	2	1	1	1	1	1	1	30	4	3	2	1	1	1	1	1	1
	25	4	3	2	1	1	1	1	1	1	30	4	3	2	1	1	1	1	1	1	35	5	3	2	1	1	1	1	1	1
	30	4	3	2	1	1	1	1	1	1	35	5	3	2	1	1	1	1	1	1	40	5	3	2	1	1	1	1	1	1
	35	5	3	2	1	1	1	1	1	1	40	5	3	2	1	1	1	1	1	1	45	5	3	2	1	1	1	1	1	1
	40	5	3	2	1	1	1	1	1	1	45	5	3	2	1	1	1	1	1	1	50	5	3	2	1	1	1	1	1	1
	45	5	3	2	1	1	1	1	1	1	50	5	3	2	1	1	1	1	1	1										
	50	5	3	2	1	1	1	1	1	1																				
10	5	2	2	1	1	1	1	1	1	1	10	2	2	1	1	1	1	1	1	1	15	2	2	1	1	1	1	1	1	1
	10	2	2	1	1	1	1	1	1	1	15	3	2	2	1	1	1	1	1	1	20	3	2	2	1	1	1	1	1	1
	15	3	2	2	1	1	1	1	1	1	20	3	2	2	1	1	1	1	1	1	25	4	3	2	2	1	1	1	1	1
	20	3	2	2	1	1	1	1	1	1	25	4	3	2	2	1	1	1	1	1	30	4	3	2	2	1	1	1	1	1
	25	4	3	2	2	1	1	1	1	1	30	4	3	2	2	1	1	1	1	1	35	5	3	2	2	1	1	1	1	1
	30	4	3	2	2	1	1	1	1	1	35	5	3	2	2	1	1	1	1	1	40	5	3	2	2	1	1	1	1	1
	35	5	3	2	2	1	1	1	1	1	40	5	3	2	2	1	1	1	1	1	45	5	3	2	2	1	1	1	1	1
	40	5	3	2	2	1	1	1	1	1	45	5	3	2	2	1	1	1	1	1	50	5	3	2	2	1	1	1	1	1
	45	5	3	2	2	1	1	1	1	1	50	5	3	2	2	1	1	1	1	1										
	50	5	3	2	2	1	1	1	1	1																				
12	5	2	2	2	1	1	1	1	1	1	10	2	2	2	1	1	1	1	1	1	15	2	2	2	1	1	1	1	1	1
	10	2	2	2	1	1	1	1	1	1	15	3	2	2	1	1	1	1	1	1	20	3	2	2	1	1	1	1	1	1
	15	3	2	2	1	1	1	1	1	1	20	3	2	2	1	1	1	1	1	1	25	4	3	2	2	1	1	1	1	1
	20	3	2	2	1	1	1	1	1	1	25	4	3	2	2	1	1	1	1	1	30	4	3	2	2	1	1	1	1	1
	25	4	3	2	2	1	1	1	1	1	30	4	3	2	2	1	1	1	1	1	35	5	3	2	2	1	1	1	1	1
	30	4	3	2	2	1	1	1	1	1	35	5	3	2	2	1	1	1	1	1	40	5	3	2	2	1	1	1	1	1
	35	5	3	2	2	1	1	1	1	1	40	5	3	2	2	1	1	1	1	1	45	5	3	2	2	1	1	1	1	1
	40	5	3	2	2	1	1	1	1	1	45	5	3	2	2	1	1	1	1	1	50	5	3	2	2	1	1	1	1	1
	45	5	3	2	2	1	1	1	1	1	50	5	3	2	2	1	1	1	1	1										
	50	5	3	2	2	1	1	1	1	1																				
14	5	3	3	2	2	1	1	1	1	1	10	3	3	2	2	1	1	1	1	1	15	3	3	2	2	1	1	1	1	1
	10	3	3	2	2	1	1	1	1	1	15	5	3	2	2	1	1	1	1	1	20	7	5	2	2	1	1	1	1	1
	15	5	3	2	2	1	1	1	1	1	20	7	5	2	2	1	1	1	1	1	25	9	6	4	2	2	1	1	1	1
	20	7	5	2	2	1	1	1	1	1	25	8	6	3	1	1	1	1	1	1	30	10	7	5	3	1	1	1	1	1
	25	8	6	3	1	1	1	1	1	1	30	8	6	3	1	1	1	1	1	1	35	10	8	5	3	1	1	1	1	1
	30	8	6	3	1	1	1	1	1	1	35	8	6	3	1	1	1	1	1	1	40	10	8	5	3	1	1	1	1	1
	35	8	6	3	1	1	1	1	1	1	40	10	8	5	3	1	1	1	1	1	45	10	8	5	3	1	1	1	1	1
	40	8	6	3	1	1	1	1	1	1	45	10	8	5	3	1	1	1	1	1	50	10	8	5	3	1	1	1	1	1
	45	8	6	3	1	1	1	1	1	1	50	10	8	5	3	1	1	1	1	1										
	50	8	6	3	1	1	1	1	1	1																				
	5	10	15	20	25	30	35	40	45	50	5	10	15	20	25	30	35	40	45	50	5	10	15	20	25	30	35	40	45	50

Predict Stem Wood Volume - All Hardwood

DBH = 50-70

Predict Stem Wood Volume Between Two Heights

All Hardwood

DBH

Total Height (ft)

DBH	50											60											70										
	5	10	15	20	25	30	35	40	45	50		5	10	15	20	25	30	35	40	45	50		5	10	15	20	25	30	35	40	45	50
6																																	
5											5											5										
10	1										10	1										10	1									
15	1	1									15	1	1									15	1	1								
20	2	1	1								20	2	1	1								20	2	1	1							
25	2	2	1	0							25	2	2	1	1							25	2	2	1	1						
30	3	2	1	1	0						30	3	2	2	1	0						30	3	2	2	1	0					
35	3	2	2	1	1	0					35	3	2	2	1	1	0					35	3	3	2	1	1	0				
40	3	2	2	1	1	0	0				40	3	3	2	1	1	1	0				40	4	3	2	2	1	1	0			
45	3	2	2	1	1	0	0	0			45	3	3	2	2	1	1	0	0			45	4	3	2	2	1	1	0	0		
50	3	2	2	1	1	0	0	0	0		50	4	3	2	2	1	1	0	0	0		50	4	3	3	2	1	1	1	0	0	
8																																	
5											5											5										
10	1										10	1										10	1									
15	2	1									15	2	1									15	2	1								
20	3	2	1								20	3	2	1								20	3	2	1							
25	4	3	2	1							25	4	3	2	1							25	4	3	2	1						
30	5	4	3	1	1						30	5	4	3	2	1						30	5	4	3	2	1					
35	5	4	3	2	1	0					35	6	4	3	2	1	1					35	6	5	3	2	1	1				
40	5	4	3	2	1	1	0				40	6	5	4	3	2	1	0				40	6	5	4	3	2	1	1			
45	5	4	3	2	1	1	0	0			45	6	5	4	3	2	1	1	0			45	7	5	4	3	2	2	1	0		
50	5	4	3	2	1	1	0	0	0		50	6	5	4	3	2	1	1	0	0		50	7	6	5	4	3	2	1	1	0	
10																																	
5											5											5										
10	2										10	2										10	2									
15	4	2									15	4	2									15	4	2								
20	5	3	2								20	5	3	2								20	5	3	2							
25	7	5	3	1							25	7	5	3	1							25	7	5	3	1						
30	8	6	4	2	1						30	8	6	4	3	1						30	8	6	4	3	1					
35	8	6	5	3	2	1					35	9	7	5	3	2	1					35	9	7	5	4	2	1				
40	8	7	5	3	2	1	0				40	9	7	6	4	3	1	1				40	10	8	6	5	3	2	1			
45	9	7	5	3	2	1	0	0			45	10	8	6	4	3	2	1	0			45	11	9	7	5	4	2	1	1		
50	9	7	5	3	2	1	0	0	0		50	10	8	6	5	3	2	1	1	0		50	11	9	7	6	4	3	2	1	0	
12																																	
5											5											5										
10	3										10	3										10	3									
15	5	2									15	5	2									15	5	3								
20	8	5	2								20	8	5	2								20	8	5	2							
25	10	7	4	2							25	10	7	4	2							25	10	7	5	2						
30	11	8	6	3	1						30	11	9	6	4	2						30	12	9	6	4	2					
35	12	9	7	4	2	1					35	13	10	7	5	3	1					35	13	10	8	5	3	2				
40	12	9	7	5	3	1	0				40	13	11	8	6	4	2	1				40	14	12	9	7	4	3	1			
45	12	10	7	5	3	1	1	0			45	14	11	9	6	4	3	1	1			45	15	12	10	7	5	3	2	1		
50	12	10	7	5	3	1	1	0	0		50	14	11	9	7	5	3	2	1	0		50	16	13	10	8	6	4	3	1	1	
14																																	
5											5											5										
10	4										10	4										10	4									
15	7	3									15	7	3									15	7	3								
20	10	7	3								20	10	7	3								20	11	7	3							
25	13	9	6	3							25	13	9	6	3							25	13	10	6	3						
30	15	11	8	5	2						30	16	12	8	5	2						30	16	12	9	5	3					
35	16	12	9	6	3	1					35	17	13	10	7	4	2					35	18	14	11	7	5	2				
40	17	13	10	6	4	2	1				40	18	15	11	8	5	3	1				40	20	16	12	9	6	4	2			
45	17	13	10	7	4	2	1	0			45	19	15	12	9	6	4	2	1			45	21	17	13	10	7	5	3	1		
50	17	13	10	7	4	2	1	0	0		50	19	16	12	9	6	4	2	1	0		50	21	18	14	11	8	5	3	2	1	

Predict Stem Wood Volume - All Pines

DBH = 20-40

Predict Stem Wood Volume Between Two Heights

All Pine

DBH

Total Height (ft)

DBH	20											30											40										
	5	10	15	20	25	30	35	40	45	50		5	10	15	20	25	30	35	40	45	50		5	10	15	20	25	30	35	40	45	50
6																																	
5											5											5										
10	1										10	1										10	1									
15	1	1									15	1	1									15	1	1								
20	2	1	0								20	2	1	1								20	2	1	1							
25	2	1	0								25	2	2	1	0							25	2	2	1	0						
30	2	1	0								30	2	2	1	0	0						30	3	2	1	1	0					
35	2	1	0								35	2	2	1	0	0						35	3	2	2	1	0	0				
40	2	1	0								40	2	2	1	0	0						40	3	2	2	1	1	0	0			
45	2	1	0								45	2	2	1	0	0						45	3	2	2	1	1	0	0			
50	2	1	0								50	2	2	1	0	0						50	3	2	2	1	1	0	0			
8																																	
5											5											5										
10	1										10	1										10	1									
15	2	1									15	2	1									15	2	1								
20	3	2	1								20	3	2	1								20	3	2	1							
25	3	2	1								25	4	3	2	1							25	4	3	2	1						
30	3	2	1								30	4	3	2	1	0						30	5	4	2	1	1					
35	3	2	1								35	4	3	2	1	0						35	5	4	3	2	1	0				
40	3	2	1								40	4	3	2	1	0						40	5	4	3	2	1	0	0			
45	3	2	1								45	4	3	2	1	0						45	5	4	3	2	1	0	0			
50	3	2	1								50	4	3	2	1	0						50	5	4	3	2	1	0	0			
10																																	
5											5											5										
10	2										10	2										10	2									
15	3	2									15	4	2									15	4	2								
20	5	3	1								20	5	3	2								20	5	3	2							
25	5	3	1								25	6	4	3	1							25	7	5	3	1						
30	5	3	1								30	6	4	3	1	0						30	7	6	4	2	1					
35	5	3	1								35	6	4	3	1	0						35	8	6	4	3	1	0				
40	5	3	1								40	6	4	3	1	0						40	8	6	4	3	1	0	0			
45	5	3	1								45	6	4	3	1	0						45	8	6	4	3	1	0	0			
50	5	3	1								50	6	4	3	1	0						50	8	6	4	3	1	0	0			
12																																	
5											5											5										
10	3										10	3										10	3									
15	5	2									15	5	2									15	5	2								
20	7	4	2								20	7	5	2								20	8	5	2							
25	7	4	2								25	9	6	4	1							25	9	7	4	2						
30	7	4	2								30	9	6	4	2	0						30	11	8	6	3	1					
35	7	4	2								35	9	6	4	2	0						35	11	9	6	4	2	1				
40	7	4	2								40	9	6	4	2	0						40	11	9	6	4	2	1	0			
45	7	4	2								45	9	6	4	2	0						45	11	9	6	4	2	1	0			
50	7	4	2								50	9	6	4	2	0						50	11	9	6	4	2	1	0			
14																																	
5											5											5										
10	4										10	4										10	4									
15	7	3									15	7	3									15	7	3								
20	9	6	2								20	10	6	3								20	10	7	3							
25	9	6	2								25	12	8	5	2							25	13	9	6	3						
30	9	6	2								30	12	9	5	2	0						30	15	11	8	4	2					
35	9	6	2								35	12	9	5	2	0						35	16	12	8	5	3	1				
40	9	6	2								40	12	9	5	2	0						40	16	12	9	5	3	1	0			
45	9	6	2								45	12	9	5	2	0						45	16	12	9	5	3	1	0			
50	9	6	2								50	12	9	5	2	0						50	16	12	9	5	3	1	0			

Predict Stem Wood Volume - All Pines

DBH = 50-70

Predict Stem Wood Volume Between Two Heights

All Pine

Total Height (ft)

DBH	50											60											70										
	5	10	15	20	25	30	35	40	45	50		5	10	15	20	25	30	35	40	45	50		5	10	15	20	25	30	35	40	45	50
6	5										5											5										
	10	1									10	1										10	1									
	15	1	1								15	1	1									15	1	1								
	20	2	1	1							20	2	1	1								20	2	1	1							
	25	2	2	1	1						25	2	2	1	1							25	2	2	1	1						
	30	3	2	2	1	0					30	3	2	2	1	0						30	3	2	2	1	0					
	35	3	2	2	1	1	0				35	3	3	2	1	1	0					35	3	3	2	1	1	0				
	40	3	3	2	1	1	1	0			40	4	3	2	2	1	1	0				40	4	3	2	2	1	1	0			
	45	3	3	2	2	1	1	0	0		45	4	3	3	2	1	1	1	0			45	4	3	3	2	2	1	1	0		
	50	3	3	2	2	1	1	0	0	0	50	4	3	3	2	2	1	1	0	0		50	4	4	3	2	2	1	1	1	0	
	5	10	15	20	25	30	35	40	45	50		5	10	15	20	25	30	35	40	45	50		5	10	15	20	25	30	35	40	45	50
8	5										5											5										
	10	1									10	1										10	1									
	15	2	1								15	2	1									15	2	1								
	20	3	2	1							20	3	2	1								20	3	2	1							
	25	4	3	2	1						25	4	3	2	1							25	4	3	2	1						
	30	5	4	3	2	1					30	5	4	3	2	1						30	5	4	3	2	1					
	35	6	4	3	2	1	1				35	6	5	4	3	2	1					35	6	5	4	3	2	1				
	40	6	5	4	3	2	1	0			40	6	5	4	3	2	1	1				40	7	6	4	3	2	1	1			
	45	6	5	4	3	2	1	0	0		45	7	6	4	3	2	2	1	0			45	7	6	5	4	3	2	1	1		
	50	6	5	4	3	2	1	0	0	0	50	7	6	5	4	3	2	1	1	0		50	8	6	5	4	3	2	2	1	0	
	5	10	15	20	25	30	35	40	45	50		5	10	15	20	25	30	35	40	45	50		5	10	15	20	25	30	35	40	45	50
10	5										5											5										
	10	2									10	2										10	2									
	15	4	2								15	4	2									15	4	2								
	20	5	3	2							20	5	3	2								20	5	3	2							
	25	7	5	3	1						25	7	5	3	1							25	7	5	3	2						
	30	8	6	4	3	1					30	8	6	4	3	1						30	8	6	5	3	1					
	35	9	7	5	4	2	1				35	9	7	6	4	2	1					35	10	8	6	4	3	1				
	40	9	7	6	4	3	1	1			40	10	8	6	5	3	2	1				40	11	9	7	5	4	2	1			
	45	10	8	6	4	3	2	1	0		45	11	9	7	5	4	3	1	1			45	11	9	8	6	5	3	2	1		
	50	10	8	6	4	3	2	1	0	0	50	11	9	7	6	4	3	2	1	0		50	12	10	8	7	5	4	3	2	1	
	5	10	15	20	25	30	35	40	45	50		5	10	15	20	25	30	35	40	45	50		5	10	15	20	25	30	35	40	45	50
12	5										5											5										
	10	3									10	3										10	3									
	15	5	3								15	5	3									15	5	3								
	20	8	5	2							20	8	5	2								20	8	5	2							
	25	10	7	4	2						25	10	7	5	2							25	10	7	5	2						
	30	11	9	6	4	2					30	12	9	6	4	2						30	12	9	7	4	2					
	35	13	10	7	5	3	1				35	13	11	8	6	3	2					35	14	11	8	6	4	2				
	40	14	11	8	6	4	2	1			40	15	12	9	7	5	3	1				40	15	12	10	7	5	3	2			
	45	14	11	8	6	4	2	1	0		45	15	13	10	8	6	4	2	1			45	16	14	11	9	7	5	3	1		
	50	14	11	9	6	4	2	1	0	0	50	16	13	11	8	6	4	3	1	0		50	17	15	12	10	7	5	4	2	1	
	5	10	15	20	25	30	35	40	45	50		5	10	15	20	25	30	35	40	45	50		5	10	15	20	25	30	35	40	45	50
14	5										5											5										
	10	4									10	4										10	4									
	15	7	3								15	7	3									15	7	3								
	20	10	7	3							20	11	7	3								20	11	7	3							
	25	13	9	6	3						25	14	10	6	3							25	14	10	6	3						
	30	16	12	8	5	2					30	16	12	9	6	3						30	16	12	9	6	3					
	35	17	14	10	7	4	2				35	18	14	11	8	5	2					35	19	15	11	8	5	2				
	40	18	15	11	8	5	3	1			40	20	16	13	9	6	4	2				40	21	17	13	10	7	4	2			
	45	19	15	12	8	6	3	1	0		45	21	17	14	11	8	5	3	1			45	22	19	15	12	9	6	4	2		
	50	19	15	12	8	6	3	2	0	0	50	22	18	14	11	8	6	4	2	1		50	24	20	16	13	10	7	5	3	1	

Volume Measurements

Comparison of Log Rules

Top DIB (In)	Doyle	Scribner	International	Cubic Ft.
Formula	$(D-4)^2xL$	$79D^2-2D-4$	$0.796D^2-1.370-1.230$	(B+b)L/2
8	16	32	40	7
9	25	42	50	9
10	36	54	65	11
11	49	64	80	13
12	64	79	95	15
13	81	97	115	17
14	100	114	135	20
15	121	142	160	22
16	144	159	180	25
17	169	185	205	28
18	196	213	230	32
19	225	240	260	35
20	256	280	290	39

16’ Logs (From Forestry Handbook)

Log Volume Tables

Scale of 16-Foot Logs to Nearest Board Foot
Board Foot Int. 1/4

Scribner Rule

Diameter inside bark, tenths of Inches

D.I.B (In)	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
6 - - -	12	13	14	15	16	16	17	18	19`	20
7 - - -	21	22	23	24	24	25	26	27	28	29
8 - - -	30	31	32	33	34	36	37	38	39	41
9 - - -	42	43	45	46	47	48	50	51	52	54
10 - - -	55	56	58	60	61	63	64	66	67	69
11 - - -	70	72	74	75	77	78	80	81	83	84
12 - - -	86	88	90	91	93	95	97	99	101	102
13 - - -	104	106	108	110	111	113	115	117	119	121
14 - - -	123	125	127	129	131	133	135	137	140	142
15 - - -	144	146	148	150	153	155	157	159	161	164
16 - - -	166	168	171	173	175	177	180	182	185	187
17 - - -	189	191	194	196	199	202	204	207	210	213
18 - - -	216	218	221	224	227	229	231	234	237	240
19 - - -	243	245	248	251	254	257	260	263	266	269
20 - - -	272	275	278	281	284	287	290	293	296	299
21 - - -	302	305	308	311	314	317	320	323	327	330
22 - - -	334	337	340	344	348	351	354	358	361	365
23 - - -	368	372	375	379	382	386	390	394	397	400
24 - - -	403	406	410	414	418	422	426	429	432	436
25 - - -	440	444	448	452	456	460	464	468	472	475
26 - - -	478	482	486	490	494	498	502	506	510	514
27 - - -	518	522	526	530	534	538	542	546	550	564
28 - - -	559	563	567	571	575	579	583	587	592	597
29 - - -	602	606	611	615	620	624	629	633	638	642
30 - - -	647	651	656	660	665	669	674	678	683	688
31 - - -	693	698	703	708	712	717	722	726	731	736
32 - - -	741	746	751	756	761	766	770	775	780	785
33 - - -	790	795	800	805	810	815	802	825	830	835
34 - - -	841	846	851	856	862	867	872	877	883	888
35 - - -	894	900	905	910	915	921	926	931	937	942
36 - - -	948	954	959	965	971	977	982	988	993	998
37 - - -	1,004	1,010	1,016	1,021	1,027	1,032	1,038	1,043	1,049	1,055
38 - - -	1,061	1,067	1,073	1,079	1,085	1,091	1,097	1,103	1,109	1,115
39 - - -	1,120	1,126	1,132	1,138	1,144	1,150	1,156	1,162	1,168	1,174
40 - - -	1,180	1,180	1,192	1,198	1,204	1,210	1,216	1,222	1,228	1,235
41 - - -	1,242	1,249	1,255	1,261	1,268	1,274	1,280	1,286	1,293	1,300
42 - - -	1,306	1,312	1,318	1,325	1,331	1,338	1,344	1,351	1,358	1,364

Formula used V= 0.796D2 -1.376D -1.230

International Rule 1/4 Inch

Diameter inside bark, tenths of Inches

D.I.B (In)	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
6 - - -	19	20	21	22	23	23	24	25	26	27
7 - - -	28	29	30	31	32	33	34	35	36	38
8 - - -	39	40	41	42	43	45	46	47	48	50
9 - - -	51	52	54	55	56	58	59	60	63	63
10 - - -	65	66	68	69	71	72	74	75	77	78
11 - - -	80	82	83	85	87	88	90	92	93	95
12 - - -	97	99	100	102	104	106	108	110	112	114
13 - - -	115	117	119	121	123	125	127	129	131	133
14 - - -	136	138	140	142	144	146	148	151	153	155
15 - - -	157	160	162	164	166	169	171	173	176	178
16 - - -	181	183	185	188	190	193	195	198	200	203
17 - - -	205	208	211	213	216	219	221	224	227	229
18 - - -	232	235	237	240	243	246	249	251	254	257
19 - - -	260	263	266	269	272	275	278	281	284	287
20 - - -	290	293	296	209	302	305	308	311	315	318
21 - - -	321	324	327	331	334	337	341	344	347	351
22 - - -	354	357	361	364	367	371	374	378	381	385
23 - - -	388	392	395	399	403	406	410	413	417	421
24 - - -	424	428	432	435	439	443	447	451	454	458
25 - - -	462	466	470	474	478	481	485	489	493	467
26 - - -	501	505	509	513	517	521	526	530	534	538
27 - - -	542	546	550	555	559	563	567	572	576	530
28 - - -	584	589	593	598	602	606	611	615	620	624
29 - - -	628	633	637	642	647	651	656	660	665	669
30 - - -	674	679	683	683	693	697	702	707	712	716
31 - - -	721	726	731	736	741	745	750	755	760	765
32 - - -	770	775	780	785	790	795	800	805	810	815
33 - - -	820	826	831	836	841	846	851	857	862	867
34 - - -	872	878	883	888	894	899	904	910	915	921
35 - - -	826	931	937	942	948	953	959	964	970	976
36 - - -	981	987	902	998	1,004	1,009	1,015	1,021	1,026	1,032
37 - - -	1,038	1,044	1,049	1,055	1,061	1,067	1,073	1,079	1,084	1,090
38 - - -	1,096	1,102	1,108	1,114	1,120	1,126	1,132	1,138	1,144	1,150
39 - - -	1,156	1,162	1,168	1,174	1,181	1,187	1,193	1,199	1,205	1,211
40 - - -	1,218	1,224	1,230	1,236	1,243	1,249	1,255	1,262	1,268	1,274
41 - - -	1,281	1,287	1,294	1,300	1,306	1,313	1,319	1,326	1,332	1,339
42 - - -	1,345	1,352	1,359	1,365	1,372	1,378	1,385	1,392	1,398	1,405
43 - - -	1,412	1,419	1,425	1,432	1,439	1,446	1,452	1,459	1,466	1,473
44 - - -	1,480	1,487	1,493	1,500	1,507	1,514	1,521	1,528	1,535	1,542
45 - - -	1,549	1,556	1,563	1,570	1,577	1,585	1,592	1,599	1,606	1,613
46 - - -	1,602	1,627	1,635	1,642	1,649	1,656	1,664	1,671	1,678	1,686
47 - - -	1,693	1,700	1,708	1,715	1,722	1,730	1,737	1,745	1,752	1,760
48 - - -	1,767	1,775	1,782	1,790	1,797	1,805	1,813	1,820	1,828	1,835

Formula used V= 0.796D2 -1.376D -1.230

Doyle Rule

Diameter inside bark, tenths of Inches

D.I.B (In)	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
5 - - -	1	1	1	2	2	2	3	3	3	4
6 - - -	4	4	5	5	6	6	7	7	8	8
7 - - -	9	10	10	11	12	12	13	14	14	15
8 - - -	16	17	18	18	19	20	21	22	23	24
9 - - -	25	26	27	28	29	30	31	32	34	35
10 - - -	36	37	38	40	41	42	44	45	46	48
11 - - -	49	50	52	53	55	56	58	59	61	62
12 - - -	64	66	67	69	71	72	74	76	77	79
13 - - -	81	83	85	86	88	90	92	94	96	98
14 - - -	100	102	104	106	108	110	112	114	117	119
15 - - -	121	123	125	128	130	132	135	137	139	142
16 - - -	144	146	149	151	154	156	159	161	164	166
17 - - -	169	172	174	177	180	182	185	188	190	193
18 - - -	196	199	202	204	207	210	213	216	219	222
19 - - -	225	228	231	234	237	240	243	246	250	253
20 - - -	256	259	262	266	269	272	276	279	282	288
21 - - -	289	292	296	299	303	306	310	303	317	320
22 - - -	324	328	331	335	339	342	346	350	353	357
23 - - -	361	365	369	372	376	380	384	388	392	396
24 - - -	400	404	408	412	416	420	424	428	433	437
25 - - -	440	445	449	454	458	462	467	471	475	480
26 - - -	484	488	493	497	502	505	511	515	520	524
27 - - -	529	534	538	543	548	552	557	562	566	571
28 - - -	576	581	586	590	595	600	606	610	615	620
29 - - -	625	630	635	640	645	650	655	660	665	671
30 - - -	678	681	686	692	697	702	706	713	718	724
31 - - -	729	734	740	748	751	756	762	767	773	778
32 - - -	784	790	796	801	807	812	818	824	829	835
33 - - -	841	847	853	856	864	870	876	882	888	894
34 - - -	900	906	912	918	924	930	936	942	949	956
35 - - -	951	967	973	980	985	992	999	1,005	1,011	1,018
36 - - -	1,024	1,030	1,037	1,043	1,050	1,056	1,063	1,069	1,076	1,082
37 - - -	1,089	1,096	1,102	1,109	1,116	1,122	1,129	1,136	1,142	1,249
38 - - -	1,156	1,163	1,170	1,176	1,183	1,190	1,197	1,204	1,211	1,218
39 - - -	1,225	1,232	1,239	1,246	1,252	1,260	1,267	1,274	1,282	1,290
40 - - -	1,296	1,303	1,310	1,318	1,325	1,332	1,340	1,347	1,354	1,362
41 - - -	1,369	1,376	1,394	1,391	1,399	1,406	1,414	1,421	1,429	1,436
42 - - -	1,444	1,452	1,459	1,467	1,475	1,482	1,490	1,498	1,505	1,513

Computed from formula: ((D-4)2 X L) / 16

Tree Cordwood Volume Tables

Merchantable Rough Cord Volume Using Total Tree Height

Form classes 65-69

Diameter Brest High (Inches)	Total Tree Height (Feet)							
	30	40	50	60	70	80	90	100
	Pulpwood Volume (Rough Cords)							
5	0.020	0.025	0.028	0.032				
6	0.029	0.035	0.040	0.045	0.052			
7	0.041	0.049	0.057	0.065	0.072	0.078		
8	0.055	0.063	0.074	0.084	0.094	0.104		
9	0.066	0.078	0.091	0.104	0.116	0.128	0.139	
10		0.097	0.115	.0132	0.148	0.165	0.179	
11		0.117	0.138	0.156	0.175	0.194	0.212	0.229
12		0.136	0.160	0.182	0.207	0.226	0.250	0.272
13		0.162	0.191	0.217	0.243	0.269	0.295	0.324
14			0.221	0.250	0.280	0.309	0.343	0.372
15			0.247	0.280	0.313	0.351	0.389	0.422
16			0.277	0.313	0.350	0.391	0.433	0.469

Form Classes 70-74

Diameter Brest High (Inches)	Total Tree Height (Feet)							
	30	40	50	60	70	80	90	100
	Pulpwood Volume (Rough Cords)							
5	0.021	0.026	0.030	0.034				
6	0.032	0.039	0.046	0.051	0.059			
7	0.045	0.054	0.063	0.071	0.080	0.088		
8	0.063	0.073	0.086	0.098	0.110	0.121		
9	0.077	0.090	0.106	0.121	0.135	0.148	0.162	
10		0.110	0.132	0.151	0.170	0.188	0.205	
11		0.130	0.154	0.176	0.197	0.219	0.240	0.259
12		0.154	0.183	0.208	0.237	0.259	0.287	0.313
13		0.184	0.218	0.248	0.277	0.307	0.341	0.371
14			0.252	0.286	0.321	0.355	0.394	0.429
15			0.282	0.321	0.360	0.403	0.447	0.485
16			0.317	0.360	0.404	0.452	0.501	0.544

Form Classes 75-79

Diameter Brest High (Inches)	Total Tree Height (Feet)							
	30	40	50	60	70	80	90	100
	Pulpwood Volume (Rough Cords)							
5	0.020	0.025	0.028	0.032				
6	0.029	0.035	0.040	0.045	0.052			
7	0.041	0.049	0.057	0.065	0.072	0.078		
8	0.055	0.063	0.074	0.084	0.094	0.104		
9	0.066	0.078	0.091	0.104	0.116	0.128	0.139	
10		0.097	0.115	0.132	0.148	0.165	0.179	
11		0.117	0.138	0.156	0.175	0.194	0.212	0.229
12		0.136	0.160	0.182	0.207	0.226	0.250	0.272
13		0.162	0.191	0.217	0.243	0.269	0.295	0.324
14			0.221	0.250	0.280	0.309	0.343	0.372
15			0.247	0.280	0.313	0.351	0.389	0.422
16			0.277	0.313	0.350	0.391	0.433	0.469

Merchantable Rough Cord Volume Using Merchantable Stem Length

Form Classes 70-74

Diameter Brest High (Inches)	Merchantable Length of Stem (Feet)													
	20	25	30	35	40	45	50	55	60	65	70	75	80	85
	Pulpwood Volume (Rough Cords)													
5	0.024	0.028	0.032	0.036										
6	0.032	0.037	0.043	0.048	0.053	0.058								
7	0.041	0.048	0.054	0.061	0.067	0.074	0.080	0.087						
8	0.054	0.063	0.071	0.079	0.088	0.096	0.105	0.113	0.121					
9	0.065	0.075	0.085	0.094	0.104	0.114	0.123	0.133	0.142	0.152	0.162			
10	0.080	0.092	0.130	0.115	0.127	0.139	0.151	0.162	0.174	0.186	0.198	0.210		
11	0.093	0.106	0.120	0.133	0.146	0.160	0.173	0.186	0.200	0.213	0.227	0.240	0.253	
12	0.110	0.126	0.142	0.157	0.173	0.189	0.205	0.221	0.237	0.253	0.268	0.284	0.300	0.316
13	0.128	0.147	0.165	0.184	0.203	0.221	0.240	0.259	0.277	0.296	0.315	0.333	0.352	0.371
14	0.148	0.170	0.191	0.213	0.234	0.256	0.278	0.299	0.321	0.342	0.364	0.386	0.407	0.429
15	0.166	0.190	0.215	0.239	0.263	0.287	0.311	0.335	0.360	0.384	0.408	0.432	0.456	0.481
16	0.188	0.215	0.242	0.269	0.296	0.323	0.350	0.377	0.404	0.431	0.458	0.484	0.511	0.538

Form Classes 75-79

Diameter Brest High (Inches)	Merchantable Length of Stem (Feet)													
	20	25	30	35	40	45	50	55	60	65	70	75	80	85
	Pulpwood Volume (Rough Cords)													
5	0.026	0.031	0.035	0.040										
6	0.036	0.042	0.048	0.054	0.060	0.067								
7	0.047	0.055	0.062	0.070	0.077	0.085	0.092	0.100						
8	0.060	0.069	0.079	0.088	0.098	0.107	0.117	0.126	0.136					
9	0.071	0.082	0.093	0.104	0.115	0.125	0.136	0.147	0.158	0.169	0.180			
10	0.089	0.102	0.116	.0129	0.143	0.156	0.170	0.184	0.197	0.211	0.224	0.238		
11	0.105	0.120	0.136	0.151	0.167	0.183	0.198	0.214	0.229	0.245	0.261	0.276	0.292	
12	0.122	0.141	0.159	0.177	0.196	0.214	0.232	0.251	0.269	0.287	0.306	0.324	0.342	0.361
13	0.142	0.163	0.184	0.205	0.226	0.248	0.269	0.290	0.311	0.333	0.354	0.375	0.396	0.417
14	0.165	0.189	0.214	0.238	0.262	0.287	0.311	0.336	0.360	0.384	0.409	0.433	0.458	0.482
15	0.188	0.216	0.244	0.273	0.301	0.329	0.358	0.386	0.414	0.443	0.471	0.500	0.528	0.556
16	0.210	0.241	0.271	0.302	0.333	0.363	0.394	0.425	0.455	0.486	0.517	0.547	0.578	0.609

*Cord = Stack of 4' X 4' X 8' roundwood

Tree Cubic Foot Volume Tables (Southern Pine)

Cubic foot volume, including bark, for stands of southern pine that are above average form

Merchantable length of stem in feet

Form Point	Dbh	12	16	20	24	28	32	36	40	44	48	52	56	60	64	Mid Diameter
Pct.	In.	Cubic Feet														
85	6	1.7	2.3	2.8	3.4	4.0	4.3	5.1								5.1
83	8		3.8	4.8	3.8	6.7	7.7	8.7	9.6	10.6	11.6					6.7
81	10			7.2	8.6	10.0	11.4	12.9	14.3	15.7	17.2	18.6	20.0	21.5		8.1
79	12				11.8	13.7	13.7	17.6	17.6	21.6	23.3	25.5	27.4	29.4	31.4	9.3
77	14					17.7	20.3	22.8	25.3	27.9	30.4	32.9	35.5	36.0	40.3	10.8
75	16						25.1	28.3	31.4	34.3	37.7	40.8	43.9	47.1	30.2	12.0

Cubic foot volume, including bark, for stands of southern pine that are average form

Merchantable length of stem in feet

Form Point	Dbh	12	16	20	24	28	32	36	40	44	48	52	56	60	64	Mid Diameter
Pct.	In.	Cubic Feet														
85	6	1.6	2.2	2.7	3.2	3.8	4.3	4.8								4.95
83	8		3.6	4.6	5.3	6.4	7.3	8.3	9.1	10.1	11.0					6.50
81	10			6.8	8.2	9.3	10.8	12.3	13.6	14.9	16.3	17.7	19.0	20.4		7.92
79	12				11.2	13.0	14.9	16.7	18.6	20.5	22.3	24.2	26.0	27.9	29.8	9.23
77	14					16.8	19.3	21.7	24.0	26.5	28.9	31.3	33.7	36.1	38.3	10.31
75	16						23.8	26.9	29.8	32.8	33.8	38.8	41.7	44.7	47.7	11.71

Cubic foot volume, including bark, for stands of southern pine that are below average form

Merchantable length of stem in feet

Form Point	Dbh	12	16	20	24	28	32	36	40	44	48	52	56	60	64	Mid Diameter
Pct.	In.	Cubic Feet														
81	6	1.6	2.1	2.6	3.1	3.7	4.2	4.7								4.9
79	8		3.5	4.3	5.2	6.0	6.9	7.8	8.6	9.5	10.4					6.3
77	10			6.3	7.8	9.0	10.3	11.6	12.9	14.2	15.3	16.8	18.1	19.4		7.7
75	12				10.6	12.4	14.1	15.9	17.7	19.4	21.2	23.0	24.8	26.3	28.3	9.0
73	14					15.9	18.1	20.4	22.7	24.9	27.2	29.3	31.8	24.0	36.3	10.2
71	16						22.7	25.3	28.4	31.2	34.0	36.9	39.7	42.5	45.4	11.4

Top utilization, 5 inches outside bark. Tables 45,46,47 varies from 3.8 to 6 inches. Source for Tables 45,46,47: Hawes, E.T. 1940. Volume tables, converting factors and information applicable to commercial timber in South. 3rd. ed., U.S.D.A. Forest Serv., Div. of State and Private Forestry, Atlanta, GA.

Standard cubic foot volume table southern pines outside bark

DBH	Merchantable Height in Feet								
In.	10	20	30	40	50	60	70	80	90
	Cubic Feet (OB) to 4-inch Top								
5	.7								
6	1.1	2.1	3.2						
7	1.4	2.9	4.3						
8	1.9	3.7	5.6	7.5					
9	2.4	4.7	7.1	9.5	11.4				
10	2.9	5.8	8.8	11.7	14.6				
11	3.5	7.1	10.6	14.1	17.7	21.2	24.7		
12	4.2	8.	12.6	16.8	21.0	25.2	9.4		
13	4.9	9.9	14.8	19.7	24.6	29.6	34.5	39.5	
14	5.7	11.5	17.2	22.9	28.6	34.3	40.1	45.8	51.5
15	6.6	13.1	19.7	26.3	32.8	39.4	46.0	52.6	59.1
16	7.5	15.0	22.4	29.9	37.4	44.8	52.3	59.8	67.3
17	8.4	16.9	25.3	33.8	42.2	50.6	59.1	67.5	75.9
18	9.5	18.9	28.4	37.8	47.3	56.8	66.2	75.7	85.1
19	10.5	21.1	31.6	42.2	52.7	63.2	73.8	84.3	94.8
20	11.7	23.4	35.0	46.7	58.4	70.1	81.7	93.4	105.1
21	12.9	23.8	38.6	51.5	64.4	77.2	90.1	103.0	115.9
22	14.1	28.3	42.4	56.5	70.6	84.8	98.8	113.0	127.2
23	15.5	30.9	46.3	61.8	77.2	92.7	108.1	123.5	139.0
24	16.8	33.6	50.4	67.3	84.1	101.0	117.7	134.5	151.3
25	18.3	36.5	54.7	73.0	91.2	109.3	127.7	146.0	164.2
26	19.7	39.5	59.2	78.9	98.7	118.4	138.1	157.9	177.6
27	21.3	42.6	63.8	85.1	106.4	127.7	149.0	170.2	191.5
28	22.9	45.8	68.7	91.5	114.4	137.3	160.2	183.1	206.0
29	24.6	49.1	73.7	98.2	122.7	147.3	171.8	196.4	220.9
30	26.3	52.5	78.8	105.1	131.4	157.6	183.9	210.2	236.4
31	28.1	56.1	84.2	112.2	140.3	168.3	196.3	224.4	252.5
32	29.9	59.8	89.7	119.6	149.7	179.3	209.2	239.1	269.0
33	31.8	63.6	95.4	127.2	158.9	190.7	222.5	254.3	286.1
34	33.7	67.5	101.2	135.0	168.7	202.5	236.2	269.9	303.7

From: James H. Hemping, School of Forestry, University of Georgia, Athens.

Merchantable cubic foot volume, inside bark, based on total height

Dbh.	Total Tree Height							
	30	40	50	60	70	80	90	100
In.	Cubic Feet							
Form Classes 65-69, Average 67								
6	2.1	2.5	2.9	3.2	3.7			
8	4.1	4.7	5.6	6.3	7.1	7.8		
10		7.5	8.9	10.2	11.5	12.7	13.8	
12		10.8	12.7	14.5	16.4	17.9	19.9	21.6
14			17.8	20.2	22.6	25.0	27.7	30.1
16			22.7	25.7	28.7	32.1	35.5	38.5
Form Classes 70-74, Average 72								
6	2.3	2.8	3.3	3.7	4.3			
8	4.7	5.5	6.5	7.4	8.2	9.1		
10		8.6	10.2	11.7	13.1	14.6	15.9	
12		12.2	14.5	16.5	18.8	20.6	22.8	24.8
14			20.3	23.1	25.9	29.1	32.2	35.8
16			26.0	29.5	33.1	37.1	41.0	44.6
Form Classes 75-79, Average 77								
6	2.6	3.2	3.8	4.2	4.9			
8	5.2	6.0	7.2	8.2	9.2	10.2		
10		9.6	11.5	13.2	14.8	16.5	18.0	
12		13.8	16.4	18.7	21.4	23.4	26.0	28.4
14			22.8	25.9	29.1	32.2	35.8	38.9
16			29.3	33.3	37.3	41.9	46.4	50.4
Form Classes 80-84, Average 82								
6	2.8	3.5	4.1	4.6	5.3			
8	5.8	6.8	8.1	9.2	10.3	11.4		
10		10.8	12.9	14.8	16.8	18.6	20.3	
12		15.2	18.2	20.7	23.6	25.9	28.8	31.4
14			25.6	29.3	32.9	36.5	10.6	44.2
16			32.7	37.3	41.8	46.9	52.0	56.6
Form Classes 85-89, Average 87								
6	3.2	4.0	4.6	5.2	6.0			
8	6.5	7.6	9.0	10.2	11.5	12.7		
10		11.9	14.3	16.5	18.6	20.7	22.6	
12		17.2	20.5	23.4	26.7	29.3	32.6	35.5
14			28.4	32.4	36.4	40.5	45.0	49.0
16			36.4	41.5	46.6	52.3	58.0	63.1

Compiled from Miner's (1950) form class volume tables. Source: Burns, Paul Y. 1965. A condensation of Minor's form class volume tables for southern pine pulpwood. La.Agr.Exp.

Trees Per Rough Cord

Trees Per Rough Cord Using Merchantable Stem Length

Form Classes 70-74 (F.C.72)

Diameter Brest High (Inches)	Merchantable Length of Stem (Feet)													
	20	25	30	35	40	45	50	55	60	65	70	75	80	85
	Number of Trees per Rough Cord of Pulpwood													
5	42	36	31	28										
6	31	27	23	21	19	17								
7	24	21	19	16	15	14	12	11						
8	19	16	14	13	11	10	10	9	8					
9	15	13	12	11	10	9	8	7	7	7	6			
10	12	11	10	9	8	7	7	6	6	5	5	5		
11	11	9	8	8	7	6	6	5	5	5	4	4	4	
12	9	8	7	6	6	5	5	5	4	4	4	4	3	3
13	8	7	6	5	5	5	4	4	4	3	3	3	3	3
14	7	6	5	5	4	4	4	3	3	3	3	3	2	2
15	6	5	5	4	4	3	3	3	3	3	2	2	2	2
16	5	5	4	4	3	3	3	3	2	2	2	2	2	2

Form Classes 75-79 (F.C.77)

Diameter Brest High (Inches)	Merchantable Length of Stem (Feet)													
	20	25	30	35	40	45	50	55	60	65	70	75	80	85
	Number of Trees per Rough Cord of Pulpwood													
5	38	32	29	25										
6	28	24	21	19	17	15								
7	21	18	16	14	13	12	11	10						
8	17	14	13	11	10	9	9	8	7					
9	14	12	11	10	9	8	7	7	6	6	6			
10	11	10	9	8	7	6	6	5	5	5	4	4		
11	10	8	7	7	6	5	5	5	4	4	4	4	3	
12	8	7	6	6	5	5	4	4	4	3	3	3	3	3
13	7	6	5	5	4	4	4	3	3	3	3	3	3	2
14	6	5	5	4	4	3	3	3	3	3	2	2	2	2
15	5	5	4	4	3	3	3	3	2	2	2	2	2	2
16	5	4	4	3	3	3	3	2	2	2	2	2	2	2