

BLACK WALNUT

on Nonforest Land in Kentucky



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COVER PHOTO—*Black walnut trees growing on nonforest land in Kentucky, as on this pastured woodlot, add 22 million cubic feet to the State's supply of black walnut, bringing the total in the State to 89 million cubic feet.*

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**by Ronald D. Lindmark
and Paul S. DeBald**



CONTENTS

Introduction	1
The study	1
Sampling	1
Tree measurements	3
Computations	4
Results	4
Volume	4
Size and quality	6
Conclusions	8
Appendix	9
Accuracy of volume estimates	9
Definition of terms	10
Quality categories	11
Statistical tables	14

Introduction

NOT ALL black walnut trees grow in the forest. Many are found in open places — along fence rows, in pastures, in narrow wooded strips. Trees in places like this are not counted in the forest surveys made by the U. S. Forest Service to find out how much timber we have. Yet such trees are part of our over-all black walnut resource.

The U.S.D.A. Forest Service undertook a study to find out how much black walnut (*Juglans nigra* L.) timber there is in these nonforest areas. The study was made in Kentucky for two reasons. First, because Kentucky produces a lot of black walnut. Second, because a forest survey had recently been completed there.

The results of this study, supplementing the data collected in the forest survey, give us a more complete estimate of the total black walnut resource of Kentucky.

The Study

Sampling

Our statistics were obtained from a sampling survey of two sampling units — the Blue Grass and the Forested Unit (fig. 1). The Blue Grass is identical to the Blue Grass Unit of the 1963 Kentucky forest survey. The Forested Unit includes the other six forest-survey units. Although the Blue Grass is only 20 percent forested (fig. 2) and has less than one-tenth of the State's total forest area, it has more than 16 percent of the black walnut volume found on Kentucky's commercial forest land.¹

¹Gansner, David A. and Paul S. DeBald. KENTUCKY FORESTS — BLUE GRASS UNIT. U.S.D.A. Forest Serv. Resource Bull. CS-7, 33 pp., illus. CS. Forest Exp. Sta., Columbus, Ohio. 1966.

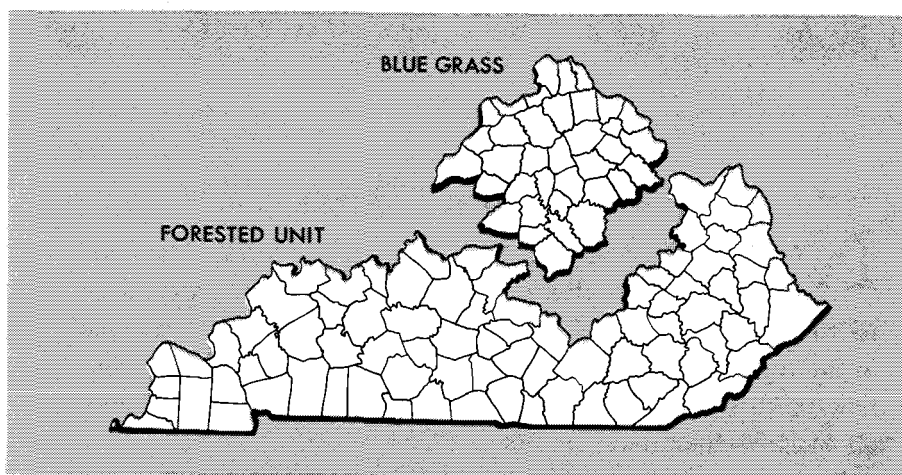


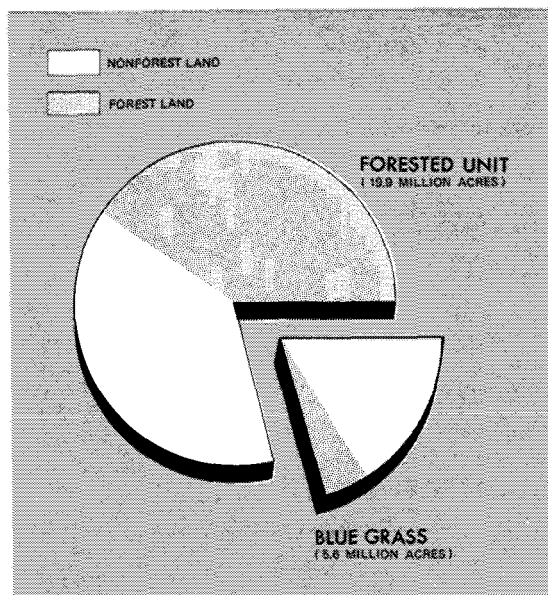
Figure 1.—Location of the sampling units.

Because we expected a high volume of black walnut in the Blue Grass, we selected study plots in every county of the Unit. In the Forested Unit, plots were taken in selected counties. We selected the counties so that our sample included the same proportion of nonforest land in each of the forest-survey units outside the Blue Grass.

Sample ground plots were drawn from records compiled during the 1963 Kentucky forest survey. In the Blue Grass one-fourth of the survey nonforest ground checks in each county were chosen at random as walnut study plots; in the Forested Unit one-half of those in the selected counties were chosen at random. Those in urban or built-up areas were discarded. We used 444 sample plots — 216 in the Blue Grass and 228 in the Forested Unit.

Using aerial photographs for reference, field crews visited each of the sample plots. A 20-acre circular area was examined at each. The forest and nonforest portions in each 20-acre sample were delineated on acetate overlays placed over the photographs. Highways and utility rights-of-way were excluded from the sample. On the nonforest portion of each sample plot, every black walnut tree was tallied. Nearly 3,000 trees were observed in the study.

Figure 2.—Distribution of forest and nonforest land in Kentucky, by study unit, 1963.



Tree Measurements

We used forest-survey definitions and procedures as much as possible in this study. For this reason we have applied to trees on nonforest land certain terms that are usually reserved for forest-grown trees — for example, *growing stock* and *sawtimber*.

We departed most from forest-survey procedures and definitions in collecting and compiling data for short-log trees. Because open-grown black walnut trees commonly yield 6- or 7-foot bolts suitable for veneer, we determined the net volumes of short-log trees in addition to volumes of trees that met the 8-foot standard used in the forest survey. As a result, we can present two sets of volume figures for nonforest land; one set of figures is comparable to Kentucky forest-survey statistics.

We used five categories to evaluate tree quality. The first three — log grades F1, F2, and F3 — are based on the standard grade specifications for hardwood factory-lumber logs (see appendix). The fourth category — tie-and-timber — includes logs that are at least 8 feet long, but do not meet the grade specifications for

hardwood factory-lumber logs. This group, sometimes referred to as a structural log class, includes material that meets the U.S.D.A. Forest Service specifications for hardwood construction logs. The fifth category — short-logs — includes merchantable butt sections that are 6 or 7 feet long, regardless of their actual grade quality.

Because there is no uniform veneer-log grading system, we did not try to determine walnut volume by veneer quality. However, because a portion of both grade 1 and 2 logs contain veneer-quality material, we can use volume by quality classes to judge the relative amount of veneer-quality material in sawtimber trees. Also, diameter can indicate relative quality in short-log trees because the bolts from these trees are usually clear.

Computations

We found the net volume of each tallied walnut tree, using procedures consistent with those employed in the Kentucky forest survey. Then we measured the nonforest area of each sample plot from the acetate overlays that had been delineated in the field. Using this volume and area information, we determined the total net volume and volume per nonforest acre for each sample plot. In addition, we determined the average volume per nonforest acre for each of the two sampling units. Next, we arbitrarily reduced the total nonforest area in each of the two sampling units by 5 percent to adjust for nonforest land excluded from the study — urban or builtup areas, highways, and utility rights-of-way. To each unit's adjusted nonforest area we applied its average volume per nonforest acre to determine the black walnut volume on nonforest land in each unit. Finally, we estimated sampling errors for each of the two units, using the variation in per-acre volumes for the sample plots in each.

Results

Volume

Nonforest land in Kentucky contains about 22 million cubic feet of black walnut, including nearly 63 million board feet of sawtimber. More than 90 percent of this volume is in trees that meet the specifications used in the Kentucky forest survey to

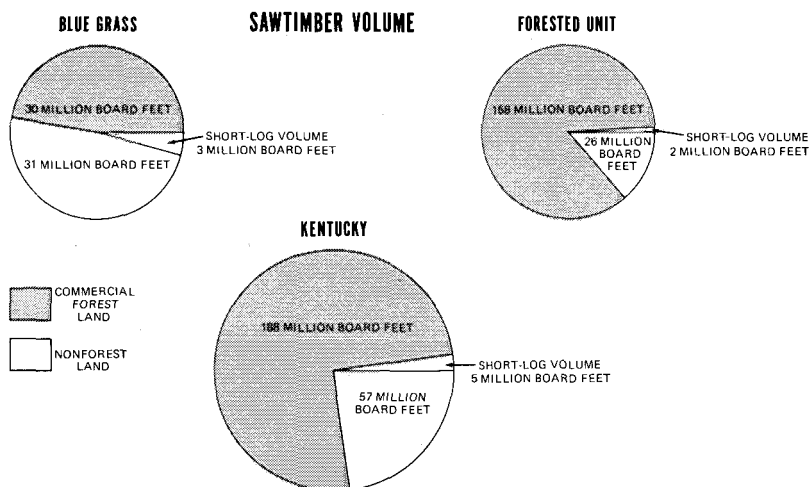


Figure 3.—Net board-foot volume of black walnut, by sampling units and for the entire state, 1965.

define growing stock and sawtimber. The rest — 2 million cubic feet or 5 million board feet — is in short-log trees.

Adding the State's nonforest walnut supply to the volume found on commercial forest land brings Kentucky's total supply of black walnut to 89 million cubic feet of timber, including 251 million board feet. The nonforest supply makes up one-fourth of this total supply.

The Blue Grass has more walnut sawtimber on nonforest land than it does on forest land. Even without the volume in short-log trees, walnut sawtimber volume on nonforest land — 31 million board feet — exceeds that found on commercial forest land in the Blue Grass. Short-log volumes add another 3 million board feet to the unit's walnut supply (fig. 3).

Nonforest land in the Forested Unit contains about 10 million cubic feet, including more than 28 million board feet, of black walnut (fig. 3). Although this volume is not as concentrated as the black walnut volume on nonforest land in the Blue Grass,

it amounts to more than 15 percent of the Forested Unit's overall supply of black walnut.

Size and Quality

Most of the black walnut trees on nonforest land in Kentucky are small in diameter. Only about one-fourth are of sawtimber size, and more than half of the sawtimber trees are smaller than 16 inches d.b.h. (fig. 4).

PERCENT OF
ALL SAWTIMBER-
SIZE TREES

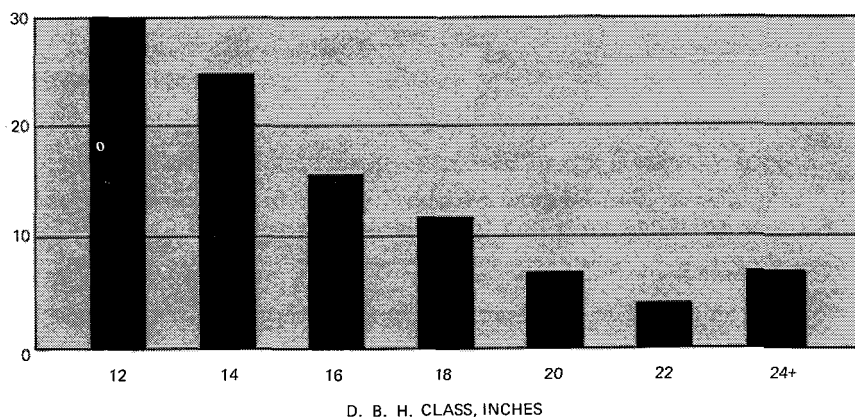


Figure 4.—Distribution of black walnut sawtimber-size trees on nonforest land, by diameter class, Kentucky, 1965.

As might be expected for open-grown trees, most of them have short boles. Fewer than one-third of the sawtimber-size trees will yield a 16-foot log. More than one-fourth have no usable bole at all. (Many grow along fence rows and actually are part of a barbed-wire fence.) Of every 100 open-grown sawtimber-size trees, 11 contain only one 6- or 7-foot bolt; and only 8 have usable lengths of 24 feet or more (fig. 5).

Even though most of the black walnut trees grown on nonforest land are short and small, many of them are large and have relatively high quality. In fact, three-fifths of the net board-

PERCENT OF
ALL SAWTIMBER-
SIZE TREES

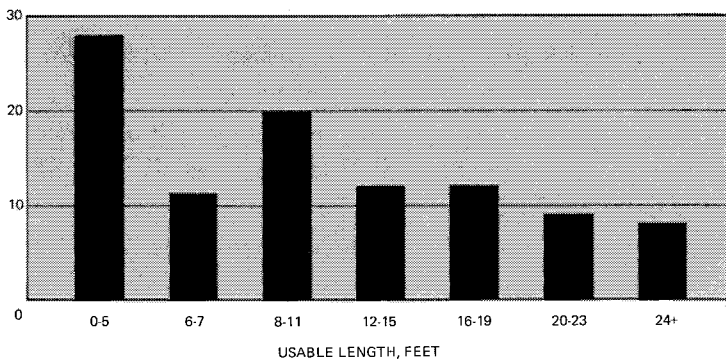


Figure 5.—Distribution of black walnut sawtimber-size trees on nonforest land, by usable length, Kentucky, 1965.

foot volume in trees with sawlog lengths of 8 feet or longer is in log grades F1 and F2 (fig. 6). Much of this material may be considered veneer quality. As for the volume in trees with bolt lengths of 6 or 7 feet, more than half is in trees 18 inches and larger. These bolts are usually clear; so much of this material may also be considered veneer quality.

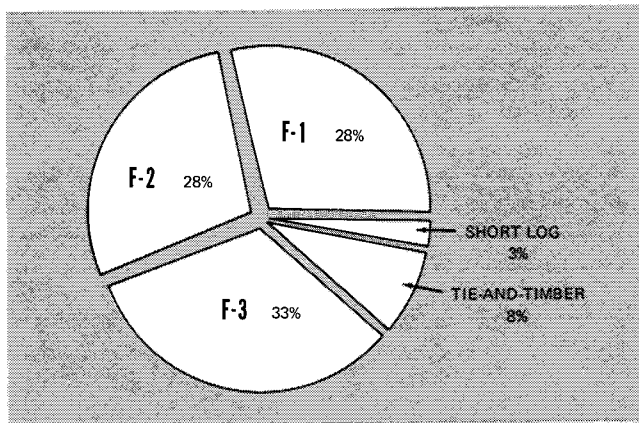


Figure 6.—Distribution of net board-foot volume of black walnut on nonforest land by quality category, Kentucky, 1965.

Conclusions

Black walnut trees growing on nonforest land in Kentucky add substantially to the State's supply of black walnut. The concentration of these trees is especially high in the Blue Grass region. Although the trees growing under nonforest conditions tend to be short-boled, many of them have large diameters and contain quality timber. Those trees that yield only one 6- or 7-foot bolt also add to the State's overall supply of black walnut.



Appendix

ACCURACY OF VOLUME ESTIMATES

The volume estimates in this report are subject to sampling and non-sampling errors. Sampling errors are inherent in statistical work. They can be calculated on the basis of the variation of the sample. Nonsampling errors consist of mistakes in judgment, measurement, recording, and computation. Although they cannot be measured, they can be held to a minimum by training and supervision of personnel and by checking all phases of the work.

Because the Blue Grass and the Forested Unit were sampled separately, the data for each were compiled and analyzed separately. Sampling errors were calculated for each unit, then were statistically combined to obtain a sampling error for State totals. The sampling error for the total black walnut growing-stock volume on nonforest land in the Blue Grass was ± 13.3 percent. The sampling error in the Forested Unit was ± 24.2 percent. The large difference in sampling errors was expected because a more intensive sample was used in the Blue Grass.

As sampling unit or state total volumes are broken down by tree size, diameter, and so forth, the sampling errors increase — the smaller the unit of volume, the larger the sampling error. The order of this increase is suggested in the following tabulation, which shows the sampling error to which the volume estimates are liable, two chances out of three.

Volume estimate Growing stock: (thousand cubic feet)	Standard error of sampling		
	Blue grass (percent)	Forested (percent)	State total (percent)
20,000	—	—	14.0
15,000	—	—	16.2
10,000	14.2	24.6	19.8
5,000	20.1	34.7	28.0
3,000	26.0	44.8	36.2
2,000	31.8	54.9	44.3
1,000	45.0	77.7	62.6
<i>Sawtimber:</i>			
(thousand board feet)			
60,000	—	—	14.6
30,000	15.7	25.5	20.7
25,000	17.2	27.9	22.7
15,000	22.3	36.1	29.2
10,000	27.3	44.2	35.8
5,000	38.6	62.5	50.7
3,000	49.8	80.6	65.4
2,000	61.0	98.8	80.1

DEFINITION OF TERMS

Land Area Classes

Total land.—The area of dry land and of land temporarily or partially covered by water such as marshes, swamps, and flood plains; streams and sloughs less than $\frac{1}{8}$ mile wide; and lakes, reservoirs, and ponds less than 40 acres in area.

Forest land.—Land at least 10 percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. Excludes urban or thickly settled residential and resort areas, city parks, orchards, farmsteads, improved roads, or lands developed and maintained for nonforest use. The minimum area for classification of forest land is 1 acre. Roadside, streamside, and shelterbelt strips of timber must be at least 120 feet wide to qualify as forest land. Unimproved roads, trails, and streams less than 120 feet wide and clearings less than 1 acre in size within forest land are also included as forest.

Commercial forest land.—Forest land that is producing or is capable of producing crops of industrial wood and that is not withdrawn from timber utilization by statute or administrative regulation. Industrial wood includes commercial products such as sawlogs and pulpwood but excludes fuelwood and fence posts.

Nonforest land.—Land that has never supported forests and lands formerly forested that are now developed for other uses. Includes areas used for crops, improved pasture, residential areas, city parks, and improved roads or power-line clearings of any width. If intermingled in forest areas, unimproved roads, trails, and nonforest strips must be more than 120 feet wide and clearings more than 1 acre in size to qualify as nonforest.

Adjusted nonforest area.—Nonforest land area reduced by 5 percent to make allowances for nonforest areas excluded from this study — urban and builtup areas, highways, and utility rights-of-way.

Volume Classes

Growing-stock volume.—Net volume in cubic feet of sound wood in the boles of live sawtimber and poletimber trees from stump to a minimum 4.0-inch top diameter outside bark of the central stem or to the point where the central stem breaks into limbs. Does not include short-log trees.

Net cubic-foot volume.—Growing-stock volume as defined above plus the net volume in cubic feet of short-log trees.

Sawtimber volume.—Net volume in board feet (International $\frac{1}{4}$ -inch rule) in the sawlog portions of live sawtimber trees from a 1-foot stump to a minimum 8.0-inch top diameter inside bark or to the point on the bole of sawtimber trees above which a sawlog cannot be produced. A sawlog is a log that is at least 8 feet long and meets the other standards of diameter and defect as specified for grade F1, F2, or F3 logs or for tie-and-timber class logs.

Net board-foot volume.—Sawtimber volume as defined above plus the net volume in board feet (International $\frac{1}{4}$ -inch rule) of short-log trees.

Short-log volume.—Net volume in short-log trees — those containing 6- or 7-foot usable saw lengths, now or prospectively — expressed in either net cubic feet or net board feet (International $\frac{1}{4}$ -inch rule).

Tree Size Classes

Sawtimber trees.— Live trees 11.0 inches d.b.h. and larger, containing at least an 8-foot sawlog.

Poletimber trees.— Live trees 5.0 to 10.9 inches d.b.h. that are of good form and vigor (i.e., are expected to produce at least an 8-foot sawlog).

Short-log trees.— Live trees 5.0 inches d.b.h. and larger that contain, now or prospectively, a usable 6- or 7-foot bolt.

Diameter Measurements

Diameter at breast height (d.b.h.).— The diameter of a tree at 4.5 feet above ground level.

Diameter class.— Trees in a 2-inch diameter range, ranging from 1.0 inch below the midpoint of the class to 0.9 inch above the midpoint. For example, the 12-inch class would include trees from 11.0 to 12.9 inches d.b.h.

QUALITY CATEGORIES

Log quality is based on surface characteristics. Sawtimber trees were classified according to the U.S.D.A. Forest Service **HARDWOOD LOG GRADES FOR STANDARD LUMBER** and Forest Service standard specifications for hardwood tie-and-timber class logs. Sawtimber-size short-log trees were classified primarily on the basis of having a 6- or 7-foot usable length. The following standards were used for assigning quality categories:

HARDWOOD LOG GRADES FOR STANDARD LUMBER

Grade factors		Specifications							
		Log grade 1			Log grade 2			Log grade 3	
Position in tree		Butts only	Butts and uppers		Butts and uppers			Butts and uppers	
Minimum scaling diameter (inches)		13-15	16-19	20+	11 ¹	12+			8+
Minimum length (feet)		10+	10+	10+	10+	8-9	10-11	12+	8+
Clear cuttings ² on each of the 3 best faces	Minimum length (feet)	7	5	3	3	3	3	3	2
	Maximum number	2	2	2	2	2	2	3	No limit
	Minimum yield in face length	5/6	5/6	5/6	2/3	3/4	2/3	2/3	1/2
Maximum sweep and crook deduction (percent of gross volume)		15			30			50	
Maximum cull deduction including sweep and crook (percent of gross volume)		40 ³			50 ⁴			50	

¹ 10-inch logs can be No. 2 if otherwise meeting requirements for small No. 1's.² A clear cutting is a portion of a face free of defects, extending the width of the face. A face is one-fourth the surface of the log as divided lengthwise.³ Otherwise No. 1 logs with 41-50 percent cull can be No. 2.⁴ Otherwise No. 2 logs with 51-60 percent cull can be No. 3.

SPECIFICATIONS FOR TIE-AND-TIMBER LOGS

Grade factors		Specifications
Position in tree		Butts and uppers
Scaling diameter		8 inches and larger
Length, without trim		8 feet and longer
Clear cuttings		No requirements: Not graded on cutting basis.
Maximum sweep allowance		One-fourth d.i.b. of small end for half logs, and one-half d.i.b. for logs 16 feet long.
Sound surface defects permitted	Single knots	Any number, if none has an average collar ¹ diameter that is more than one-third of log diameter at point of occurrence.
	Whorled knots	Any number, provided the sum of the collar diameters does not exceed one-third the log diameter at point of occurrence.
	Holes	Any number not exceeding knot specifications if they do not extend more than 3 inches into the contained tie or timber.
Unsound defects permitted	Surface	Any number and size if they do not extend into contained tie or timber. If they extend into contained tie or timber, they shall not exceed size, number, and depth of limits for sound defects.
	Interior	None permitted except one shake not more than one-third the width of contained tie or timber and one split not over 5 inches long.

¹ Knot collar is the average of the vertical and horizontal diameters of the limb or knot swelling as measured flush with the surface of the log.

SPECIFICATIONS FOR SHORT-LOG TREES

Grade factors	Specifications
Position in tree	Butts
Scaling diameter	8 inches and larger
Length, without trim	6 foot and 7 foot

STATISTICAL TABLES

Table 1.—Area by land class and study unit, Kentucky, 1965
[In acres]

Land class	State total	Blue Grass	Forested Unit
Total land ¹	25,512,300	5,648,600	19,863,700
Forest land ²	11,855,200	1,135,500	10,719,700
Nonforest land ²	13,657,100	4,513,100	9,144,000
Adjusted nonforest ³	12,974,200	4,287,400	8,686,800

¹ From U.S. Bureau of Census, LAND AND WATER AREA OF THE UNITED STATES, 1960.

² From Gansner, David A. TIMBER RESOURCES OF KENTUCKY, U.S.D.A. Forest Serv. Resource Bull. NE-9. 97 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa. 1968.

³ Total nonforest area was reduced by 5 percent to account for urban developments, highways, and so forth.

Table 2.—Net cubic foot volume of black walnut by land class, volume class, and study unit, Kentucky, 1965
[In thousands of cubic feet]

Land class	State total	Blue Grass	Forested Unit
Commercial forest land ¹	66,750	10,990	55,760
Nonforest land:			
Growing-stock volume ²	20,200	10,440	9,760
Short-log volume ³	1,560	1,010	550
Total nonforest land	21,760	11,450	10,310
All land	88,510	22,440	66,070

¹ From Gansner, David A. TIMBER RESOURCES OF KENTUCKY, U.S.D.A. Forest Serv. Resource Bull. NE-9. 97 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa. 1968.

² Volume estimates in this class meet the specifications for growing stock used in the Kentucky forest survey and are directly comparable to data shown for the commercial forest land class.

³ Volume in 6- or 7-foot bolts.

**Table 3.—Net board-foot volume of black walnut by land class,
volume class, and study unit, Kentucky, 1965**

[In thousands of board feet]¹

Land class	State total	Blue Grass	Forested Unit
Commercial forest land ²	188,160	30,100	158,060
Nonforest land			
Sawtimber volume ³	57,410	31,170	26,240
Short-log volume ⁴	5,210	3,380	1,830
Total nonforest land	62,620	34,550	28,070
All land	250,780	64,650	186,130

¹ International 1/4-inch rule.

² From Gansner, David A. TIMBER RESOURCES OF KENTUCKY. U.S.D.A. Forest Serv. Resource Bull. NE-9. 97 pp., illus. NE. Forest Exp. Sta., Upper Darby, Pa. 1968.

³ Volume estimates in this class meet the specifications for sawtimber used in the Kentucky Forest Survey and are directly comparable to data shown for the commercial forest land class.

⁴ Volume in 6- or 7-foot bolts.

**Table 4.—Number of live black walnut trees on nonforest land,
by d.b.h. class and study unit, Kentucky, 1965**

[In thousands of trees]

D.b.h. class (inches)	State total	Blue Grass	Forested Unit
2	633	399	234
4	997	597	400
6	887	475	412
8	679	314	365
10	568	266	302
12	370	192	178
14	314	198	116
16	204	124	80
18	154	68	86
20	87	48	39
22	47	32	15
24+	77	41	36
Total	5,017	2,754	2,263

**Table 5.—Net cubic-foot volume of black walnut on nonforest land,
by d.b.h. class and study unit, Kentucky, 1965**
[In thousands of cubic feet]

D.b.h. class (<i>inches</i>)	State total	Blue Grass	Forested Unit
6	780	410	370
8	1,930	890	1,040
10	2,520	1,140	1,380
12	3,250	1,560	1,690
14	2,860	1,920	940
16	2,850	1,500	1,350
18	2,490	1,270	1,220
20	1,410	730	680
22	1,040	780	260
24+	2,630	1,250	1,380
Total	21,760	11,450	10,310

**Table 6.—Net board-foot volume of black walnut on nonforest land,
by d.b.h. class and study unit, Kentucky, 1965**
[In thousands of board feet]¹

D.b.h. class (<i>inches</i>)	State total	Blue Grass	Forested Unit
12	11,640	5,710	5,930
14	12,650	8,250	4,400
16	10,880	6,110	4,770
18	7,630	3,560	4,070
20	5,340	2,730	2,610
22	5,350	2,640	2,710
24+	9,130	5,550	3,580
Total	62,620	34,550	28,070

¹ International 1/4-inch rule.

Table 7.—Number of black walnut sawtimber-size trees on nonforest land, by d.b.h. class and usable length, Kentucky, 1965
[In thousands of trees]

D.b.h. class (inches)	Usable length (feet)							Total
	0-5	6-7	8-11	12-15	16-19	20-23	24+	
12	81	25	84	60	40	44	36	370
14	82	40	66	30	49	26	21	314
16	55	22	33	32	26	20	16	204
18	55	22	34	10	20	10	3	154
20	32	15	15	8	8	4	5	87
22	13	5	6	5	6	6	6	47
24+	33	5	14	4	3	8	10	77
Total	351	134	252	149	152	118	97	1,253

Table 8.—Net board-foot volume of black walnut on nonforest land, by usable length and study unit, Kentucky, 1965
[In thousands of board feet]¹

Usable length (feet)	State total	Blue Grass	Forested Unit
6- 7	5,210	3,380	1,830
8-11	13,070	6,490	6,580
12-15	9,290	4,860	4,430
16-19	12,040	7,800	4,240
20-23	10,580	5,040	5,540
24+	12,430	6,980	5,450
Total	62,620	34,550	28,070

¹ International 1/4-inch rule.

**Table 9.—Net board-foot volume of black walnut on nonforest land,
by quality category and study unit, Kentucky, 1965**

[In thousands of board feet]¹

Quality category	State total	Blue Grass	Forested Unit
Log grade F-1	17,490	5,840	11,650
Log grade F-2	17,090	9,660	7,430
Log grade F-3	20,850	13,790	7,060
Tie-and-timber	1,980	1,880	100
Short-log trees	5,210	3,380	1,830
Total	62,620	34,550	28,070

¹ International 1/4-inch rule.





THE FOREST SERVICE of the U. S. Department of Agriculture is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives — as directed by Congress — to provide increasingly greater service to a growing Nation.