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FOREST RESOURCES
OF
MISSOURI

 **CENTRAL STATES**
FOREST EXPERIMENT STATION
Columbus 13, Ohio

Harold L. Mitchell, Director

FOREST RESOURCES

OF

MISSOURI

BY

THE FOREST SURVEY ORGANIZATION

at the

Central States Forest Experiment Station

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The field work on which these statistics are based was done by the following men under the supervision of M. E. Becker.

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FOREWORD

The Forest Survey is a Nation-wide activity of the Forest Service. The fivefold purpose of the Forest Survey is (1) to make a field inventory of the present supply of standing timber; (2) to ascertain the rate at which this supply is being increased through growth; (3) to determine the rate at which it is being diminished through industrial and domestic uses, windfall, fire, disease, and other causes; (4) to determine the present consumption and the probable future trend in requirements for forest products; and (5) to interpret and correlate these findings with existing and anticipated economic conditions, as an aid in the formulation of both private and public policies for use of land suitable for forest production.

The Forest Survey is conducted in the various forest regions by the forest experiment stations of the Forest Service. In Missouri, the project is directed by the Central States Forest Experiment Station with headquarters in Columbus, Ohio. For Survey purposes, the State has been divided into five principal regions based on character of forest, topography, and other factors that influence tree growth.

Survey releases have been published for each of the regions (Forest Survey Releases 1 to 5 inclusive) presenting the more significant statistics on forest area and timber volume. This release summarizes these data for the State as a whole. In some instances figures for individual forest types and species may not exactly equal the totals obtained by adding the figures in the five regional releases. This is due to the fact that minor types and species were grouped differently in several of the regional releases and the State summary. Later an analytical report for the State will be published, which will interpret forest area, timber volume, growth, and drain statistics in the light of existing and anticipated economic conditions. This interpretation will focus attention on the principal forest problems and will suggest possible solutions.

SIGNIFICANT FACTS CONCERNING
THE FOREST RESOURCES OF MISSOURI

The forests of Missouri occupy 15,187,000 acres or one-third of the land area of the State. The Ozark regions are most heavily forested, and contain more than two-thirds of the forest area. In the mountainous eastern Ozark region more than 70 percent of the area is forested and even in the less rugged western Ozark regions, forests cover more than half of the land area. In the Prairie region, forests are found on only 13 percent of the land area, and are chiefly confined to stream bottoms and the rougher portions of farms.

Ninety percent of the commercial forest area is privately owned. The Clark and the Mark Twain National Forests contain 8 percent of the commercial forest area and the remaining 2 percent is about equally divided between other federal and state ownerships.

The oak-hickory forest type is prevalent throughout the State and is found on nearly two-thirds of the forest area. Shortleaf pine, usually in mixture with oaks, occurs on 7 percent of the forest area, chiefly in the Eastern Ozark region. Contrary to the impression gained in driving the ridge roads of the Ozarks, scrub hardwood stands, including stands of blackjack oak, occupy less than 2 percent of the forest land.

Less than 14 percent of the forest area supports sufficient board-foot volume to be classed as saw timber. Pole-timber stands are found on 43 percent of the forest area, seedling and sapling stands on 32 percent, and poorly stocked stands on 12 percent.

The volume of saw timber in the State is 11.9 billion board feet. Nearly two-thirds of this volume is oak, with white oak and black oak the most abundant species. Shortleaf pine makes up 4 percent of the total volume.

Nearly half of the board-foot volume occurs on the 14 percent of the forest area supporting saw-timber stands. The remaining volume is in trees of sawlog size scattered throughout stands classified as pole timber, seedling and sapling, and poorly stocked. More than half of the board-foot volume is in trees less than 15.0 inches in diameter.

The cubic volume of pole-size trees and the sawlog portion of saw-timber trees is 4.4 billion cubic feet. The distribution of this volume among the species closely parallels that of the saw-timber volume, with the oak species again accounting for nearly two-thirds of the volume. More than half of the cubic volume is in trees less than 11.0 inches in diameter.

The average saw-timber volume per acre for the State is 789 board feet. Saw-timber stands average 2,840 board feet per acre. The Ozark regions show considerably less volume per acre than the Prairie and Riverborder regions.

The average cubic-foot volume per acre of pole-size trees and the sawlog portion of saw-timber trees is 289 cubic feet. Again the averages for the Prairie and Riverborder regions are greater than those for the Ozark regions.

The total cubic volume of sound wood including the tops and limbs of hardwoods, the sound portion of cull trees, and trees of noncommercial species is 8.1 billion cubic feet. The sound wood in noncommercial species and cull trees makes up nearly one-third of the total cubic volume indicating the large proportion of the forest area occupied by trees of little present or future value.

Table 1.--Forest and nonforest area by regions, 1947

Regions	Total land area ^{1/}	Forest area		Nonforest area	
	<u>Thousand acres</u>	<u>Thousand acres</u>	<u>Percent</u>	<u>Thousand acres</u>	<u>Percent</u>
Eastern Ozark	6,174	4,488	73	1,686	27
Southwestern Ozark	5,531	3,130	57	2,401	43
Northwestern Ozark	5,059	2,603	51	2,456	49
Prairie	19,557	2,496	13	17,061	87
Riverborder	8,012	2,470	31	5,542	69
All regions	44,333	15,187	34	29,146	66

^{1/} Source: Area of the United States 1940, U. S. Bureau of the Census.

Table 2.--Commercial forest area by ownership class, 1947

Ownership class	Commercial forest area <u>1/</u>	
	<u>Thousand acres</u>	<u>Percent</u>
Federal:		
National forest	1,197	7.9
Other	121	.8
Total	1,318	8.7
State	120	.8
Private	13,636	90.5
All ownerships	15,074	100.0

1/ Does not include 113,000 acres of forest land classified as noncommercial.

Table 3.--Commercial forest area by forest
type and stand-size class, 1947

Forest type	Total		Saw- timber area	Pole- timber area	Seedling & sapling area	Poorly stocked area
	<u>M acres</u>	<u>Per- cent</u>	<u>M acres</u>	<u>M acres</u>	<u>M acres</u>	<u>M acres</u>
Shortleaf pine	226	1.5	39	119	62	6
Cedar hdwd.	492	3.3	4	188	154	146
Oak-pine	794	5.3	99	400	271	24
Oak-hickory	9,819	65.1	853	4,408	3,647	911
White oak	1,091	7.2	298	643	112	38
Mixed hdwd.	662	4.4	140	196	128	198
Pin-oak flats	342	2.3	110	108	73	51
Bottomland hdwd.	1,363	9.0	491	408	232	232
Scrub hdwd.	285	1.9	0	11	103	171
All types	15,074		2,034	6,481	4,782	1,777
Percent	100.0		13.5	43.0	31.7	11.8

Table 4.--Saw-timber volume on commercial forest area by species and stand-size class, 1947

Species	Total		Saw- timber: area	Pole- timber: area	Seedling & sapling: area	Poorly stocked: area
	<u>Million</u> <u>bd. ft.</u>	<u>Percent</u>	<u>Million</u> <u>bd. ft.</u>	<u>Million</u> <u>bd. ft.</u>	<u>Million</u> <u>bd. ft.</u>	<u>Million</u> <u>bd. ft.</u>
Shortleaf pine	483	4.1	281	138	62	2
Redcedar	52	.5	2	38	5	7
Cypress	194	1.6	184	0	2	8
White oak	2,535	21.3	1,152	768	393	222
Post-oak group	1,426	12.0	404	470	407	145
Black oak	2,145	18.0	932	667	433	113
Scarlet oak	526	4.4	222	202	81	21
Northern red oak	443	3.7	200	147	50	46
Other red oaks	463	3.9	291	96	50	26
Hickory	698	5.9	295	218	106	79
Elm	821	6.9	408	125	112	176
Ash	170	1.4	101	47	13	9
Sycamore	415	3.5	324	44	18	29
Maple	287	2.4	194	40	11	42
Cottonwood	419	3.5	367	22	20	10
Black walnut	260	2.2	111	71	26	52
Other hwd's.	561	4.7	308	113	92	48
All species	11,898		5,776	3,206	1,881	1,035
Percent		100.0	48.5	27.0	15.8	8.7

Table 5.--Saw-timber volume on commercial forest area by species and tree-diameter class, 1947

Species	Total	Tree-diameter class				
		10 1/2 inches	12-14 inches	16-18 inches	20 inches and larger	
	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	
Shortleaf pine	483	184	219	47	33	
Redcedar	52	25	23	4	0	
Cypress	194	6	35	54	99	
White oak	2,535	---	1,422	678	435	
Post-oak group	1,426	---	746	426	254	
Black oak	2,145	---	1,063	562	520	
Scarlet oak	526	---	351	102	73	
Northern red oak	443	---	217	133	93	
Other red oaks	463	---	170	120	173	
Hickory	698	---	445	155	98	
Elm	821	---	373	193	255	
Ash	170	---	81	55	34	
Sycamore	415	---	60	103	252	
Maple	287	---	131	66	90	
Cottonwood	419	---	133	125	161	
Black walnut	260	---	137	98	25	
Other hardwoods	561	---	291	173	97	
All species	11,898	215	5,897	3,094	2,692	
Percent	100	1.8	49.6	26.0	22.6	

1/ Ten-inch diameter class shown separately because in this diameter class, saw-timber volume includes softwood trees, but not hardwoods.

Table 6.--Cubic-foot volume on commercial forest area by
species and stand-size class, 1947

Species	Total		Saw- timber area	Pole- timber area	Seedling & sapling area	Poorly stocked area
	<u>Million</u> <u>cu. ft.</u>	<u>Percent</u>	<u>Million</u> <u>cu. ft.</u>	<u>Million</u> <u>cu. ft.</u>	<u>Million</u> <u>cu. ft.</u>	<u>Million</u> <u>cu. ft.</u>
Shortleaf pine	198.1	4.5	73.8	100.4	21.7	2.2
Redcedar	49.6	1.1	1.9	40.2	3.1	4.4
Cypress	41.5	1.0	39.3	0	.6	1.6
White oak	904.2	20.8	273.2	474.8	111.9	44.3
Post-oak group	641.2	14.7	109.3	350.5	140.9	40.5
Black oak	763.6	17.5	199.8	422.3	118.1	23.4
Scarlet oak	222.0	5.1	49.7	142.9	24.1	5.3
Northern red oak	141.1	3.2	38.7	77.4	16.2	8.8
Other red oaks	144.8	3.3	59.6	67.0	8.9	9.3
Hickory	342.0	7.8	96.8	169.5	52.7	23.0
Elm	253.8	5.8	103.8	78.1	34.1	37.8
Ash	54.6	1.3	25.6	21.9	4.5	2.6
Sycamore	89.7	2.1	57.5	14.4	11.3	6.5
Maple	127.3	2.9	66.5	45.2	3.3	12.3
Cottonwood	94.5	2.2	72.6	17.2	3.2	1.5
Black walnut	93.7	2.2	26.5	40.4	12.4	14.4
Other hardwoods	195.8	4.5	77.5	71.4	27.0	19.9
All species	4,357.5		1,372.1	2,133.6	594.0	257.8
Percent		100	31.5	49.0	13.6	5.9

Table 7.--Cubic-foot volume on commercial forest area
by stand-size class and tree-diameter class, 1947

Stand-size class	Total	Tree-diameter class				
		6-8 inches	10 inches	12-14 inches	16-18 inches	20 inches & larger
	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
Saw-timber area	1,372.1	211.4	214.5	388.7	268.3	289.2
Pole-timber area	2,133.6	1,040.5	561.4	374.5	99.4	57.8
Seedling & sap- ling area	594.0	158.9	113.3	179.5	92.6	49.7
Poorly stocked area	257.8	49.4	38.8	72.6	52.8	44.2
All classes	4,357.5	1,460.2	928.0	1,015.3	513.1	440.9
Percent	100	33.5	21.3	23.3	11.8	10.1

Table 8.--Average volume per acre by stand-size

class and region, 1947

BOARD-FOOT VOLUME

Stand-size class	Total	Eastern Ozark	South- western Ozark	North- western Ozark	Prairie	River- border
Saw-timber area	2,840	2,280	2,615	2,428	3,179	3,473
Pole-timber area	495	432	541	369	605	594
Seedling & sap- ling area	393	438	356	340	408	415
Poorly stocked area	582	531	398	515	724	767
All classes	789	691	635	527	1,074	1,149

CUBIC-FOOT VOLUME

Saw-timber area	675	580	637	546	712	824
Pole-timber area	329	318	289	272	406	390
Seedling & sap- ling area	124	154	103	108	118	117
Poorly stocked area	145	145	110	106	178	191
All classes	289	286	227	214	352	390

Table 9.--Total cubic-foot volume of sound wood on commercial forest area by species and class of material, 1947

Species	Total	Saw-timber trees			Pole-timber trees	Cull trees
		Total	Sawlog portion	Tops & limbs 1/		
		Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.	Million cu. ft.
Shortleaf pine	200.0	103.1	86.7	16.4	95.0	1.9
Redcedar	50.5	18.3	15.6	2.7	31.3	.9
Cypress	44.2	40.3	28.9	11.4	1.2	2.7
White oak	1,473.8	703.3	405.3	298.0	498.9	271.6
Post-oak group	1,335.8	490.0	277.2	212.8	364.0	481.8
Black oak	1,338.1	628.3	355.0	273.3	408.6	301.2
Scarlet oak	362.6	153.1	86.5	66.6	135.5	74.0
Northern red oak	265.9	123.4	71.1	52.3	70.0	72.5
Other red oaks	240.2	131.4	74.5	56.9	70.3	38.5
Hickory	552.9	201.7	114.3	87.4	227.7	123.5
Elm	579.3	234.4	133.2	101.2	120.6	224.3
Ash	122.9	47.9	27.4	20.5	27.2	47.8
Sycamore	163.8	120.3	68.7	51.6	21.0	22.5
Maple	262.6	82.1	46.6	35.5	80.7	99.8
Cottonwood	157.8	117.4	67.9	49.5	26.6	13.8
Black walnut	154.4	75.0	42.6	32.4	51.1	28.3
Other hdwds.	391.1	160.4	91.3	69.1	104.5	126.2
Noncommercial species 2/	436.3	----	----	----	----	436.3
All species	8,132.2	3,430.4	1,992.8	1,437.6	2,334.2	2,367.6
Percent	100.0	42.2	24.5	17.7	28.7	29.1

1/ Not included in the cubic-foot volumes shown in Tables 6 and 7 excepting the 30.5 million cubic feet in tops of pine, cedar, and cypress.

2/ Not included in the cubic-foot volumes shown in Tables 6 and 7.

EXPLANATION OF TERMS USED

Forest land - Land bearing forest growth or land from which the forest has been removed but which shows evidence of past forest occupancy and which is not now in other use. To qualify as forest, an area must: (1) be at least 100 feet wide; (2) be at least one acre in area; (3) have a sufficient number of trees to provide 10 percent crown coverage, or (4) lacking 10 percent crown coverage, be likely to remain in forest use.

Commercial forest land - Forest land bearing or capable of bearing timber of commercial character and economically available now or prospectively for commercial use and not withdrawn from such use.

Noncommercial forest land - Forest land not qualifying as commercial forest land. Two classes of forest area are included: (1) commercially valuable forest land withdrawn from timber use for such purposes as parks, game refuges, military reservations, or reservoir protection; and (2) forest land which because of poor growing conditions will not produce trees of commercial quality.

Forest types

Shortleaf pine - Stands in which pine trees comprise at least 60 percent of the dominant and codominant trees.

Cedar-hardwoods - Stands in which redcedar comprises at least 20 percent of the dominant and codominant trees.

Oak-pine - Stands of pine, oaks, and other hardwoods in which pines comprise 20-60 percent of the dominant and codominant trees.

Oak-hickory - Stands of hardwoods in which oaks and hickories comprise at least 60 percent of the dominant and codominant trees.

White oak - Stands in which white oak (Quercus alba) comprises at least 60 percent of the dominant and codominant trees.

Mixed hardwoods - Stands of mixed hardwood species not qualifying for other hardwood types. Principal species include elm, maple, basswood, and black walnut in mixture with oaks and hickories.

Pin-oak flats - Stands of pin oak and other hardwoods occurring on poorly drained flats. Associate species include soft maple, elm, hickory, and sweetgum.

Bottomland hardwoods - Stands on the alluvial bottoms of rivers and streams. The principal species include sycamore, willow, elm, blackgum, sweetgum, soft maple, oaks, hickory, cottonwood, and cypress.

Scrub hardwoods - Stands in which scrub oak or other noncommercial tree species comprise at least 60 percent of the dominant and codominant trees.

Tree classes

Sound saw-timber tree - A coniferous tree at least 9.0 inches d.b.h. (diameter outside bark at 4.5 feet above ground), or a hardwood tree at least 11.0 inches d.b.h., with a sound butt log at least 8 feet long, or with at least half of the gross volume of the tree in sound material.

Sound pole-timber tree - A tree at least 5.0 inches d.b.h. but less than saw-timber size, which now is or gives promise of becoming a sound merchantable tree.

Cull tree - A tree that does not qualify as a sound pole-timber or saw-timber tree because of poor form, limbiness, rot, or other defect.

Volume estimates

Board-foot volume - Includes the volume of that portion of saw-timber trees merchantable for sawlogs. Volume deductions have been made for rot, crook, and other defects. Board-foot volumes are shown in the International 1/4-inch log rule, which approximates green lumber tally.

Cubic-foot volume - Except where specifically noted, includes the volume of sound wood inside bark in: (1) the saw-timber portion of sound trees, (2) the upper stems of saw-timber-size conifers to a minimum diameter of 4 inches inside bark, and (3) the sound pole-timber trees to the same minimum top diameter.

Stand-size class

Saw timber - Stands having a minimum net volume of 1500 board feet per acre.

Pole timber - Stands having a net volume of less than 1500 board-feet per acre but which are at least 10 percent stocked with pole-size and larger trees. At least one-half the minimum stocking must be in pole-size trees.

Seedlings and saplings - Stands not qualifying either for saw timber or pole timber but having at least 300 seedlings and saplings of commercial species per acre.

Poorly stocked - Commercial forest land not qualifying for any other class, including denuded area.

Species listed

Shortleaf pine - Pinus echinata. Includes a small volume of other pines occurring in plantations.

Redcedar- Eastern redcedar - Juniperus virginiana

Cypress - Taxodium distichum

White oak - Quercus alba

Post-oak group includes:

Post oak - Quercus stellata

Swamp white oak - Quercus bicolor

Swamp chestnut oak - Quercus prinus

Overcup oak - Quercus lyrata

Bur oak - Quercus macrocarpa

Chinquapin oak - Quercus muehlenbergii

Black oak - Quercus velutina

Scarlet oak - Quercus coccinea

Northern red oak - Quercus borealis

Other red oaks include:

Southern red oak - Quercus falcata

Pin oak - Quercus palustris

Willow oak - Quercus phellos

Water oak - Quercus nigra

Shingle oak - Quercus imbricaria

Hickory - includes all species of hickory (Carya)

Elm - includes all species of elm (Ulmus)

Ash - includes all species of ash (Fraxinus)

Sycamore - Platanus occidentalis

Maple - includes all species of maple (Acer)

Cottonwood - Populus deltoides

Black walnut - Juglans nigra

Other hardwoods - include all other commercial hardwood species.

Noncommercial species - include species which do not normally have commercial value such as blackjack oak, sassafras, blue beech, ironwood, alder, redbud, and service berry.

FOREST SURVEY PROCEDURE

The inventory of the forest resources of Missouri was begun in September 1946 and was completed in September 1947. A sampling procedure was used involving an office study of aerial photographs and a field examination of randomly selected forest and nonforest plots.

The proportion of forest land by counties was obtained by placing over each photograph a transparent template marked with uniformly spaced dots and counting the number of dots falling on forest and on nonforest areas. The percentage of forest dots in a county applied to the total land area gave a preliminary estimate of the forest acreage.

The location of every second or third dot (depending on the template used) falling on forest land was marked on the photograph. The acre surrounding each marked dot was examined under stereoscope and classified by stand-size class on the basis of the height, crown width, and density of trees on the plot.

Plots for field examination were selected from those photo classified as follows:

Saw timber - - - - -	1 in 5
Pole timber- - - - -	1 in 10
Seedling & sapling - - - - -	1 in 20
Poorly stocked - - - - -	1 in 10

In addition, every 50th nonforest plot was selected for field examination to measure the movement of nonforest land to forest.

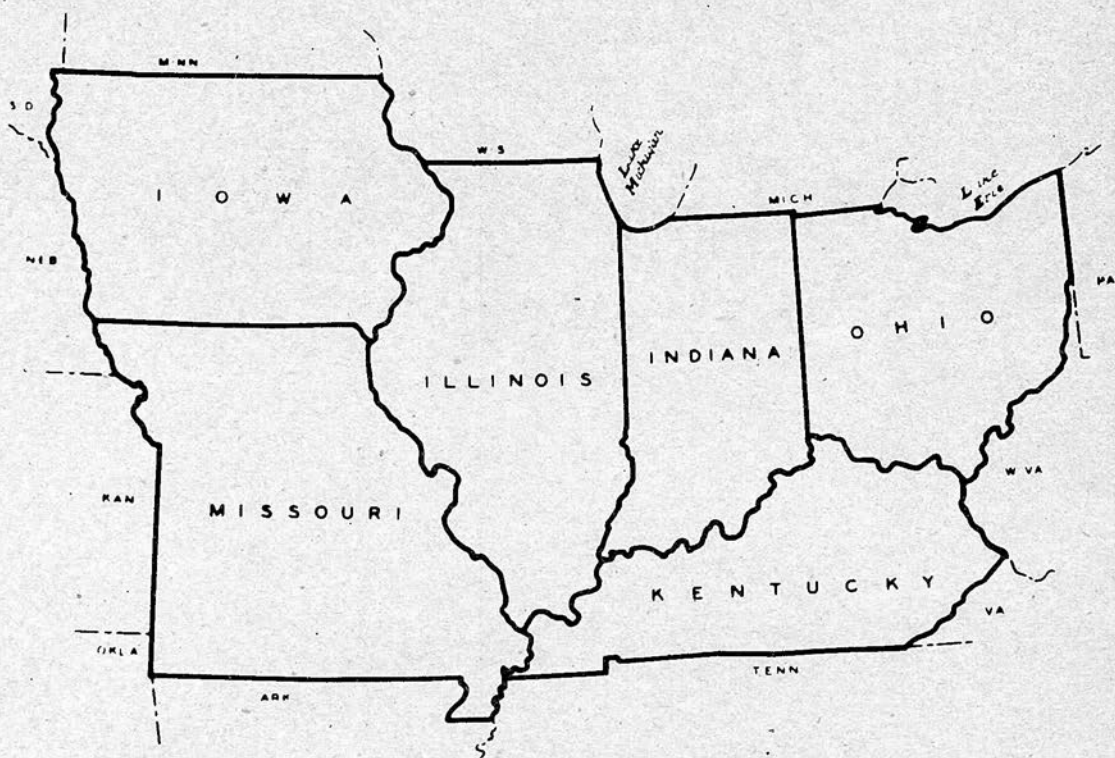
The locations of the selected plots were marked on the photographs which were then sent to the field. Crews of two men each located these points on the ground and at each established a 1/5-acre plot on which they recorded the species, size, condition, and growth rate of trees, and the forest type and site quality of plots. A field check of the photo interpreter's stand-size-class determination was also made. The field examination also provided a basis for adjusting the preliminary estimate of forest and nonforest area.

Approximately 196,590 dots were counted on the photos for forest area determination. Stereoscopic examinations were made on 26,370 forest plots to determine stand-size class, and 3,489 plots were examined on the ground. These photo and field examinations provided the basic data for computation of forest area and timber volume statistics for the State.

ACCURACY OF DATA

Forest area - Statistical analysis of the forest area data for the State of Missouri shows a sampling error of ± 0.7 percent of the total forest area or $\pm 100,190$ acres, at a level of one standard deviation. The error of estimate increases with each subdivision of the total forest area so that small tabular acreages may have large errors and therefore indicate only relative magnitudes.

Timber volume - The sampling error of the total board-foot volume in the State is ± 2.6 percent or ± 315 million board feet. This does not include the errors of volume tables, cull factors, or other phases of the inventory work for which satisfactory methods of measuring accuracy have not been developed. All phases of field work and computations were closely supervised to keep these errors at a minimum. Again the error of estimate increases with each subdivision of the total volume so that small volumes indicate only relative magnitudes.



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BY THE
CENTRAL STATES FOREST EXPERIMENT STATION
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