

FOREST STATISTICS AND INFORMATION NEEDS IN  
THE CENTRAL HARDWOOD REGION<sup>1/</sup>

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Abstract.--Since the 1930's, Forest Inventory and Analysis (FIA) Projects (formerly called Forest Survey) of the USDA Forest Service, at its regional forest experiment stations, have conducted extensive forest inventories of every state. As forest land management and use have intensified, public and private landowners, as well as forest industry representatives, have needed more information about timber and other forest resources. Included in this paper are facts about the inventory of Central Hardwood forests, and some types of information that users tell us they need to know in addition to information already published.

Keywords: forest area, timber volume, data changes

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#### INTRODUCTION

The USDA Forest Service, through its regional forest experiment stations, has been conducting state-wide forest inventories in the East since the 1930's. The information gained from these inventories, which are mandated by Congress, is used by national forestry program planners, as well as by regional and state planners, forest industry planners, forest managers, and others.

We assumed that the Central Hardwoods encompassed an area of 13 states, as shown in figure 1. We then gathered published results of the latest inventories of those states (see Literature Cited), and summarized some of the major tables to provide a brief look at the current forest situation among hardwood forest types. Data for Illinois come from 1985 unpublished information on file at the North Central Forest Experiment Station.

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Figure 1.--Central Hardwood States

THE CENTRAL HARDWOOD FOREST

Area

The 133.9 million acres of timberland<sup>3/</sup> in the 13-state Central Hardwood Region represented 28 percent of the total timberland in the Nation in 1977 (U.S. Department of Agriculture 1982). The Central Hardwood Region total is made up of the following general forest types:

Forest type	Area of timberland (Million acres)
Oak-hickory	75.3
Softwoods	19.8
Maple-beech-birch	14.6
Oak-pine	10.2
Elm-ash-cottonwood	6.9
Oak-gum-cypress	6.5
Aspen-birch	0.6
<b>Total</b>	<b>133.9</b>

Eliminating forest types that are obviously not part of the Central Hardwood forest (softwoods, oak-gum-cypress, and aspen-birch) results in an adjusted Central Hardwood area of 107.0 million acres as shown below:

Forest type	Area of timberland (million acres)
Oak-hickory	75.3
Maple-beech-birch	14.6
Oak-pine	10.2
Elm-ash-cottonwood	6.9
<b>Total</b>	<b>107.0</b>

We include the oak-pine type although Braun (1950) describes it as transitional

<sup>3/</sup> Formerly called commercial forest land. Defined as forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization.

between the Central Hardwood and Southern Regions.

The oak-hickory type has the largest area of this residual 107.0 million acres that we will call the Central Hardwood forest. This type accounts for 70 percent of the total, and the largest areas of it are found in Missouri (10.3 million acres), Virginia (9.7 million) and Tennessee (9.3 million). The maple-beech-birch type is the second largest with 14 percent of the Central Hardwood forest area. Pennsylvania (6.3 million acres), West Virginia (2.6 million), and Ohio (1.5 million) lead other Central Hardwood States in area of this type. Largest areas of the oak-pine type are in Arkansas (3.0 million acres) and North Carolina (2.3 million), showing the southern orientation of this type. The elm-ash-cottonwood type is generally evenly divided among the 13 states, suggesting its preference for river and stream bottoms.

Nonindustrial private parties own 81 percent of the Central Hardwood forest (table 1). They own somewhat more of the elm-ash-cottonwood (89 percent) and oak-hickory types (82 percent), than of the maple-beech-birch (77 percent) and oak-pine (69 percent) types.

Volume

Total volume of all hardwood growing stock in the 13 Central Hardwood States is 121.0 billion cubic feet. This represents 47 percent of the 1977 total hardwood volume in the U.S., and 17 percent of the 1977 combined softwood and hardwood volume. The hardwood volume includes all hardwood species, including some not generally considered part of the Central Hardwood forest.

Sawtimber-size trees account for 61 percent of the hardwood volume, and poletimber trees account for the remaining 39 percent. Pennsylvania (20.0 billion cubic feet), North Carolina (17.7 billion), and Virginia (17.1 billion) lead other Central Hardwood States in hardwood volume (table 2).

Table 1.--Area of timberland in the Central Hardwood Region by forest type and owner class

Owner class	Total	Oak-hickory	Maple-beech-birch	Oak-pine	Elm-ash-cottonwood
Thousand acres					
National Forest	7,694.7	5,438.8	1,008.3	1,192.4	55.2
Other public	5,810.6	3,894.6	1,254.3	343.8	317.9
Forest industry	7,147.3	4,091.7	1,070.4	1,585.5	399.7
Farmer and misc. priv.	86,378.2	61,897.7	11,284.4	7,102.1	6,094.0
<b>All owners</b>	<b>107,030.8</b>	<b>75,322.8</b>	<b>14,617.4</b>	<b>10,223.8</b>	<b>6,866.8</b>

Table 2.--Volume of hardwood growing stock in the Central Hardwood Region by state and class of timber

State	All growing stock	Sawtimber trees	Saw-log portion	Upper stem portion	Pole timber trees
<u>Million cubic feet</u>					
Arkansas	9,080	5,076	4,173	903	4,004
Illinois	4,718	3,378	2,556	822	1,340
Indiana	3,442	2,346	1,994	352	1,096
Iowa	1,049	703	477	226	346
Kentucky	10,581	6,464	5,250	1,214	4,117
Maryland	2,699	1,791	1,462	329	908
Missouri	5,633	2,840	1,979	861	2,793
No. Carolina	17,711	11,927	8,845	3,082	5,784
Ohio	6,119	3,958	3,232	726	2,161
Penn.	19,989	10,747	8,673	2,074	9,242
Tenn.	10,400	6,186	5,073	1,113	4,214
Virginia	17,055	11,304	8,220	3,084	5,751
W. Va.	12,520	7,356	5,973	1,383	5,164
Total	120,996	74,076	57,907	16,169	46,920

Farmers and miscellaneous private persons own 77 percent of the hardwood growing-stock volume, compared with 81 percent of the timberland area mentioned earlier. The largest proportion of hardwood inventory owned by these parties is in Ohio (90 percent), followed by Kentucky (89 percent) and Illinois (89 percent).

National Forests administer 8 percent of the hardwood volume, and other public agencies and forest industry each accounts for 7 percent (table 3). The large proportions of timberland and volume owned by nonindustrial private parties suggest that many Central Hardwood stands are not receiving intensive forest management.

Table 3.--Volume of hardwood growing stock in the Central Hardwood Region by state and owner class

State	All ownerships	National Forest	Other public	Forest industry	Farmer & misc. priv.
<u>Million cubic feet</u>					
Arkansas	9,080	1,268	478	2,038	5,296
Illinois	4,718	257	250	14	4,197
Indiana	3,442	146	235	20	3,041
Iowa	1,049	--	120	12	917
Kentucky	10,581	600	336	231	9,414
Maryland	2,699	--	260	97	2,342
Missouri	5,633	665	153	146	4,669
No. Carolina	17,711	1,727	514	1,405	14,065
Ohio	6,119	192	320	88	5,519
Penn.	19,989	1,180	4,730	1,342	12,737
Tenn.	10,400	517	501	936	8,446
Virginia	17,055	1,877	692	1,096	13,390
W. Va.	12,520	1,669	279	1,090	9,482
Total	120,996	10,098	8,868	8,515	93,515
Percent	100.0	8.4	7.3	7.0	77.3

Table 4.--Volume of hardwood sawtimber in the Central Hardwood Region by state and owner class

State	All ownerships	National Forest	Other public	Forest industry	Farmer & misc. priv.
Million board feet <sup>1/</sup>					
Arkansas	25,096	3,029	1,779	6,398	13,890
Illinois	17,705	950	948	59	15,748
Indiana	10,717	344	787	64	9,522
Iowa	3,475	--	383	39	3,053
Kentucky	25,585	1,496	679	529	22,881
Maryland	6,440	--	576	148	5,716
Missouri	13,875	1,551	404	371	11,549
No. Carolina	52,930	5,596	1,478	4,195	41,661
Ohio	19,530	640	1,255	322	17,313
Penn.	42,097	2,027	10,167	2,971	26,932
Tenn.	31,213	1,503	1,571	2,786	25,353
Virginia	49,550	5,163	2,104	3,042	39,241
W. Va.	25,031	3,446	490	2,491	18,604
Total	323,244	25,745	22,621	23,415	251,463
Percent	100.0	8.0	7.0	7.2	77.8

<sup>1/</sup> International 1/4-inch rule.

The volume in hardwood sawtimber-size trees in the Region is 323.2 billion board feet<sup>4/</sup> or 54 percent of the Nation's 1977 total (table 4). This compares with 47 percent of the Nation's hardwood growing-stock volume mentioned earlier. North Carolina boasts the largest hardwood sawtimber volume (52.9 billion board feet), followed by Virginia (49.5 billion) and Pennsylvania (42.1 billion).

Two-thirds of the hardwood growing-stock volume in the Region is in trees 14 inches in diameter and smaller (table 5). Trees 20 inches and larger account for only 14 percent of the volume. Illinois contains the largest share of its volume in diameter classes 20 inch and larger (28 percent), followed by Iowa (22 percent) and Ohio (20 percent).

Likewise, 41 percent of the hardwood sawtimber volume is in trees 14 inches in diameter and smaller (table 6). Trees 20 inches and larger account for 27 percent of the sawtimber volume.

Forty-five percent of the hardwood sawtimber volume is in log grade 3, next to the poorest of the 4-grade system used to record log grade (table 7). Thirty-six percent of the volume is in log grades 1 and 2, at the better end of the 4-grade system. Highest proportions of total

volume in log grades 1 and 2 are found in Indiana (52 percent), followed by Illinois (44 percent) and Iowa (43 percent).

In addition to the growing-stock volume mentioned earlier, there is a total of 17.4 billion cubic feet of rough and rotten trees as shown in the following tabulation. Many of these trees can be used for such products as fuelwood, charcoal, or pallet lumber.

State	Class of timber		
	Total rough and rotten	Rough trees	Rotten trees
Million cubic feet			
Arkansas	2,017	1,459	558
Illinois	362	268	94
Indiana	377	307	70
Iowa	223	169	54
Kentucky	1,070	646	424
Maryland	372	264	108
Missouri	2,485	2,033	452
No. Carolina	1,817	1,457	360
Ohio	492	396	96
Penn.	1,667	1,198	469
Tenn.	2,262	1,489	773
Virginia	2,291	1,998	293
W. Va.	1,973	1,373	600
Total	17,408	13,057	4,351
Percent	100.0	75.0	25.0

<sup>4/</sup> International 1/4-inch rule.

Table 5.--Volume of hardwood growing stock in the Central Hardwood Region by state and diameter class

State	Diameter class (inches)					All classes
	6	8	10	12	14	
<u>Million cubic feet</u>						
Arkansas	9,080	1,082	1,450	1,472	1,260	1,122
Illinois	4,718	346	463	530	543	535
Indiana	3,442	248	383	465	478	488
Iowa	1,049	84	124	138	132	141
Kentucky	10,581	1,186	1,326	1,605	1,528	1,440
Maryland	2,699	240	303	365	368	369
Missouri	5,633	806	954	1,033	921	763
No. Carolina	17,711	1,430	1,997	2,356	2,707	2,504
Ohio	6,119	465	770	926	832	756
Penn.	19,989	2,405	3,253	3,584	3,189	2,544
Tenn.	10,400	1,014	1,433	1,767	1,634	1,473
Virginia	17,055	1,323	1,995	2,434	2,550	2,426
W. Va.	12,520	1,497	1,751	1,916	1,707	1,669
Total	120,996	12,126	16,202	18,591	17,849	16,230
Percent	100.0	10.0	13.4	15.4	14.8	13.4

(Table 5 continued)

State	Diameter class (inches)					All classes
	16	18	20	22-28	30+	
<u>Million cubic feet</u>						
Arkansas	911	635	436	616	96	
Illinois	536	446	346	736	237	
Indiana	414	291	226	376	73	
Iowa	111	90	67	119	43	
Kentucky	1,218	843	512	776	147	
Maryland	324	249	156	278	47	
Missouri	472	268	144	215	57	
No. Carolina	2,140	1,593	1,050	1,605	329	
Ohio	642	506	378	645	199	
Penn.	1,787	1,312	770	992	153	
Tenn.	1,145	797	456	594	87	
Virginia	2,079	1,526	982	1,494	246	
W. Va.	1,334	941	618	945	142	
Total	13,113	9,497	6,141	9,391	1,856	
Percent	10.8	7.8	5.1	7.8	1.5	

Table 6.--Volume of hardwood sawtimber in the Central Hardwood Region by state and diameter class

State	Diameter Class (inches)							
	All classes	12	14	16	18	20	22-28	30+
<u>Million board feet</u> <sup>1/</sup>								
Arkansas	25,096	5,138	5,326	4,710	3,424	2,418	3,509	571
Illinois	17,705	2,764	2,785	2,799	2,368	1,850	3,930	1,209
Indiana	10,717	2,063	2,259	1,926	1,392	1,044	1,715	318
Iowa	3,475	648	708	558	445	338	590	188
Kentucky	25,585	5,125	5,404	4,878	3,558	2,239	3,683	698
Maryland	6,440	1,105	1,258	1,183	953	610	1,135	196
Missouri	13,875	4,515	3,746	2,324	1,312	706	1,044	228
No. Carolina	52,930	9,278	10,114	9,616	7,706	5,392	8,821	2,003
Ohio	19,530	3,646	3,711	3,270	2,614	1,921	3,353	1,015
Penn.	42,097	11,024	9,701	7,287	5,464	3,368	4,506	747
Tenn.	31,213	6,960	7,200	6,081	4,370	2,589	3,491	522
Virginia	49,550	8,729	9,756	9,282	7,317	4,958	8,048	1,460
W. Va.	25,031	5,061	5,531	4,703	3,404	2,306	3,508	518
Total	323,244	66,056	67,499	58,617	44,327	29,739	47,333	9,673
Percent	100.0	20.5	20.9	18.1	13.7	9.2	14.6	3.0

<sup>1/</sup>International 1/4-inch rule.

Table 7.--Volume of hardwood sawtimber in the Central Hardwood Region by state and log grade

State	Log grade				
	All grades	1	2	3	4
<u>Million board feet</u> <sup>1/</sup>					
Arkansas	25,096	2,739	4,240	11,580	6,537
Illinois	17,705	3,014	4,743	8,096	1,852
Indiana	10,717	1,929	3,644	4,716	428
Iowa	3,475	483	1,004	1,626	362
Kentucky	25,585	3,008	4,538	12,807	5,232
Maryland	6,440	806	1,283	2,811	1,540
Missouri	13,875	1,069	3,165	6,605	3,036
No. Carolina	52,930	9,634	12,488	22,642	8,166
Ohio	19,530	2,897	4,305	8,267	4,061
Penn.	42,097	6,427	9,016	19,991	6,663
Tenn.	31,213	3,653	5,008	14,718	7,834
Virginia	49,550	7,707	10,614	20,138	11,091
W. Va.	25,031	3,432	4,380	11,496	5,723
Total	323,244	46,798	68,428	145,493	62,525
Percent	100.0	14.5	21.2	45.0	19.3

<sup>1/</sup>International 1/4-inch rule.

## Growth and Removals

Net annual growth of hardwood growing stock in the Region amounts to 4.1 billion cubic feet, compared to annual timber removals of 2.0 billion cubic feet (table 8). The surplus of growth over removals results in increasing hardwood inventories. However, a comparison of growth and removals can lead to inaccurate conclusions because a substantial volume of growth is in trees too small to be part of the removals volume. And individual species may be more heavily utilized than others because of their greater value and, therefore, their inventories may be increasing more slowly than the hardwood average, or even decreasing. The average hardwood growth rate for the Region is 3.4 percent of inventory, compared to a removals rate of 1.7 percent.

### WHAT INDUSTRY AND LAND MANAGERS TELL US THEY WANT TO KNOW

In recent years, the Forest Inventory and Analysis program has conducted two workshops that evaluated the current national program and made recommendations for new direction in the next decade. These reviews were cosponsored by the National Association of State Foresters, the National Forest Products Association, and in the most recent workshop, the Hardwood Research Council.

The 1983 program review was the first of its kind and was directed toward addressing national and regional issues rather than state-level concerns that are more appropriately addressed

during preinventory planning sessions. Major recommendations from the 1983 review include:

- a. The inventory remeasurement cycle should be planned collectively with users within the Station survey territory so that a regional consensus can be developed. Credibility of resource information is based on a combination of factors: the accuracy of the estimate, the appropriateness of the information, and the recentness of the statistics. Too often the emphasis is placed on the first two components, and the inventory remeasurement cycle absorbs the impact of austere budget decisions. Two options exist to cope with reduced funding: accept lower accuracy levels or collect only a minimum of information.
- b. The county is the most logical reporting and analysis unit for the forest inventory. To report county data in a way that is acceptable to most clients, we must agree on what information should be reported and what level of precision is acceptable.
- c. State Foresters should help FIA identify and involve resource information user groups to form jointly a consensus on issues and objectives to be addressed by the inventory. To the extent that these objectives require funding and other resources not available to FIA projects, states and other cooperators in the inventory should be prepared to help find supplementary support to accomplish this work.

Table 8.--Volume of net annual growth and annual timber removals of hardwood growing stock by state.

State	Annual growth	Annual removals	Difference
<u>Million cubic feet</u>			
Arkansas	369	210	159
Illinois	92	67	25
Indiana	92	64	28
Iowa	41	50	(-) 9
Kentucky	354	137	217
Maryland	86	62	24
Missouri	164	159	5
No. Carolina	627	315	312
Ohio	289	87	202
Penn.	607	279	328
Tenn.	415	176	239
Virginia	573	273	300
W. Va.	415	155	260
Total	4,124	2,034	2,090

d. A framework of data and procedures consistent from Station to Station is essential to a national inventory program so that statistics from more than one Station territory may be combined. This kind of reporting can be accomplished through a series of core or standard tables for all newly completed inventories.

e. Inventory statistics should be compiled, reviewed, validated, and released within 6 months of the completion of inventory field work.

f. Direct access to detailed forest inventory data is needed by users of the information. Data management systems should be developed to facilitate statistical analysis by cooperators.

In 1985, a followup program review was conducted to address those special issues that are unique to cooperators who manage and use the hardwood resources. These issues are of special importance to the participants at the Central Hardwood Forest Conference. In addition to the issues raised at the 1983 review, the following recommendations were made:

a. Data on the volume of "short-log" trees are needed for local (state) resource statistics. This issue is most important to resource managers in the Plains States and in other states where inventory volumes are small and short-log trees represent a significant portion of the live tree volume. If hardwood trees containing less than a 12-foot saw log are being grown and utilized, then this volume should be included in the forest inventory. Currently the North Central Station is including the volume in these short-log trees in separate tables in their statistical reports.

b. Tree grades versus log grades. FIA in the East currently collects log grade information by recording the grade of the butt log of every sawtimber tree on our sample plots. In addition, all logs are graded on a smaller sample of trees. The volume distribution by grade from this smaller sample is used to distribute volume by log grade for the whole sawtimber inventory. This method is preferable to simply reporting volume by butt log grade.

c. The use of "select" species separation for oaks is no longer informative. FIA compiles tree volumes by species before combining the select red and white oaks. If this aggregation is no longer used, we will discontinue presenting these data.

d. A higher level of technical assistance should be furnished by a partnership of FIA and states. States should also have a more active role in serving the public who request resource information.

e. Land use change should be monitored frequently and intensively. In addition to timber supply, information on land use change is essential for using long-range projection models and for evaluating changes in wildlife habitat and recreation values.

f. More effort should be spent on gathering uniform timber removals information. This would include information on the consumption of all timber products, including fuelwood, and the structure of the forest products industry.

The recommendations seem to tell FIA that our clients need a continuation of the service we have traditionally provided, in addition to closer collaboration between cooperators, and, perhaps, some modification of current procedures. We would like your opinions and assistance. What are the best means of expressing tree quality? What information is needed about forest landowners and timber output, and how often should it be updated? How can we best present and transfer inventory information to those who want it? What procedural changes should be made to make our information more useful to a larger audience? We want to be responsive to the needs of our clients and we welcome any suggestions you may have about our program. Please direct your comments to James T. Bones at the address shown in footnote 1.

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