

A COMPARATIVE ANALYSIS OF HARDWOOD SAWTIMBER QUALITY ON NATIONAL FORESTS VERSUS ADJACENT LANDS

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ABSTRACT

Since the mid 1980s, increased public scrutiny of timber sales in national forests and changes in Forest Service policy have resulted in delayed or reduced sales of hardwood sawtimber. As a result, the hardwood industry has become increasingly concerned about future supplies of timber from national forests. On the surface, these concerns seem difficult to understand since national forests contain only 7 percent of the nation's hardwood sawtimber. To determine the validity of these concerns, the relative quality of sawtimber on national forest lands was compared with that on adjacent lands for 41 eastern Forest Service survey units. This analysis found large variations in the relative quantity and quality of hardwood sawtimber on national forests. Many national forests in the Appalachian region have proportionately more high-quality timber than adjacent lands, while the quality of hardwood on national forests in the South appears to be similar to that on private lands. Because of a lack of data on tree quality, the proportional volumes of quality timber on public and private lands could not be determined for the Central region.

Since the mid 1980s, sales of timber in national forests have been under continued public scrutiny. Nowhere is this more apparent than in the popular press. Charges of creative bookkeeping to maintain below-cost timber sales, pork barrel politics, and collaboration with the timber industry are commonplace (5,15). Knize (5) asserted that harvesting national forest timber is unnecessary because adequate supplies can be obtained from private lands, and that the quality of timber on national forests is poor. Furthermore, the benefits of the national forest extend far beyond timber supply and include wildlife habitat, recreation, and water quality (2). However, even as the Forest Service seems to have adjusted its policy on timber sales (3), these changes continue to be eyed with distrust (13).

Much of the controversy surrounding timber sales has been in the western states where the Forest Service controls nearly

60 percent of the softwood sawtimber inventories (12). Still, sales of eastern timber also have come under public scrutiny (1). These efforts have delayed or canceled timber sales and have caused the eastern hardwood industry to become concerned (1). On the surface, these concerns are somewhat difficult to understand because only 7 percent of the hardwood sawtimber volume is controlled by the Forest Service. These concerns seem even more dubious if Knize (5) is correct in asserting that most national forest timber is worthless.

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Contentious issues, that on the surface appear without merit, are not uncommon within the hardwood industry. For example, the export of hardwood logs has been the subject of heated debates within the industry even though these exports account for less than 2 percent of sawtimber production (6). The controversy is that exports tend to be for higher grade logs of specific species and have caused domestic users of these logs to compete in an international market.

Another assertion of the hardwood industry is that quality sawtimber is becoming scarcer, even though Forest Service surveys indicate that sawtimber inventories are increasing for all species and tree grades (10). Again, the answer to this apparent contradiction is in the details; the hardwood industry looks at the timber base in terms of specific species within a finite procurement area, while analysis of state forest surveys provides a larger, more aggregated picture of the hardwood resource.

In both issues just mentioned, species and quality were more important to industry than quantity of sawtimber. Species composition is important because industry tends to focus on species with the greatest market value (11). This emphasis is reflected in changes in stump age prices.

In Ohio, the price of red oak stumpage increased twice as fast as that of yellow-poplar (9). Timber quality is important to industry because of the expanding domestic and international markets for higher grade hardwood lumber. Luppold and Baumgras (9) found that the higher the log quality, the greater the growth in real price, suggesting that higher quality materials are becoming economically scarce.

To evaluate the validity of industry's concerns about Forest Service timber sales policy in the national forest, we focused on the relative quantity of sawtimber in these forests and the proportional volume of higher grade sawtimber of the more valued species. The finite procurement area and the relatively small size of hardwood sawmills (7) required an analysis of hardwood timber inventories at the lowest level of aggregation possible. Given these

considerations, we decided to examine the relative proportion of higher grade timber of higher valued species on national forest lands versus adjacent land at the survey unit level.

DATA COLLECTION AND DEVELOPMENT

Forest-inventory data are developed by the USDA Forest Service Forest Inventory and Analysis (PIA) unit or similar research units associated with each of the seven experiment or research stations. Most of the recent forest surveys for eastern regions are available in the East Wide Forest Inventory Data Base. The Northeastern Station has yet to include its inventory information in this database.

Forest inventory statistics traditionally have been reported by survey units. The geographic dimensions of these units initially were based on forest type and physiography subject to existing county boundaries. Because forest types and county size vary by state, survey units vary in size from one county to an entire state. Although inventory statistics also can be developed at the county level, county-level data are not valid for examining specific tree species and grades because the sample size is usually too small.

Specific inventory data needed for this study were sawtimber volumes (in board feet international scale) by species and tree grade on national forest versus adjacent forest lands for Forest Service inventory units containing national forests. Data for states included in the Southern Research Station and North Central Forest Experiment Station regions were obtained from the East Wide Data Base with the help of FIA personnel in Starkville, Miss. Data for states in the Northeastern Research Station region were purchased from the PIA unit in Radnor, Pa.

Examination of the inventory data revealed large variations in the following:

1) the proportion of national forest lands in various survey units; 2) year the survey was completed; and 3) proportion of hardwood vs. softwood sawtimber. Units with less than 2 percent sawtimber on national forests were excluded from the study because they also had small quantities of hardwood timber in national forests. The two survey units in east Texas were excluded because they had a high proportion of softwood material and low quantities of hardwood timber. The states

TABLE 1. - Survey units examined in study by region, State, and national forests associated with these units.

State	Survey unit	National forest
Appalachian region		
GA	Northern	Chattahoochee
TN	East	Cherokee
NC	Mountains	Pisgah and Nantahala
VA	South Mountains	Jefferson
VA	North Mountains	George Washington
WV	Northeastern	Monongahela
WV	Southern	Monongahela
KY	Eastern	Daniel Boone
KY	South Cumberland	Daniel Boone
KY	North Cumberland	Daniel Boone
KY	Bluegrass	Daniel Boone
PA	Allegheny	Allegheny
Southern region		
OK	Southeast	Ouachita
AR	Ouachita	Ouachita
AR	Ozark	Ozark
AR	South Delta	St. Francis
LA	Northwest	Kisatchie
LA	Southwest	Kisatchie
MS	Delta	Delta
MS	South	Desota
MS	Southwest	Homochitto
AL	North	Bankhead
AL	North Central	Bankhead and Talladega
AL	West Central	Talladega
SC	North Coastal Plain	Francis Marion
SC	Piedmont	Sumter
VA	Northern Piedmont	George Washington
Central region		
OH	Southeastern	Wayne
OH	South Central	Wayne
IN	Knobs	Hoosier
IL	Southern	Shawnee
MO	Southwestern Ozarks	Mark Twain
MO	Eastern Ozarks	Mark Twain
MO	Northwestern Ozarks	Mark Twain
MI	Northern Lower Peninsula	Huron and Manistee
MI	Eastern Upper Peninsula	Hiawatha
MI	Western Upper Peninsula	Hiawatha and Ottawa
WI	Northeastern	Nicolet
WI	Northwestern	Chequamegon
MN	Northern Pine	Chippewa
MN	Aspen Birch	Superior

of New Hampshire and Vermont were excluded due to incomplete information. These exclusions left 41 survey units for analysis. Because of large regional differences in forest types and topography, these survey units were separated as the Appalachian, Southern, and Central regions. The survey units analyzed in this study and the national forests within them are listed by region in Table 1.

The information collected included details on at least 18 specific hardwood species or species groups. Species were grouped into three classifications (Table 2) based on the current market value of lumber and quality attributes of subspecies. Group 1 included species with the greatest market value. Group 2 included other species that currently have a relatively high market value. Red and white oak traditionally have been separated into "select" and "other" groupings. "Other" red and white oaks are included in group 2 because the grade yields of these species are less than those of the select oaks for identical log grades (4). The other oaks also tend to have differences in color and other characteristics that make them less valuable in the market (8).

Six variables were used in order to condense the volumes of FIA data into information that describes the relative quality of sawtimber in national forests:

1. The percentage of sawtimber volume in the survey unit;
2. The percentage of grade 1 saw timber;

3. The percentage of grade 1/group 1 sawtimber;

4. The percentage of grade 1/group 2 sawtimber;

5. The percentage of grade 1 sawtimber of the most important group 1 species;

6. The volume of hardwood sawtimber.

Grade 1 sawtimber contains a 12-foot log in the first 16 feet of the tree and must be at least 16 inches in diameter at breast height (15 in. for ash and basswood). The log must have at least 83 percent of the third worst face clear and have 2 clear cuttings. The most important group 1 species was the one species with the greatest volume in the survey unit.

Because most of the survey units within the North Central Experiment Station region lacked data on log grades for most private lands, the percentage of grade 1 timber could not be determined. As a result, only a percentage of group 1, group 2, and important group 1 sawtimber could be determined for these units.

REGIONAL ANALYSIS OF HARDWOOD SAWTIMBER IN NATIONAL FORESTS

Of the three hardwood regions defined in Table 1, the Appalachian region is the most important. This region contains 43 percent of the eastern sawtimber volume and produces 42 percent of the hardwood lumber manufactured east of the Rocky Mountains (12,14). Eight percent of the hardwood sawtimber in this region is on national forests. The bulk of the national forest timber is in mountainous areas.

The national forests contain a relatively large volume of the hardwood sawtimber in most of the Appalachian survey units (Table 3). Of greatest importance is the group of national forests that extend almost continuously along the spine of the Appalachian Mountains in Georgia, North Carolina, Tennessee, Virginia, and West Virginia and include the Chattahoochee, Cherokee, Pisgah, Nantahala, Jefferson, George Washington, and Monongahela forests. In half of the survey units listed in Table 3, national forests control more than

TABLE 2. - Species included in groups 1, 2, and 3.

Group 1	Group 2	Group 3
Select white oaks	Other white oaks	All other species
Select red oaks	Other red oaks	
Hard maple	Soft maple	
Ashes	Yellow birch	
Black cherry		
Black walnut ^a		

^a Although black walnut was considered a group 1 species, it was not in sufficient quantities on national forest lands to be considered in the analysis of any of the survey units studied.

TABLE 3. - Percentage (of hardwood sawtimber on national forests in Appalachian survey units and quality characteristics of this sawtimber.

Survey unit	State	Total sawtimber	Grade I sawtimber	Grade 1/ group I sawtimber	Grade 1/ group 2 sawtimber	Important grade I sawtimber	Volume of hardwood sawtimber on NF (million BF)
----- (%) -----							
Northern	GA	33.2	59.8	68.9	70.4	81.4 ^a	2,744
East	TN	19.1	23.9	32.4	22.9	43.3 ^a	2,103
Mountains	NC	27.8	37.4	40.7	53.0	52.7 ^a	5,982
S. Mountains	VA	12.4	13.8	19.6	31.8	13.4 ^a	1,793
N. Mountains	VA	39.4	33.3	42.3	28.5	51.9 ^a	4,137
Northeastern	WV	20.1	22.0	29.6	11.6	26.0 ^a	3,742
Southern	WV	3.2	3.6	2.8	0.8	2.5	599
Eastern	KY	5.4	8.2	8.2	12.1	24.2	331
N. Cumberland	KY	12.5	19.5	16.2	11.0	17.1 ^b	757
S. Cumberland	KY	22.2	23.8	32.5	20.6	42.9 ^b	1,556
Bluegrass	KY	5.0	9.1	20.3	0.0	14.0 ^b	150
N. Central	PA	21.5	28.6	33.6	34.6	41.8 ^c	3,336

^a Red oak is the most important group 1 species.

^b White oak is the most important group 1 species.

^c Black cherry is the most important group 1 species.

TABLE 4. - Percentage of hardwood sawtimber on national forests in Southern survey units and the quality characteristics (If this sawtimber (national forests in units that are italicized are more than 70% softwood).

Survey unit	State	Total sawtimber	Grade I sawtimber	Grade 1/ group I sawtimber	Grade 1/ group 2 sawtimber	Important grade I sawtimber	Volume of hardwood sawtimber On NF (million BF)
<i>Southeast</i>	OK	9.3	9.7	19.4	22.6	6.6 ^a	18
Ozark	AR	29.7	46.0	63.1	30.4	71.7 ^a	5
<i>Quachita</i>	AR	4.6	31.4	56.1	34.6	40.0 ^a	2,859
S. Delta	AR	3.5	5.0	0.0	12.5	0.0 ^a	973
<i>Northwest</i>	LA	3.3	4.1	2.5	7.0	3.9 ^b	198
<i>Southwest</i>	LA	14.2	19.7	24.9	23.0	31.9 ^b	228
Delta	MS	4.5	8.7	2.1	31.6	0.0 ^a	861
<i>South</i>	MS	9.1	7.3	5.6	7.4	5.7 ^b	353
<i>Southwest</i>	MS	7.0	7.9	15.4	4.3	35.4 ^a	423
North	AL	4.2	15.1	18.6	8.9	31.3 ^b	529
<i>N. Central</i>	AL	8.4	20.0	29.8	15.3	34.2 ^b	197
<i>W Central</i>	AL	4.2	9.0	13.5	5.3	13.5 ^b	470
N. Coastal Plain	SC	3.5	1.9	2.9	0.0	0.0 ^b	227
Piedmont	SC	8.7	8.6	4.3	10.2	4.3 ^b	315
N. Piedmont	VA	4.1	3.9	9.1	6.5	8.5 ^b	840
							507

^a Red oak is the most important group 1 species.

^b White oak is the most important group 1 species.

20 percent of the sawtimber volume. In all cases, the percentage of grade 1 sawtimber in these forests was disproportionate to the volume of grade 1 sawtimber on private lands. With respect to the percentage of grade 1/group 1 and grade 1/group 2 sawtimber, national forests contained significant proportional volumes of this material.

Northern red oak is the most predominant group 1 species in the Appalachian region. This species has been logged heavily over the last 25 years as national and international users have been willing to pay escalating prices for red oak lumber. The current high volumes of quality red oak in the national forests of Georgia, North Carolina, Tennessee, and Virginia are the result of long-term national forest management of this species as opposed to heavy cutting of this species on adjacent lands.

The survey units in Kentucky have considerably more white oak than other units in the Appalachian region. A significant volume of grade 1 white oak sawtimber is contained within the North Cumberland survey units. The percentage of grade 1 and group 1/grade 1 timber in the four Kentucky survey units exceeds the percentage of total sawtimber. However, grade 1/group 2 timber is found in lesser percentages in the Blue grass, South Cumberland, and North Cumberland

districts.

Perhaps the most unique national forest is the Allegheny, which contains nearly 7.9 percent of the nation's total volume of black cherry sawtimber. Given that the Monongahela National Forest contains an additional 3.5 percent of the cherry volume, availability of this species is especially affected by Forest Service policy. Black cherry on the Allegheny is known domestically and internationally for its quality. Further, black cherry currently is the most expensive of the commonly traded, domestically produced hardwood lumbers. As in the case of most national forests in the Appalachian region, the Allegheny contains higher relative volumes of grade 1/group 1 sawtimber.

Unlike the large, contiguous, and predominantly hardwood national forests of the Appalachian region, the national forests in the Southern region tend to be smaller, fragmented (noncontinuous), represent a smaller portion of the hardwood resource base, and tend to have a larger softwood component (Table 4). The exception is the Ozark National Forest in northwestern Arkansas. This forest is large, predominantly hardwood, and contains greater relative volumes of grade 1/group 1 sawtimber and grade 1/group 1 red oak than any other forest in the Southern region. The Quachita National Forest in Arkansas also

is large, contains relatively high volumes of higher grade hardwood sawtimber and red oak, but is predominantly softwood.

The Kisatchie National Forest in the northwest and southwest Louisiana survey units is predominantly softwood. However, the hardwood component of this forest includes a greater percentage of higher value, high-grade sawtimber than was found on adjacent lands. The southwestern portion of the Kisatchie tends to have more hardwood and higher quality hardwood than the northwestern portion.

The Delta National Forest is the only predominantly hardwood forest in Mississippi. Although this forest has a large amount of the grade 1/group 2 sawtimber, the inventory data indicate no grade 1 select oak. The other two survey regions in Mississippi that are associated with the Homochitto and Desota National Forests are predominantly softwood. Although the unit associated with the Desota seems to have a lower quality timber base than adjacent lands, the unit associated with the Homochitto has somewhat better timber.

The survey units examined in Alabama also have a high softwood component. However, the hardwood component of these forests tends to include a large volume of grade 1 select white oak and ash. The relatively high volumes of these two species increased the percentage of grade I and

TABLE 5. - Percentage of hardwood sawtimber on national forests in Central survey units and the quality characteristics of this sawtimber (for states with sufficient tree grade data).

Survey unit	State	Total sawtimber	Grade I sawtimber	----- (%) -----			Volume of hardwood sawtimber onNF (million BF)
				Grade II group I sawtimber	Grade II group 2 sawtimber	Important grade I sawtimber	
Southeastern	OH	8.7	10.0	6.4	9.3	9.2 ^a	309
S. Central	OH	5.3	11.3	17.3	6.8	27.6 ^a	95
Knobs	IN	8.2	10.1	15.0	11.3	17.9 ^a	677

^a White oak is the most important group I species.

TABLE 6. - Percentage of hardwood sawtimber on national forests in Central survey units and the species mix (for states with insufficient tree grade data).

Survey unit	State	Total I sawtimber	Group I sawtimber	----- (%) -----			Volume of hardwood sawtimber onNF (million BF)
				Group 2 sawtimber	Important sawtimber		
Southern	IL	22.8	26.8	25.4	31.3 ^b	922	
Southeastern Ozarks	MO	12.9	17.8	12.1	17.8 ^b	409	
Eastern Ozarks	MO	23.1	22.3	26.7	22.8 ^b	1,640	
Northwestern Ozarks	MO	5.4	5.4	5.1	5.7 ^b	152	
N. Lower Peninsula	MI	10.0	10.6	18.5	3.8 ^c	1,794	
E. Upper Peninsula	MI	16.1	14.6	20.5	14.5 ^c	1,043	
W. Upper Peninsula	MI	16.7	17.2	16.6	17.6 ^c	1,985	
Northeastern	WI	13.3	13.8	13.3	13.8 ^c	755	
Northwestern	WI	11.6	13.1	22.8	13.7 ^c	758	
Northern Pine Aspen	MN	13.5	7.1	0.0	0.0 ^a	1,058	
Birch	MN	23.2	42.6	0.0	38.9 ^c	1,287	

^a Red oak is the most important group 1 species.

^b White oak is the most important group 1 species.

^c Hard maple is the most important group 1 species.

grade 1/group 1 sawtimber. However, the percentage of grade 1/group 2 sawtimber is about half that of the group 1 sawtimber.

The national forests in the Piedmont and Coastal Plain regions of the Carolinas do not appear to have large volumes of the quality material desired by the hardwood industry. In fact, all three of the North Carolina units in these regions were excluded from the study because of the low volumes on national forests. The North Piedmont unit in Virginia contains the eastern fringes of the George Washington National Forest. Although this unit has a higher component of select white oak, it contains only 4 percent of the sawtimber volume.

The national forests in the Central region fall into one of two groups. Forests in the southern section are fragmented and contain oak-hickory forest types, while forests in the Lake States are larger, less fragmented, and contain large volumes of maple, beech, birch, or aspen.

Both the South Central survey unit associated with the Wayne National Forest in Ohio and the Knobs unit associated with the Hoosier National Forest in Indiana have relatively large volumes of grade I select white oak sawtimber (Table 5). Because the white oak in this region generally is valued higher by the market than white oak grown in the Southern or Appalachian regions, the relatively higher volume of quality white oak on federal lands is even more significant. In many respects, Indiana white oak has an international notoriety similar to that of Pennsylvania cherry.

Both the Mark Twain National Forest in Missouri and the Shawnee National Forest in Illinois have a white oak component similar to or slightly higher than that on adjacent lands. However, the lack of data on tree grade for much of the private land adjoining these forests made it impossible to rate the relative quality of this white oak.

National forests in the central and northern sections of the Lake States contain

a fairly large amount of hardwood timber (Table 6). Hard maple is the most predominant group I hardwood species in these areas. Because of a renewed interest in this species in recent years, prices for hard maple have increased dramatically to levels greater than those for red oak. Still, with the exception of the Aspen Birch unit of Minnesota, the volume of hard maple on national forests is roughly similar to that on adjacent lands. Again, the lack of data on tree grades for adjoining private lands made it impossible to rate the relative quality of the hard maple on national forests.

SUMMARY AND CONCLUSIONS

Although the national forests contain less than 7 percent of the eastern hardwood sawtimber volume, this percentage is not indicative of how the hardwood industry perceives the national forests. Some national forests contain only small amounts of hardwood sawtimber or hardwood sawtimber of lesser quality than what is found on adjoining lands, while other

national forests contain some of the nation's most valuable hardwood timber.

The large and contiguous national forests in the Appalachian region have relatively high volumes of grade I sawtimber of the species valued by the market. The difference between national forests and other land is due to different methods for managing this forest resource. A significant portion of the timber on private lands has been high graded or cut prior to becoming grade I sawtimber. Given the market for the oaks and cherry over the last 5 years, the degree of cutting on private lands has increased. If forest surveys were completed today, the portion of the nation's supply of cherry sawtimber on all Appalachian national forests would exceed 35 percent. Similarly, the current relative volume of quality red oak in the southern and central Appalachian forests and white oak in Kentucky probably are greater than that indicated in **Table 3**.

Except for the Ozark National Forest, timber in southern national forests is not as valuable as that in the Appalachian forests. Much of the southern national forests have a high softwood component and the hardwood in these forests tends to be in relatively low volumes or similar in quality to those on adjoining lands. The fragmented nature of these forests also means that individual regions are not totally dependent on national forest sales policy.

The Wayne and Hoosier are the only national forests in the Central region that were fully evaluated in this study. These

forests contain a significant proportion of higher grade white oak. Because of the relative value of this material, reduced timber sales affect both the hardwood lumber and veneer industry. The other national forests in this region also may contain greater proportions of higher grade material, but there is no tree-grade information with which to evaluate this hypothesis. However, given the current market for hard maple and the potential for overcutting on private lands, the national forests in the Lake States could easily become a store of value.

Although it appears that many of our national forests contain large quantities of higher valued sawtimber, this study did not look at growth rate trends or forest health considerations. Such analysis might lead to other conclusions regarding national forests versus adjoining lands. That some of the sawtimber on certain national forests is reaching biological maturity means that we could see a decline in higher value sawtimber in these forests over the next 20 to 50 years.

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Corrections

The Allegheny National Forest is in the Allegheny survey unit not the North Central unit.

In this paper it was stated that the Allegheny contains 25 percent of the national cherry sawtimber volume and that the Monongahela contains an additional 10 percent. Both figures are in error because an incorrect estimate of national cherry sawtimber volume was used. The correct proportions are 7.9 and 3.5 percent, respectively.