DEVELOPMENT AND USE OF RELATIONAL DATA BASES FOR ANALYSES OF REGIONAL HARDWOOD TIMBER PRODUCTION AND CONSUMPTION

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Abstract.—The hardwood forests of the eastern United States are diverse with respect to terrain, species distribution, tree size, and timber quality. These attributes directly affect the value and use of the timber resource. Unfortunately, these attributes are not necessarily related to political boundaries. For example, forests in the central and western sections of Kentucky and Tennessee have similar biological and physical attributes, while forests of eastern Kentucky are similar to those in West Virginia.

INTRODUCTION

The variation of timber attributes within a particular state combined with the consistency of timber attributes across similar regions of several states make it difficult to analyze market issues using data bases based on state boundaries. To make hardwood timber issues easier to analyze, we are developing a hardwood timber data base that defines regions by attributes. These regions will be developed by aggregating physiographic and biological variables as is done for USDA Forest Service forest survey units. The timber data base is relationally linked to other data bases containing primary product manufacturing capacity and other influential factors. This paper explains the process by which these data bases are being developed and how they can be used to examine forest policy issues.

The eastern hardwood resource has long been a source of timber and fiber for numerous hardwood products industries. Although the hardwood resource has been harvested since colonial times, total draws on this resource appear to be higher today than at any previously recorded period. In 1991, hardwood lumber production exceeded 11 billion board feet while hardwood pulpwood consumption exceeded 30 million cords (Figure 1). This represents roughly 4.7 billion cubic feet of timber consumed by the hardwood industries in 1991, a 34-percent increase since 1980 and a 66-percent increase since 1970.

The increased consumption of hardwood timber over the last two decades is still dwarfed by the increases in timber growth on the national level. However, there is some evidence that harvest may be exceeding growth for individual species in some northern areas, and that total timber growth may be exceeded by total removals in some southern areas. There also is concern that exports of hardwood logs and chips may be hurting forest products industries in several eastern areas. In addition to increased hardwood timber demand, there are increased demands on the hardwood resources for recreational and preservational pursuits.

The results of the changes in hardwood markets and society at large are increased regional disputes over hardwood timber use. The manifestation of these disputes ranges from movements to ban the exports of hardwood logs, to place restrictions on timber available to the pulp and paper industry, to reduce cuts on national forests. Since these disputes are becoming increasingly political, there is an increased need for objectivity in the analysis of hardwood issues.

There is tremendous interest in hardwood resource issues by the forest industry, environmental groups, and local, state, and national governments. However, analyses of these issues are extremely difficult. Data on hardwood market activity tend to be ambiguous at best, and forest inventory data are accurate but collected every 5 to 10 years, making it difficult to analyze short-term changes. But, the most insidious problem hindering the analysis of hardwood market issues may be the diverse nature of the eastern hardwood resource and the diverse nature of hardwood material use.

Eastern hardwood timber stands are not homogeneous. There are large differences in site and stand attributes such as terrain, species distribution, tree size, and timber quality in different areas of the East. These differences directly affect the value and use of timber stands. However, stand and tree attributes considered desirable or acceptable by one type of end-use market may be considered undesirable or unnecessary by another market.

Understanding the relationship between site and stand attributes in a given area and national and local demand would be useful when analyzing the impact of changing policies or market conditions on timber supply, regional

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employment, and the supply of forest products. Unfortunately, timber stand attributes usually are not related to political or Forest Service regional boundaries. Because important hardwood attributes are extremely variable and usually unrelated to political boundaries, examination of hardwood timber issues by use of aggregated data collected over state or multisate areas may lead to spurious conclusions.

To analyze regional timber issues in a consistent manner, individual regions must be somewhat homogeneous with respect to biological and physiologic attributes. Current inventory statistics developed by Forest Service forest inventory and analysis units are designed to be valid at the multicounty survey unit level. However, analysis of timber issues at this survey unit level is impractical because of the number of units that exist in the eastern United States. A more practical size can be developed by aggregating contiguous survey units of similar biological and physiologic attributes. Once these regions are defined, additional data on forest industry production capacity, rate of timber growth, employment, sociological and demographic characteristics, and other pertinent data could be relationally linked to the regional timber data base.

DEVELOPMENT OF HARDWOOD TIMBER REGIONS

The proposed boundaries of the alternative or new timber regions would be based on previously developed Forest Service state survey units. However, these individual units will be combined without consideration of current regional political delineations. The new regions will be based on identifiable characteristics such as physiography terrain, tree quality, species composition and distribution, and other important stand and site attributes that are homogeneous over the potential region.

Under the new regional classification system, Virginia could be divided into three regions (Figure 2). The northern and southern mountain units could be classified into the Appalachian region; the northern and southern Piedmont units could be classified in the eastern Piedmont region; and the Coastal Plains unit could be classified as Coastal Plains region.

The three regions within Virginia would not end at the state line or even the southeastern survey region. As currently developed, the Coastal Plains region extends from the Florida peninsula to sections of Maryland, Delaware, and New Jersey. The Piedmont region includes the Piedmont areas of North Carolina, Virginia, and Maryland. The Appalachian region includes the mountain areas of Virginia, North Carolina, Georgia, Tennessee, Kentucky, all of West Virginia, and potentially the south-central survey unit in Pennsylvania.

SOUTHERN UPLANDS EXAMPLE

As mentioned previously, concerns over hardwood resource issues tend to occur in specific regions. An example of such a situation is occurring in the Southern Uplands region encompassing northeastern Mississippi, northern Alabama, northwestern Georgia, and the eastern half of Tennessee. The primary concern in this region is that hardwood timber supplies may or may not be adequate to meet increasing demands by the hardwood pulp and lumber industries. An additional concern is that a large proportion of the chips produced in this region are being exported to Japan and other Asian markets.

Unfortunately, timber use is changing so quickly in the Southern Uplands region that the forest survey data developed by the Forest Service are insufficient to analyze the current situation. However, analysis of this region using a variety of information from several relational data bases allows the current problem to be put into focus.

At present, our analysis using the regional approach has been accomplished only for data sets for the state of Alabama. However, Alabama lends itself well to demonstration of a relational approach to data analysis. Northern Alabama is part of the Southern Uplands region. This region extends north of the Fall Line boundary of the Gulf Coastal Plain and Piedmont Uplands in Alabama and contains diverse geological formations usually found in predominantly ridge and valley physiography. For our analysis, the entire region is contained in the Forest Survey units of northern and north-central Alabama and is referred to as northern Alabama (Figure 3). About 50 percent of the forest type in this area is classified as oak-hickory compared to 34 percent for the state as a whole.

To analyze these issues, several data bases of information were developed and related to each other as well as to forest inventory statistics for the region. These data bases include hardwood lumber and log production, hardwood pulpwood and chip production, and chip mill and pulp mill capacity and location. Data from a variety of sources were compiled at a county level and aggregated to the forest inventory unit level. 1

HARDWOOD SAWTIMBER RESOURCES AND PRODUCTION

The most recent forest inventory for Alabama was completed in 1990. The largest land holding group in this region is the nonindustrial private land owner, with nearly 80 percent ownership of forest lands. The volume of hardwood sawtimber estimated on nonindustrial private lands in northern Alabama increased from 5.35 billion board feet in 1982 to 7.8 billion board feet in 1990. These data do not indicate a problem in sawtimber reduction in northern Alabama. If we
examine the change in growing stock for the region as an indication of future shortages in sawtimber production, we see an overall increase of 29 percent in hardwood growing stock on private lands between 1982 and 1990 (Table 1). In fact, diameter distribution of select oak for these lands also shows overall increases in all diameter categories except the 6-inch class (Figure 4).

Hardwood lumber production for Alabama actually declined during the period following the expansion of hardwood chip exports. Between 1987 and 1991 hardwood lumber production for the state declined by 16 percent, from 273.6 to 228.7 million board feet. However, this decline does not differ significantly from declines in hardwood lumber production in other southern regions attributed to market preferences for higher quality northern hardwoods. In addition, for the northern area of Alabama under investigation, hardwood lumber production declined by less than 7 percent during the same time period (from 49 to 46 million board feet).

HARDWOOD FIBER PRODUCTION AND FACILITIES

Creation and evaluation of hardwood fiber production data for Alabama shows a much different trend from hardwood lumber production. Between 1980 and 1991, hardwood pulpwood and chip production nearly doubled while pine production increased by less than 8 percent (Figure 5). However, for the period influenced by hardwood chip export markets (1987-91), hardwood fiber production increased by only 9.4 percent. For 1991, exports through the Mobile Export District accounted for an estimated 12 percent of Alabama’s fiber production, with much of this material originating from Mississippi, Tennessee, and Georgia. It is easy to conclude that the current export market contributes only a fragment of the increases in hardwood fiber production in Alabama during the past decade.

However, a regional picture of hardwood fiber production in Alabama reveals important additional information. During 1987-91, the greatest increases have occurred in the state’s Northern Uplands hardwood growing region (Figure 6). The two northern forest inventory units combined increased production by 72 percent. In 1987, this region accounted for only 16 percent of the hardwood fiber production in the state. By 1991, this figure had grown to 24 percent of Alabama’s production. In fact, the greatest change within this period occurred between 1990 and 1991.

An overlay of fiber production facilities within Alabama provides additional insight into the nature of hardwood fiber demand (Figure 7). We see the greatest concentration of new chip mill facilities in and around northern Alabama. As prices for pine fiber increased in the 1980’s, it became economical for pulp and paper companies to substitute lower cost hardwood fiber for pine for a portion of their production. In addition, chip mills were established to procure pine fiber needs in a tight supply market and increasing demands for hardwood fiber. These strategic offsite production facilities have been located near both resources and transportation networks and facilitated by high production technology.

CONCLUSION

The most recent forest inventory in Alabama was taken in 1990 prior to a surge in hardwood fiber production. Average annual hardwood removals between 1982 and 1990 for this northern Alabama region were at 51.7 million cords. However, comparison with actual production of hardwood pulpwood, chips, and lumber reveals that in 1989, actual annualized production for this region exceeded this average (Figure 8). In fact, the acceleration of removals between 1990 and 1991 could not have been accounted for in the last forest inventory.

This information alone cannot establish a problem related to hardwood fiber production and sawtimber supplies or that hardwood growth and removal ratios are unbalanced for the region. However, it does highlight a potential emerging hardwood issue. Any modeling using annualized growth and removal averages not accounting for additional demand for fiber could result in incorrect conclusions.

This example, though limited in regional scope, presents an application of relational data base analysis to both identify an emerging hardwood product demand and supply issue and provide insight into the variables affecting the market. The value of the relational method for hardwood products and markets is that it accounts for regional differences, establishes a link between natural resource demands and supplies, assists in the identification of structural market changes, and provides information for better short-term demand analyses between forest inventory cycles.

ENDNOTES

1 Production data was compiled from severance tax information supplied by the Alabama Forestry Commission and the USDA Forest Service industry survey at the county level. For any state, the source of production information will vary according to availability.

2 Alabama severance tax estimates compiled by Alabama Forestry Commission.

Table 1--Growing stock volume for northern Alabama's timberlands

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<td>Private corporation</td>
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<td>434</td>
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- - - - - Million cubic feet - - - - -

a Estimated from Forest Inventory data for the survey units of northern and north-central Alabama.
Figure 1. Volume of hardwood timber consumed by the hardwood lumber and hardwood pulp and composite product industries.

Figure 2. Virginia example of hardwood timber regions.
Figure 3. Forest resource survey regions of Alabama.

Figure 4. Diameter distribution of select white oak growing stock on private nonindustrial ownership in northern Alabama.

Figure 5. Alabama pulpwood production, 1981-91.
Figure 6. Alabama regional hardwood fiber production change, 1987-91.

Figure 7. Fiber industry location map, Alabama 1991

Figure 8. Hardwood annualized removals compared with actual harvest production of lumber, pulpwood, and chips for northern Alabama.