MEASURING CHANGES IN FOREST PRODUCTS DEMANDS FOR PROJECTING TRENDS IN FOREST RESOURCES

by

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ABSTRACT--One usually thinks of a renewable resource inventory as a project designed to estimte the current quantities of some renewable resources and their change over time. Considerable efforts are focused upon defining and measuring selected resource attributes. Projecting future changes and trends is often a major goal of a research inventory system's analysis. Physical changes and trends in renewable resources attributes are usually monitored and modeled--sometimes in great detail. It has been suggested that the ideal inventory system should provide not just a prediction of change but must make possible the explanation of changes that have taken place in response to inputs.

An important and sometimes neglected aspect of monitoring and explaining change in renewable resources is measurement of forest products demands as related to changes in the physical inventory. Information about changes in resources demands and determinants of future demand level is essential for understanding, projecting, and monitoring changes in forest resource. inventories.

This paper examines methods for measuring change in forest resources demand .as related to long-range trends in demographic economic and social variables. A conceptual framework for relating changes in forest resource demands to changes in forest inventory will be presented.

KEYWORDS--Renewable resources, forest management, demand projections, timber supply, forest inventory, wood consumption

INTRODUCTION

Measures of forest resource use are an important part of renewable resource information and planning systems. Resource management decisions are usually based upon some set of assumptions about future resource demands and environmental .impacts. The ideal inventory system should be able to project change and explain change in response to inputs. In the introduction to this conference there is the premise: "Demand for the world's renewable resources is increasing in geometric proportions. The supply is constantly changing, modified by management activities, insect and disease infestations, and catastrophic events. At the same time, the capability of the lands to produce goods and services is decreasing."

This paper will show that a forest resource inventory system must consider the impacts of changing demands on the forest resource to effectively explain the changing resource situation. To do this, we will examine wood end-use demand studies conducted in the United States, methods used to project these demands, and the impact of demand on forest resources. Methods to reduce projected demand-supply imbalances will also be discussed.

RENEWABLE RESOURCE ASSESSMENTS

The current detail included in renewable resource assessments varies widely throughout the world. In many areas, resource scientists are working to establish and maintain a "base line" set of objectives for

resource measurement and comparison. Recently completed reports of the Tropical Forest Resource Assessment Project of the Food and Agriculture Organization of the United Nations (FAO), and the United Nations Environmental Programme (UNEP) provide such information (Steinlin, 1982). The FAO-UNEP projects provide, for the first time, baselines for continuous monitoring of tropical ecosystems. In other countries such as the United States, renewable resource inventories are well established. Studies of forest resource conditions in the United States have been conducted for over 100 years (Hair, 1981).

More recently, the analysis of present and anticipated uses, demand for, and supply of renewable resources of forest, range, and associated lands has been directed by Congress through the Renewable Resources Planning Act of 1974 (RPA), and the National Forest Management Act of 1976. Recently completed reports provide an assessment of the forest and rangeland situation in the United States (USDA, Forest Service, 1981, 1982). These reports present information on present and perspective demands and supplies for timber, range, forage, water, outdoor recreation and wilderness, and wildlife and fish. Future social, economic, and environmental implications of demand and supply projections are discussed and management opportunities to increase and extend supplies are presented.

Estimates of current and prospective uses of resources serve another purpose. Resource use is a good index of resource value to society. The amount of time, money, and effort expended for use values a resource. Some uses, such as recreational activities or use of land for wildlife or natural preserves, are related to physical or aesthetic quality of the land and are difficult to value directly. Other uses, such as timber, are separated from the land and shipped elsewhere for final use. These products can be valued by their market price.

Timber products are usually the most important renewable commodity resource use for forest lands. While recognizing that other uses are important, this paper will limit its concern to the use of and demand for timber products, and the relation of timber demand projections to timber supplies.

MEASURES OF WOOD PRODUCTS USE

Timber and wood products use measurements are complex because of the many and varied uses of wood. Most wood products are intermediate commodities used to produce final goods, such as a house or a newspaper. Timber products consumption can be divided into distinct phases at which use can be measured. These include: (1) primary timber products cut from the land, such as sawlogs or pulpwood; (2) intermediate wood products such as lumber, plywood, composite panel products, and woodpulp; and (3) final product or market use such as homebuilding, other construction, manufacturing, shipping, furniture-making, home improvements, and exports.

Measures of wood products use in final markets are most useful for estimating trends in consumption and for projecting changes in demand. These estimates can identify market substitution of other materials for wood due to price or technological changes. Surveys of these end-use markets are complex and require a variety of statistical techniques. In general, surveys are easiest to conduct at the point of manufacture or construction of the final product. For some uses, such as fuelwood or household use of wood products, a survey of households must be made. Surveys of wood products use for construction are conducted either by sampling building permits, examining construction specifications, or by surveying builders and contractors. For wood products consumed by manufacturers, surveys are conducted by canvassing manufacturing firms by mail questionnaires. Surveys of wood products used for residential repair and remodeling are conducted by direct surveys of homeowners or builders; however, it is often difficult for homeowners or builders to recall materials used since each job varies considerably. Surveys of residential fuelwood use are conducted by telephone or mail questionnaires of individual households. Information on paper products use is collected, by type of product, by the American Paper Institute from its members.

The results of these surveys are used to derive estimates of total wood products consumption by major end-use markets for the U.S. Major product groups arc lumber, plywood and other panel products, pulpwood, and fuelwood. These products are in turn converted back to the roundwood equivalent for total timber demand projection and comparison with timber supply.

PROJECTION OF CHANGES AND TRENDS

Projection of forest products demand is important for determining changes and trends in forest resources. Analysis of demand in relation to economically available supply is important for forest resource assessment (Haynes and Adams, 1981). This analysis is used to identify future forest resource requirements for formulation of management policy and programs (USDA, Forest Service, 1982).

Projecting resource demand requires relating past changes in demand to demographic, social, and economic determinates. Demand projections show the volume of forest products that would be consumed under a given set of assumptions about future levels of economic activity, income, energy costs, technology, institutions, relative prices, and other determinants.

It is important to distinguish between short-term and long-term projections. Many economic variables which are important in inventory and business cycles are less important in time periods of 5 years or more. Wide fluctuations in housing construction in the United States for example occur periodically because of changes in interest rates and the availability of credit. These short-term cycles have severely impacted forest products demand and prices.

In the long-term, population and the level of economic development, as measured by Gross National Product (GNP), are the principal variables in determining resource use. Technological and social change can also be major influences, but generally are difficult to quantify (Landsberg et al. 1963). Population size, age structure, and social characteristic are perhaps the most important variables for determining many forest resource demands, such as wood products, housing, furniture, and residential fuelwood. They are also major determinates of the size of the labor force which is, in turn, a principal determinate of the total output of the economy or GNP. In the long-term, GNP and the closely related indicator, Personal Disposable Income (PDI) are major reference series for the consumption of many wood products. A final factor in estimating

TABLE 1.

TIMBER DEMAND, NET FOREIGN TRADE, AND DEMAND ON AND SUPPLY FROM DOMESTIC FORESTS IN THE UNITED STATES, 1952, 1962, 1970, 1976, AND 1980 WITH PROJECTIONS TO 2030.

Item	1952	1962	1970	1976	1980	Projections 1990	2000	2010	2020	2030
	BILLION CUBIC FEET									
Softwood:										
Total demand	8.4	8.5	9.5	10.4	10.7	12.2	12.9	14.0	14.8	15.1
Net imports	1.3	1.3	.8	.9	1.0	1.4	1.1	.9	.7	.5
Demand on domestic forests	7.2	7.2	8.7	9.5	9.7	10.8	11.8	13.1	14.1	14.6
Supply from domestic forests	7.2	7.2	8.7	9.5	9.7	10.4	11.1	11.6	12.0	12.3
Supply-demand balance	0	0	0	0	0	-.4	-.7	-1.5	-2.1	-2.3
Hardwood:										
Total demand	3.5	3.1	3.0	3.0	5.0	6.0	7.6	9.1	10.3	10.7
Net imports	.1	.1	.1	.1	.1	.5	.6	.7	.8	1.0
Demand on domestic forests	3.6	3.0	2.9	2.9	4.9	5.5	7.0	8.4	9.5	9.7
Supply from domestic forests	3.6	3.0	2.9	2.9	4.9	4.9	6.0	7.1	8.1	8.9
Supply-demand balance	0	0	0	0	0	-.5	-1.0	-1.3	-1.4	-.8
Total, all species:										
Total demand	11.9	11.6	12.5	13.4	15.7	18.2	20.5	23.1	25.1	25.8
Net imports	1.4	1.4	.9	1.1	1.1	1.9	1.7	1.6	1.5	1.5
Demand on domestic forests	10.8	10.2	11.6	12.4	14.6	16.3	18.9	21.5	23.6	24.3
Supply from domestic forests	10.8	10.2	11.6	12.4	14.6	15.3	17.1	18.7	20.1	21.2
Supply-demand balance	0	0	0	0	0	-.9	-1.7	-2.8	-3.5	-3.1

Source: U.S. Department of Agriculture, Forest Service (1982, 1983).

demand is the level of imports and exports of wood products.

The final step in demand/supply assessment is the comparison of demand projections with supply projections. By assuming that recent management and investment trends continue, we can identify future imbalances between the volume of products consumed and supplied. A brief look at the timber situation follows.

TRENDS IN TIMBER PRODUCTS CONSUMPTION AND PROJECTED DEMAND

Total U.S. timber products consumption has increased modestly since the Depression years of the 1930's, from a low of 8.7 billion cubic feet (roundwood equivalent) in 1932 to about 15.7 billion cubic feet in 1980 (USDA Forest Service 1982, 1983). From 1952 to 1980 softwood consumption increased from 8.4 to 10.7 billion cubic feet (Table 1). Hardwood consumption remained fairly constant at 3 billion cubic feet throughout the 1950's, 60's, and 70's before increasing to 5 billion cubic feet in 1980 (Fig. 1).

Total United States' timber products consumption is determined by estimating consumption in all major end-use markets (Risbrudt and Stone 1980; Stone and Phelps 1980). Four major end-use markets--residential construction, nonresidential construction, manufacturing, and shipping--account for virtually all of the lumber, plywood, particleboard, hardboard, and insulation board consumed in the United States.

Residential construction is the single most important market for timber products in the United States.

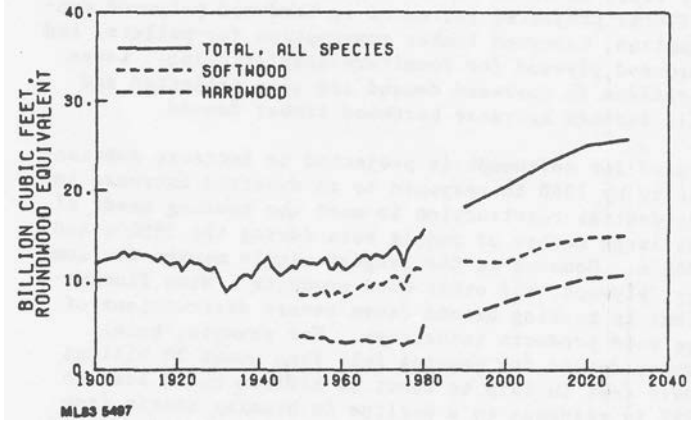

FIGURE 1. Timber products consumption and demand in the United States, 1900-2030.

Between one-third and one-half of all softwood lumber and softwood plywood, plus large amounts of other building board products, consumed annually are for new residential construction plus repair and remodeling of existing units.

New nonresidential construction, which includes commercial and noncommercial buildings, public utilities, highways, and military construction, accounts for about 10 percent of the lumber, plywood, and building board consumed annually in the United States. Manufacturing also accounts for about 10 percent of lumber and plywood consumption, but nearly 40 percent of particleboard and hardboard consumption. Shipping accounts for

16 percent of lumber and 4 percent of plywood consumption. Over one-half of this is used for wooden pallets.

Paper and paperboard consumption is also a large component of total timber products consumption. Over one-third of total annual timber products consumption is woodpulp for paper and paperboard production.

Residential fuelwood use, the final major component of timber products consumption, reversed a long demand trend during the mid-1970's. Since then, consumption has increased rapidly in response to rising energy costs. Residential fuelwood use fell from 4.8 billion cubic feet in 1900 to 2.3 billion cubic feet in 1950, and further to about 0.5 billion cubic feet in the early 1970's. It then rose to 3 billion cubic feet in the 1980's (Skog and Watterson 1983). (Note, fuelwood use includes nongrowing stock sources.)

Long-term demand projections made by the U.S. Forest Service, based on consumption in these end-use markets, trends in wood processing technologies, and projected levels of key economic and demographic indicators, indicate continued increases in demand. U.S. demand for timber is expected to be about 26 billion cubic feet by the year 2030 (Table 1). Much of the increase will be in hardwoods. By 2030 hardwood demand will be nearly 11 billion cubic feet, more than 2 times the 1980 level of consumption. Softwood demand will increase by about one-half to 15 billion cubic feet. Thus, by the year 2030, hardwoods will account for over 40 percent of total U.S. demand for timber, compared to less just 30 percent in 1980. Softwoods will account for the remainder.

The rapid increase in the demand for hardwoods largely reflects projected increases in hardwood pulpwood consumption, hardwood lumber consumption for pallets, and hardwood plywood for furniture manufacturing. Large increases in fuelwood demand are also projected and will further increase hardwood timber demand.

Demand for softwoods is projected to increase substantially by 1990 in response to an expected increase in residential construction to meet the housing needs of the large number of people born during the 1950's and 1960's. Housing is the largest single market for lumber, plywood, and other wood products. Wide fluctuations in housing demand cause severe distruptions of the wood products industries. For example, total lumber demand for housing fell from about 20 billion board feet in 1978 to about 10 billion board feet in 1982 in response to a decline in housing starts from about 2 million to 1 million. By 1990 total softwood demand is projected to be 12.2 billion cubic feet and then rise slowly to 15.1 billion in 2030.

SUPPLY--DEMAND BALANCE AND ITS IMPLICATIONS

Domestic timber supply, that is, volume of timber available for harvest from U.S. forests, is expected to increase by nearly 50 percent during the next 50 years. Most of the increase will be in hardwood timber. In the East, net annual growth of hardwood growing stock is more than twice as large as removals. Hardwood supplies in 2030 are expected to be nearly 9 billion cubic feet and softwood supplies, 12 billion cubic feet. These projections assume a declining area of commercial forestland, a continuation of stumpage price trends experienced over the past 25 years, response of removals to stumpage prices and inventory characteristics as in the past, and continuation of past owner behavioral characteristics.

Based on these projections, the demand for timber from U.S. forests will exceed available supplies as early as 1990 for softwoods and 2010 for hardwoods. A deficit of 0.4 billion cubic feet of softwood timber is expected in 1990, rising to 2.3 billion cubic feet by 2030 (see Fig. 2). A hardwood timber deficit of 0.5 billion cubic feet by 2010, rising to 0.8 billion cubic feet in 2030 is also expected. Large softwood deficits are due in part to large reductions in the supply of old growth timber in the West, reduced somewhat by increased volumes from the South. The hardwood deficit is smaller than the softwood due to large hardwood volumes that have accumulated in the East over the past 25 years. The results of these supply shortfalls will be rapidly rising stumpage prices, in excess of trends established during the past 25 years, and subsequent increases in wood products prices and reductions in timber demand. If these price increaser and reduced levels of demand are to be avoided, action' must be taken now.

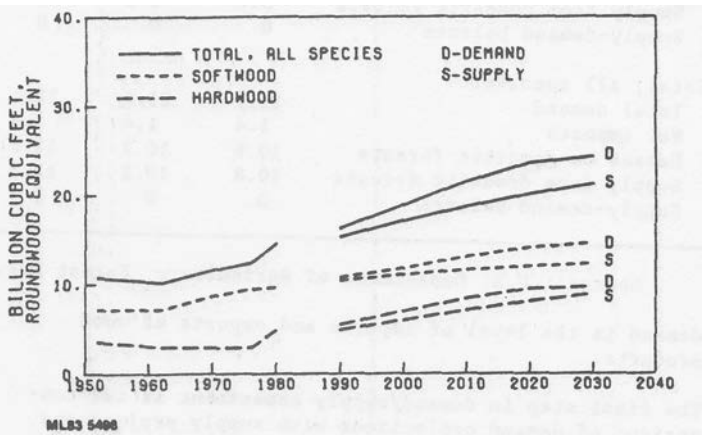

FIGURE 2. Timber demand on and supply from United States forests, 1952-2030.

Projected imbalances between timber demand and supply can be reduced either by lowering forest level demand through more efficient, low cost production and use of wood products, or by increasing supply through use of cost-effective improved management practices, assistance to forest landowners, and increased use of previously unused tree species. For example, production efficiency can be increased by using the truss-framed house construction, which uses approximately 30 percent less framing lumber, and by the powered back-up roll which increases veneer recovery by reducing chuck spin-out, core size, and permits the peeling of previously unpeelable logs (Tuomi et. al. 1978; Loehnertz 1982).

CONCLUSION

Measurement of forest resource use and associated projections of demand are an important part of any resource inventory system and must be used to develop forest resource management alternatives for timber and other forest resources. Measurement of use by end-use markets and by individual user groups of forest resources provides the basis for development of demand

projections related to underlying social, economic, and demographic variables.

Projected demand for timber, primarily hardwood timber, in the U.S. is expected to increase substantially over the next 50 years. Timber supply is also expected to increase but at rates below demand resulting in excess demand for timber. If no action is taken to resolve the imbalance between demand and supply, stumpage prices and wood product prices will rise, resulting in depressed equilibrium levels of demand. Research into new ways to use wood more efficiently can help reduce total wood demand. Forest resource demand analyses thus provide a basis for evaluating alternative programs for managing demand and supply balance to best meet the Nation's forest resource demands.

REFERENCES CITED

Hair, Dwight. 1981. The prospective renewable resource situation in United States. Unasylva, 33(134):19-24.

Haynes, Richard W. and D. M. Adams. 1981. Hatching projections supply and demands for forest products in the U.S. Forest Products Journal, 31(10):77-81.

Landsberg, Hans H., Leonard L. Fischman and Joseph L. Fisher. 1963. Resources in America's future. Published for Resources for the Future, Inc. by the Johns Hopkins Press. Baltimore, Maryland. 987 p.

Loehnertz, Stephen P. 1982. Industrial performance of powered back-up roll for peeling veneer. USDA Forest Service, Forest Products Laboratory Research Paper FPL 430. Hadison, Wisconsin. 5 p.

Risbrudt, Christopher D. and Robert N. Stone. 1980. Trends and patterns in wood products consumption and production. From: "Timber Demand: The Future in Now." Proceedings P-80-29. Forest Products Research Society, Madison, Wisconsin. p. 24-34.

Skog, K. E., I. A. Watterson. 1983. Residential fuelwood use in the United States: 1980-1981. U.S. Forest Service Report forthcoming through the National Technical Information Service, Springfield, Va.

Steinlin, Hans Jurg. 1982. Monitoring the world's tropical forests. Unasylva, 34(137):2-8.

Stone, Robert N. and Robert B. Phelps. 1980. Prospective U.S. wood use situation. Forest Products Journal, 30(10):51-56.

Tuomi, R. L., G. E. Hans and D. J. Stith. 1978. Fabrication, transportation, and creation of the prototype truss-framed house. USDA Forest Service, Forest Products Laboratory, Madison, Wisconsin. 5 p.

U.S. Department of Agriculture, Forest Service. 1981. An assessment of the Forest and Rangeland Situation in the United States. Forest Resources Report No. 22. 352 p.

U.S. Department of Agriculture, Forest Service. 1982. An analysis of the timber situation in the United States 1952-2030. USDA Forest Service, Forest Resource Report No. 23. 499 p.

U.S. Department of Agriculture. 1983. America's renewable resources: A supplement to the 1979 Assessment of the Forest and Rangeland Situation in the United States. Review draft. 94 p.

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Marcin, Thomas C.; McKeever, David B. Measuring changes in forest products demands for projecting trends in forest resources. In: Bell, John F.; Atterbury, Toby, eds. Renewable Resource Inventories for Monitoring Changes and Trends: An International Conference; 1983 August 15–19; Corvallis, OR. Corvallis, OR: Oregon State University; 1983: 124–128.