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#### MONITORING CHANGING DEMANDS ON GLOBAL NATURAL RESOURCES

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#### ABSTRACT

The wise use of the world's forest resources to satisfy present and future needs of an ever-increasing world population is ultimately the goal of all resource management activities. Increasing the extent, frequency, and reliability of systems to monitor global natural resources is one important aspect of meeting this goal. Another equally important aspect of monitoring world resources is increasing the extent, frequency, and reliability of systems to monitor present and future demands on the forest resource and how these demands impact the resource. Understanding and monitoring both the supply of and demand for natural resources are essential in meeting our objectives as world resource managers. This paper reviews past and present demand estimates in the United States for forest resources, the methods used to develop these demand estimates, and their associated statistical reliability. The adequacy of these estimates to meet informational needs of resource managers and the implications for forest management are evaluated. Recommendations are also made for future monitoring of resource demands.

#### INTRODUCTION

The world's forests provide a wealth of natural resources essential to the physical and economic well-being of the world's population. Timber, water, wildlife, forest-range grazing, and outdoor recreation are commonly recognized as tangible resources of the forest. These resources provide (1) employment and income to local, regional, and national economies, (2) essential raw materials needed to house, clothe, and feed an ever-increasing population, and (3) outdoor recreational experiences needed by an increasingly urbanized society. Less tangible, although equally important, benefits are also derived from the world's forests. For example, the ability of forests to maintain and regulate the amounts of carbon dioxide and oxygen in the atmosphere are becoming increasingly apparent. Thus, it can be argued that the quality of life on this planet is inexorably linked to the quality of the forest resource.

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The wise use of the world's forest resources to satisfy present and future human needs and at the same time maintaining the integrity of the resource are ultimately the goals of all resource management activities. The extent, frequency, and reliability of forest resource supply information and of the systems to monitor these resources must be maintained and improved, if we are to have adequate information from which to make management decisions. Equally important is maintaining and improving the extent, frequency, and reliability of resource demand information and of the systems to monitor and collect this information. Demands placed by society on the forest resource will ultimately determine, to a large extent, the nature of the world's forests. This is evidenced today by the rapid destruction of tropical rain forests for timber products and agricultural land. Accurate information on present and anticipated forest resource demand and a better understanding of the determinants of that demand are essential for monitoring changes in forest resources (Marcin and McKeever 1983). If we are to meet our objectives as world resource managers, we must enter the 21st century with systems to better monitor both the supply of and demand for global natural resources.

This paper focuses, in general, on assessing and monitoring the demand for natural resources and on how these demands may impact resource supplies. While acknowledging the importance of all natural resources in all countries, this paper deals specifically with timber and other wood products demanded from the U.S. forests. Although specifics will vary, the concepts presented have general, widespread applicability to other natural resources and countries. First, a historical look at how timber demand assessments in the United States are made and the legislation requiring such assessments. Next, current demand estimates for the United States are presented, along with the methods used to develop these estimates and their associated statistical reliability. The adequacy of these estimates to meet informational needs of resource managers are then evaluated, as are implications for forest management. Finally, recommendations are made for future monitoring of resource demands.

#### PAST TIMBER DEMAND ASSESSMENTS

The U.S. government and others such as the wood industry, trade associations, and environmental groups, have long recognized the importance of the Nation's forests, and the resources associated with them, to the economic well-being of the Nation. The management of these forests, and associated rangelands and waters, has long-term implications for not only the resource but for society as a whole. Therefore, this management should be based on as complete and objective information as possible. To this end, several important pieces of legislation were enacted by the U.S. Congress to help insure sound management practices. The first such legislation was the Appropriations Act of August 15, 1876, which appropriated \$2,000 to study and report on the conditions of the Nation's forests (USDA FS 1981). Legislation between 1876

and 1927 was enacted to study forestry or timber sales as needed. The McSweeney-McNary Act of 1927, amended in 1928, directed the U.S. Secretary of Agriculture to cooperate with State and other agencies "in making and keeping current a comprehensive survey of present and prospective requirements for timber and other forest products." The McSweeney-McNary Act authorized many of the timber demand studies conducted by the USDA Forest Service through the early 1970s.

The Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974, amended by the National Forest Management Act of 1976, and the Forest and Rangeland Renewable Resources Research Act of 1978 required the U.S. Secretary of Agriculture to prepare a renewable resource assessment by December 31, 1975, an updated assessment in 1979, and updates to be made each tenth year thereafter (USDA FS 1976, 1981). This assessment was to include "an analysis of present and anticipated uses, demand for and supply of renewable resources, with consideration of the international resource situation, and an emphasis of pertinent supply and demand and price relationship trends". These legislative acts authorize and require the Forest Service to maintain current information on both the supply of timber and other forest resources and the demand for these resources.

#### FOREST SERVICE DEMAND STUDIES

In compliance with these legislative acts, the Forest Service has conducted many timber demand studies. These studies usually focus on a specific end-use market, such as housing or manufacturing, and develop detailed estimates of the types and quantities of wood products used in that market. A variety of statistical approaches are used in these end-use studies, depending on the market being studied, the availability of information on wood use and market characteristics from previous studies or other sources, the detail of wood-use estimates required, and the desired level of statistical reliability. In general, little wood-use information is available from sources outside the Forest Service in the detail needed to meet Forest Service objectives: most of the market characteristic data are available. In new, single-family residential construction, for example, very little public data with reported levels of statistical reliability are available on the types and quantities of wood products used in new construction or on how these types and quantities have changed over time. Information is available, however, on characteristics of the housing market. Detailed information on the number of houses built, their size, foundation types, number of stories, number of bedrooms, number of bathrooms, presence and size of garages, and type of exterior wall coverings are available from the U.S. Department of Commerce, Bureau of Census (USDC BC 1988). These data are collected annually at a very precise level of statistical significance. Similar characteristic data for other end-use markets are available from the U.S. Department of Commerce, other Federal and State agencies, trade associations, and private organizations. Forest

Service end-use studies are designed using this available information to increase the statistical reliability of our estimates and to help reduce data collection costs. Cooperation between the Forest Service and other agencies and organizations who collect market characteristic information is an important aspect of the Forest Service's end-use demand research program.

Major solid wood end-use markets identified by the Forest Service include new single- and multifamily housing, residential alterations and repairs, new nonresidential building and nonbuilding construction, fuelwood, and manufacturing, such as furniture, pallets, and shipping containers. In each of these major end-use areas, studies are designed to collect wood-use information for either the entire end-use area or for a specific segment of the market. Information from these individual studies is periodically aggregated and adjusted to a common year to give a detailed look at timber demand in the United States at a specific point in time and to gauge changes over time. This aggregated information forms the basis for the timber demand estimates needed to satisfy RPA legal requirements.

#### PAST FOREST SERVICE END-USE DEMAND STUDIES

Since the enactment of the McSweeney-McNary Act in 1928, many end-use demand studies have been conducted by the Forest Service. Being the principal wood product in nearly all end-use applications, detailed estimates of lumber use were made in studies conducted in the late 1920s, and 1930s. For example, 15,000 board feet of cottonwood were used in 1928 to manufacture pumps and wooden pipe (USDA FS 1928). As new and different wood products began to acquire market shares and as nonwood materials replaced lumber, lumber-use details in end-use studies were reduced accordingly.

During the past 40 years, all major end-use markets have been studied at least once, with as many as three studies being conducted in the more important markets. Figure 1 chronologically lists all major Forest Service end-use studies conducted between 1948 and 1988 where data were collected specifically for the study. One study, which is described later in detail, is in progress.

With the exception of the 1948 manufacturing survey, major Forest Service end-use studies were not conducted between 1948 and 1958. Specific reasons why are not known, but a general sluggish economy, limited budgets, and lack of public support may have been contributing factors (McKeever 1988).

Between 1959 and 1974, many large, expensive wood end-use surveys were conducted by the Forest Service. All major solid wood end-use areas were surveyed at least once, with several areas having two or more surveys. Most of these surveys were conducted by the Forest Service in cooperation with other government agencies or solely by the Forest Service. For example, the 1960 manufacturing survey was

<b>Residential construction</b>				
Single family	-----	1959-1962--	1968-----	
Multifamily	-----		1965-1969-----	
Mobile homes	-----			1970-1974-----
Repair & remodeling	-----			1970-----
<b>Nonresidential construction</b>				
Farm buildings	-----	1961---	1969-----	1983---
Conservation	-----		1965--	1970-----
Highways	-----		1962-----	1978-----
	-----			1975-----
<b>Manufacturing Pallets</b>	1948-----	1960-1965---	1977-----	
	-----			1983---
<b>Fuelwood</b>	-----			1980/1981---
<b>Coal mining</b>	-----			1980-----
	+	+	+	+
	1948	1958	1968	1978 1988

Figure 1--Forest Service end-use demand surveys conducted between 1948 and 1988.

conducted jointly by the Forest Service and the Bureau of the Census: the 1961 nonresidential survey was conducted solely by the Forest Service, and the single-family residential surveys were done cooperatively with the Federal Housing Administration. Although several of the surveys were a total canvass of all wood users, most were sample surveys. Study budgets approaching a quarter of a million dollars were not uncommon. Many of the factors necessary to put together major survey efforts fell into place during the 1960s. A strong domestic economy coupled with rising Federal budgets, support from within and outside the Forest Service, and a need for information that either had not been collected since World War II or had never been collected contributed to the large range and number of studies conducted. The number and size of end-use surveys conducted during the 1960s were, and remain, unprecedented in Forest Service history.

By the mid-1970s and early 1980s, Forest Service data collection efforts began to ebb. Shrinking Federal budgets severely impacted data collection budgets; public support for major data collection efforts seemed to vanish. New, innovative approaches for mustering support and funding were needed and found. The 1977 manufacturing survey, for example, was a cooperative effort among three Forest Service units, with each unit sharing direct and indirect costs. The 1980 fuelwood survey was a nationwide household telephone survey conducted cooperatively with the University of Wisconsin-Madison. The use of professional telephone canvassers greatly reduced data collection costs. The 1983 nonresidential construction study was a cooperative effort between the Forest Service and the Wood Products Promotion Council (WPPC) (Spelter and Anderson 1985). The WPPC is a consortium of wood products associations and corporations interested in promoting the

use of wood in the United States. The American Plywood Association, a key member of the Council, was instrumental in developing the cooperation between the WPPC and the Forest Service needed to conduct a large-scale study of this type. In this study, the WPPC and the Forest Service jointly developed study plans; the WPPC funded and conducted actual data collection; the Forest Service tabulated and analyzed the data; and the Forest Service and WPPC jointly prepared final study reports. These and other innovative support and funding procedures allowed the Forest Service to maintain wood end-use data collection efforts and their credibility through the mid-1980s.

At the same time the Forest Service was conducting end-use studies of individual markets, it was also preparing comprehensive appraisals of the timber situation in the United States. These appraisals were conducted as part of the Forest Service's overall responsibility defined in the amended 1928 McSweeney-McNary Act "to keep the people and the Congress informed as to timber supplies and outlook" (USDA FS 1958). These appraisals were essentially timber oriented and provided a comprehensive look at the supply of and demand for timber from the Nation's forest at a specific point in time. Results from the various end-use studies conducted by the Forest Service and information from other public and private sources were incorporated into unified reports depicting the current and anticipated status of the Nation's forests. Post World War II timber appraisals were conducted for 1948, 1952, 1962, and 1970.

The passage of the 1974 RPA, as amended, required the Forest Service to explicitly recognize and report on all resources of the forest, not just timber in these periodic appraisals. The RPA Assessment reports in 1975, 1979, and 1989 include supply and demand information and implications of such on all forest resources.

#### STATISTICAL RELIABILITY OF DEMAND ESTIMATES

When designing end-use demand studies, every effort is made to achieve "respectable" levels of statistical reliability. In an ideal world, all demand estimates would meet or exceed a desired level of Statistical precision. However, many factors beyond the control of the researcher make this quest for statistical precision difficult. Some of the obvious factors include budgetary and staffing constraints, the nature of the end-use market being studied, the relative amounts of wood being used, and the ability of respondents to accurately report information. Achieving high levels of precision often requires that a large number of observations be included in the sample. Increasing sample size directly increases the cost of the sample and the amount of time and human resources required to take the sample. Innovative sampling procedures may help minimize these increases. Research budget constraints frequently require that sample size and associated statistical reliability be reduced.

Many end-use markets have an inherently high variability in wood use. In manufacturing, for example, similar finished

products may be produced from a variety of wood and nonwood materials. If stratification of the industry primarily between wood users and nonwood users is not possible, large standard errors will exist. For example, in the 1977 manufacturing study, the ship building and repair industry had a standard error for lumber use of nearly 100 percent caused largely by the high variability in materials used and the relatively small volumes of lumber used (McKeever and Martens 1983). Conversely, the wooden pallet industry had a standard error of under 10 percent. A later pallet industry study had a standard error of just over 1 percent for total lumber use by the industry (McKeever and others 1986). The high incidence of lumber use and the high degree of product standardization helped reduce variability in the estimates of lumber use by the pallet industry.

Finally, end-use demand studies require that information be obtained from individuals active in the market being sampled. Individual perceptions, biases, and knowledge affect the accuracy of data being reported. Except for crude data checking and screening procedures, data reported by individual respondents must generally be considered factual. An individual perception of the volume of fuelwood burned, for example, may be quite different from what was actually burned. Statistical reliability is dependent on the willingness and ability of the respondent to give precise information.

In general, Forest Service end-use demand studies are designed to achieve the highest degree of precision possible, given budgetary, resource, and individual market constraints. Predetermined levels of precision are difficult to achieve.

#### CURRENT FOREST SERVICE END-USE DEMAND STUDIES

From the preceding discussion, it is evident that the U.S. government, the Forest Service, and many other interested parties have long been interested in maintaining current information on the extent of wood products use and recently on all natural resource use. This interest continues. The Forest Service is now actively engaged in two end-use market studies and one national assessment. The two market studies will update existing information in two major end-use areas: the national assessment will provide comprehensive information across all end-uses for a common point in time.

#### New Residential Construction Study

The first of the two end-use studies is a cooperative study between the Forest Service and the Wood Products Promotion Council. Cooperation between the Forest Service and the WPPC first began in 1983 with a nonresidential construction wood-use study, and this cooperation continues in this study of wood products used for new residential construction. This study is designed to measure total wood products used to construct new single-family and multifamily residences in the United States during the 1987 building season. Because building practices and building

codes differ significantly between single-family residences and multifamily residences (apartments), the study is divided into two distinct parts--new single-family houses and new apartment buildings. These two parts are further divided into two parts--incidence of wood use and quantity of wood used per type of application or wood-use factors. The incidence of wood use portion of the study will estimate the frequency of specific building practices, such as the percentage of houses built with nominal 2- by 6-in., 24 in. on center, exterior stud walls; the wood-use factor portion will estimate how much wood is required to build such a wall. The incidence of use data will essentially weight the wood-use factors to those building practices currently being used.

The single-family portion of the study is nearly complete. The following details apply to this portion of the study. The multifamily portion of the study closely follows these procedures.

The incidence of use portion of the new single-family housing study consists of a random telephone survey of approximately 1,200 builders who built one or more houses in 1986. Field representatives from the American Plywood Association conducted interviews and recorded types of building characteristics employed by each builder on telephone survey forms. Examples of building characteristics include stud size and spacing, roof and floor types, siding types, and garage size. This information was then stratified by region, size of structure (square feet of floor area), number of stories, and foundation type. Additional telephone calls were made in 1987 to validate and update the incidence of use data base. Comparisons with similar, although less detailed, information from the U.S. Department of Commerce indicates similar regional characteristic distribution.

The second part of this study is designed to measure wood usage rates for specific building components. These wood-use factors estimate the amount of lumber, plywood, other structural panels, and nonstructural panels used per square foot of floor area for roof, wall, and floor applications. American Plywood Association field representatives conducted personal interviews and site inspections of 500 selected builders and their houses, collecting information on the types and quantities of wood products used in houses currently being built. Builders were not selected at random but were selected to insure adequate coverage of all building types, components, and regions. Blueprints of houses currently under construction were also obtained from these builders and other sources. Use factors were developed from these blueprints by professional wood-product estimators. These data were stratified similarly to the incidence of use data.

The incidence of use data will be used to weight the wood-use factor data, resulting in use factors specific to a region and house type. The weighted wood-use factors will be applied to the total square footage of houses built in 1987 from a special tabulation made by the U.S. Department

of Commerce, Bureau of the Census, for this study. Estimated volumes of wood products used, by type, for new houses built in each region will result.

Information on wood products use for new residential construction was last collected by the Forest Service in 1968 (Phelps 1970). Although several private organizations have conducted studies since then, their information is not readily available to the public: it often lacks the detail required by the legislative acts to which the Forest Service is responsible, and the information is not always scientifically documented. Results from the cooperative study between the Forest Service and WPPC will provide the first new set of information in nearly 20 years.

#### Residential Repair and Remodeling Study

The second end-use study in which the Forest Service is currently engaged is a residential repair and remodeling study. This study is being conducted by Resource Information Systems Incorporated (RISI), a private consulting group in Bedford, Massachusetts. The Forest Service is one of several sponsors of the study and was instrumental in developing a sampling procedure to help insure adequate, statistically reliable coverage of all repair and remodeling activities. This study is a two-part telephone survey of households to determine (1) if any repair or remodeling projects were initiated in 1987, and (2) if so, what types of projects they were and what volumes of wood products were used. Wood-products use by type of activity is then calculated on a per dollar of expenditure basis. Information from the U.S. Department of Commerce on total dollar value of repair and remodeling activity in 1987 is used to expand sample wood-use estimates to total consumption for the entire United States. Further details on this study will be published by RISI. Note, however, that the residential repair and remodeling market is a very large, rapidly growing segment of the U.S. wood-using economy.

#### 1989 Resources Planning Act Assessment

The final study the Forest Service is currently engaged in is the 1989 Resources Planning Act Assessment (USDA FS 1988). This Assessment takes a detailed look at both the demand for and supply of all resources of the forest in 1986. Then, based on the specified set of assumptions about the future, it projects both demand and supply to the year 2040. As such, it provides an analytical base for anticipating future needs (USDA FS 1989).

The timber chapter of the 1989 Assessment study is currently being expanded to form the basis of the forthcoming "Analysis of the Timber Situation in the United States" report. This report will provide indepth analyses of both the timber supply and demand situations similar to the series of timber reports written under the McSweeney-McNary Act. Publication is expected by the end of 1990. Preliminary estimates of demand by end-use and wood-product type for 1986 and historical data from 1962

are presented in Tables 1 and 2. Consumption for the three major wood product groups increased between 1976 and 1986. Of the specific products, oriented strandboard and waferboard consumption increased most rapidly, and consumption of all nonstructural panels declined except for particleboard.

#### IMPLICATIONS OF TIMBER DEMAND END-USE STUDIES FOR FOREST MANAGEMENT

Results of the end-use demand studies reported here directly affect timber management decisions made by the Forest Service through the Resources, Planning Act legislation. The RPA Assessment, as described previously, is used to develop the Resources Planning Act Program. The RPA Program is designed to serve the long-term strategic planning needs of the Forest Service by recommending specific programs and actions that the Forest Service can implement to best contribute in meeting society's resource demands. The RPA Program is currently being developed. The draft program has been issued for public comment, consisting of three components: roles for Forest Service programs, consideration of contemporary issues, and long-term program strategies. Following public review, a single, long-term program strategy will be developed, and it will provide guidance for amendments and updates of the National forest land management plans and assistance for program budgets. The final RPA program will be submitted to the U.S. Congress in March 1990. Thus, it is in the RPA Program that the information collected in the various end-use demands studies and the timber supply studies is integrated into a workable plan for meeting the timber needs of the Nation.

#### FUTURE MONITORING OF END-USE DEMAND

As we approach a new decade and a new century, it is important to reevaluate the quantity, quality, and means of acquiring end-use demand information. Information now available is aging rapidly. Some major end-use markets have not been examined for more than 10 years, and lesser markets have never been examined. The development of new types of wood products, the development of new manufacturing and construction technologies, increasing environmental consciousness, concerns over rare and endangered species, and increasingly open foreign markets are but a few of the factors that will affect both the demand for wood products and the supply of timber to produce these products. We cannot assume that information acquired 10 or more years ago, or even last year, is valid today. Just as the forest survey units of the Forest Service have a fixed schedule for resurveying the forest resources of individual states, so must the economics research units of the Forest Service develop similar schedules to reevaluate end-use markets. New, innovative procedures must be developed to provide timely, accurate information on the types and quantities of timber products and other forest products demanded by the world's population. The physical and economic well-being of the U.S. forests and of the world depend on our ability to

Table 1--U.S. Timber consumption by product and end use from 1962 to 1986

Timber product consumption ( $\times 10^3 \text{ m}^3$ )							
Year	Total <sup>a</sup>	New housing	Residential repair and remodeling	New non-residential construction <sup>b</sup>	Manufacturing	Shipping	All other <sup>c</sup>
LUMBER							
1962	92,224	33,418	10,219	9,912	10,714	10,738	17,223
1970	94,091	31,506	11,753	11,092	11,021	13,511	15,208
1976	105,381	40,120	14,774	10,549	11,481	13,959	14,497
1986	134,999	45,595	23,435	12,532	11,340	16,013	26,085
STRUCTURAL PANELS							
1962	8,415	3,496	1,478	1,460	646	186	1,150
1970	12,593	4,947	2,053	1,655	797	252	2,889
1976	15,897	6,868	2,867	1,690	1,000	230	3,242
1986	22,965	8,806	5,460	2,726	1,111	332	4,530
NONSTRUCTURAL PANELS							
1962	7,075	2,248	1,239	792	1,398	199	1,198
1970	11,680	3,257	1,469	1,049	2,770	279	2,857
1976	14,949	4,080	1,938	1,058	4,058	173	3,643
1986	16,142	4,168	2,797	1,336	6,859	217	765

<sup>a</sup>Data may not add to totals because of rounding.

<sup>b</sup>In addition to new construction, includes railroad ties laid as replacements in existing track and lumber and structural panels used by railroads for railcar repair.

<sup>c</sup>Includes upkeep and improvement of nonresidential buildings and structures; made-at-home projects, such as furniture, boats, and picnic tables; made-on-the-job items, such as advertising and display structures; and a wide variety of miscellaneous products and uses.

Table 2--U.S. timber consumption by product and by use of softwoods and hardwoods from 1962 to 1986

Year	Timber products consumption ( $\times 10^3 \text{ m}^3$ )											
	Lumber					Nonstructural panels						
	Softwoods		Hardwoods		Total	Structural panels		Nonstructural panels				
Total <sup>a</sup>	Softwoods	Hardwoods	Softwoods	Hardwoods	Total	Softwood plywood	Oriented strand-board and waferboard	Hardwood plywood	Insulating board	Particle-board		
1962	92,224	72,624	20,062	8,415	8,415	8,415	-- <sup>b</sup>	7,075	2,128	3,402	823	722
1970	94,091	75,423	18,668	12,593	12,593	12,593	-- <sup>b</sup>	11,680	3,349	3,830	1,391	3,110
1976	105,381	86,440	18,941	15,696	15,897	15,696	201	14,949	2,974	3,983	1,863	6,130
1986	134,999	111,142	23,857	22,965	19,174	19,174	3,791	16,142	2,345	3,376	1,728	8,692

<sup>a</sup>Data may not add to totals because of rounding.

<sup>b</sup>Less than  $500 \text{ m}^3$ .

recognize both the demands on and supplies of resources from our forests, which directly affect our ability to effectively manage them.

#### REFERENCES

Marcin, Thomas C.; McKeever, David B. 1983. 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. 124-128.

McKeever, David B.; Martens, David G. 1983. Wood used in U.S. manufacturing industries, 1977. FPL-RB-12. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 56 p.

McKeever, David B.; McCurdy, Dwight R.; Kung, Fan Hao; Ewers, James T. 1986. Wood use in pallets manufactured in the United States, 1982. Resource Bulletin FPL-RB-17. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 13 p.

McKeever, David B. 1988. Wood used in new residential construction in the United States: a Forest Service end-use survey. In: Abt, Robert C., ed. Forest resource economics: Past, present, and future: Proceedings of the 1988 Southern forest economists workshop; 1988 May 4-6; Orlando, FL. Gainesville, FL: University of Florida. 155-161.

Phelps, Robert B. 1970. Wood products used in single-family houses inspected by the Federal Housing Administration 1959, 1962, and 1968. Statistical Bulletin No. 452. Washington, DC: U.S. Department of Agriculture, Forest Service. 29 p.

Spelter, Henry; Anderson, Robert G. 1985. A profile of wood use in nonresidential building construction. FPL-RB-15. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. 22 p.

USDA FS. 1928. Lumber used in manufacture, 1928 (Summary tables). Preliminary statistics. Washington, DC: U.S. Department of Agriculture, Forest Service.

USDA FS. 1976. The National Forest Management Act of 1976. USDA Forest Service Current Information Report No. 16. Washington, DC: U.S. Department of Agriculture, Forest Service. 44 p.

USDA FS. 1958. Timber resources for America's future. USDA Forest Service Resource Report No. 14. Washington, DC: U.S. Department of Agriculture, Forest Service. 713 p.

USDA FS. 1981. An assessment of the forest and rangeland situation in the United States. USDA Forest Service Resource Report No. 22. Washington, DC: U.S. Department of Agriculture, Forest Service. 352 p.

USDA FS. 1988. An Analysis of the timber situation in the United States: 1989-2040. Parts I: The current resource and use situation, and II: The future resource situation. Draft. Washington, DC: U.S. Department of Agriculture, Forest Service.

USDA FS. 1989. Draft 1990 RPA program. Washington, DC: U.S. Department of Agriculture, Forest Service. 335 p.

USDC BC. 1988. Characteristics of new housing: 1987. Current Construction Repts. C25-87-13. Washington, DC: U.S. Department of Commerce, Bureau of the Census. 75 p.