PROJECTIONS OF SHIFTS IN US FOREST PRODUCTS PRODUCED, IMPORTED, AND EXPORTED AND SOURCES OF ROUNDWOOD AND OTHER FIBER USED TO MAKE THEM

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ABSTRACT. The RPA Timber Assessment projects, over the next 50 years, the likelihood of increasing relative use of imported forest products versus U.S. roundwood harvest to meet U.S. consumption needs, although our projected consumption needs are now estimated to be lower than we projected in 1993. The projected higher imports relative to U.S. roundwood harvest is due in part to slower projected increase in available hardwood inventory and harvest in the South. Softwood harvest is projected to increase notably with increasing area and management intensity for plantations in the South, and we project higher softwood harvest than we did in 1993. U.S. roundwood harvest to meet domestic and export demands is projected to increase from 18.0 to 22.4 billion cubic feet (24%) over the next 50 years (less than one-third the annual rate of the past 44 years). All the projected increase in roundwood harvest comes from nonsawtimber, most from nonindustrial land, and most from the South. To offset current net imports of forest products would require 14% more than current harvest be provided for domestic use by redirecting harvest used for exports or by increasing harvest. By 2050, this requirement increases to 36% of roundwood harvest.

KEY WORDS. Projections, United States, forest products, roundwood requirements, trade

INTRODUCTION

This paper provides selected findings from the base projection of the 2001 USDA Forest Service RPA Timber Assessment' on the shifts in forest products consumption and production and in roundwood needed for U.S. production, imports, and exports. The first section gives an overview of trends and projections of the mix of all forest products the U.S. consumes and exports and materials used to make them (outputs and inputs). The second section gives a more detailed view of trends in roundwood sources used for U.S. product consumption, production, and trade. The first section expresses quantities in million short tons of roundwood and products in order to compare solid wood and paper products. The second section expresses quantities in billions (10^9) of cubic feet of roundwood.

[9] Based on "An Analysis of the Timber situation in the United States: 1952-2050 — A technical document supporting the 2000 USDA Forest Service RPA Assessment" to be published by the Pacific Northwest Research Station, Richard Haynes, Technical Coordinator.

U.S. forest products outputs and inputs

Harvested roundwood is one of several raw materials required to meet U.S. forest product consumption, export, and wood energy demands. United States consumption and export demands are satisfied by a combination of

1. forest products produced in the United States for domestic use,
2. U.S. products produced for export,
3. wood used for energy, and
4. product imports.

Source materials needed to meet these consumption and export demands include

1. U.S. roundwood harvest,
2. log and chip imports,
3. product imports,
4. recovered paper, and
5. nonwood fillers in products.

The relationship between product outputs (demands) and wood inputs (material sources) can be seen in the following sums:

All outputs (demands)

= U.S. production for domestic use
+ product exports
+ log and chip exports
+ wood energy consumption
+ forest products imports

= U.S. roundwood harvest
+ log and chip imports
+ forest product imports
+ recovered paper use
+ nonwood fillers in products

= All inputs (material sources)

In 1998, the amount of all outputs (= inputs) was 349 million tons. This is projected to increase 36% to 476 million tons by 2050 (0.6% per year). This is much slower than the 1.7% per year increase rate between 1965 and 1998 (Figs. 1, 2). Of the 36% increase in inputs (or 127 million tons), 53% comes from increased U.S. roundwood harvest, 27% from increased imports, and 20% from increased recovered paper and fillers.

Over the course of the projection, significant changes are expected in the composition of the inputs (material sources) and outputs (demands):

- The mix of outputs will change — Import of products increases at a faster rate than production for domestic use, exports, and energy; and, for U.S. product production, paper production increases faster than lumber or composites production (Fig 1).
- The mix of inputs will change — Imports of products will increase faster than recovered paper use or roundwood harvest; virtually all increase in roundwood harvest is for nonsawtimber uses; roundwood harvest from nonindustrial private land increases faster than that from industrial or public land; and roundwood harvest increases faster in the South than in the North or West (Figs 2, 5, 6, 7).
- Improvement in U.S. productivity in making products from roundwood will be limited by limited increases in recycling rates and limited improvements in wood residue use for products.
- U.S. consumption of products per capita will remain about constant while U.S. roundwood harvest per capita decreases. Consumption per capita can remain constant while U.S. harvest per capita decreases primarily due to increased imports and, to a lesser degree, increased use of recovered paper (Fig 3).

OUTPUTS

Outputs include forest products produced in the United States (for domestic use and export), forest product imports, log and chip exports, and wood energy use (includes use of roundwood, mill residue, and pulp liquor). Between 1998 and 2050 it is projected that output needs will disproportionately be met by increased imports.

- Role of product imports is projected to increase from 14% to 17% share of outputs.
- Role of U.S. production for domestic use declines from 50% to 48%.
- Role of products provided for export decreases from 6% to 5%.
- Role of export of logs and chips declines from 4% to 2%.
- Role of wood energy remains about 28% (Fig. 1).

Consumption of wood, paper and paperboard products is projected to increase from 223 to 310 million tons (0.6% per year) between 1998 and 2050. (In comparison, the United States consumed 138 million tons of steel and 113 million tons of cement in 1998.)

- Projected increase in product consumption is less than half the annual rate from 1965 to 1998.
- Consumption per capita stays about the same, averaging 1,565 pounds per year between 1998 and 2050, up from 1,243 pounds per year in 1965 (Figs. 3).
- Product consumption came 78% from U.S. production in 1998; this share is projected to decline to 73% by 2050. The relative contribution of imports to consumption increases from 22% in 1998 to 27% in 2050 (Fig 1).

Total U.S. production (for domestic use and exports) is projected to increase 0.5% per year, from 174 million tons in 1998 to 227 million tons in 2050, while the increase rate was 1.5% per year over the prior 33 years.

- Product exports are projected to remain about 10% of production between 1998 and 2050 (Fig. 1).
- The fastest growing component of production over the next 50 years is projected to be paper and paperboard (up 41%), followed by composite products (38%), and lumber and miscellaneous products (up 18%). However, paper and paperboard production will be declining temporarily in the next several years (Fig. 4).
- The composition of production in 1998 was (1) paper and paperboard, 51 % (54% by 2050), (2) lumber and miscellaneous products, 33% (30% in 2050), and (3) composites, 16% (16% in 2050). In 1965, these shares were 40% for paper, 59% for lumber, and 11% for composites.
- For lumber and miscellaneous products, softwood lumber accounts for most of the lumber increase over the next 50 years, from 35 to 42 million tons, while hardwood increases from 23 to 24 million tons. Composites increase from 29 to 40 million tons, with OSB accounting for much of the increase, from 7 to 17 million tons.

Effect of increasing paper and paperboard and OSB share of output on inputs. The increasing share of paper and paperboard and OSB production will increase the share of all inputs that are small trees and recovered paper. The amount of wood mill residue available to make paper per ton of paper produced will decline with the decreasing share of lumber and increased efficiency of lumber production.

INPUTS

Inputs include U.S. roundwood harvest, log and chip imports, forest product imports, recovered paper use, and nonwood fillers in products. Between 1998 and 2050, the relative role of U.S. roundwood harvest is projected to decrease.

- Role or roundwood harvest decreases from 73% to 68% share of all inputs.
- Role of log, chip, and product imports increases from a 14% to an 18% share.
- Role of recovered paper continues to increase from a 10% to a 12% share.
- Role of roundwood has decreased notably since 1965 when it provided an 85% share of inputs (Fig. 2).

U.S. roundwood harvest is projected to increase from 256 to 323 million tons between 1998 and 2050 (0.4% per year).

- This increase rate is down from 1.2% per year over the prior 33 years.
- U.S. roundwood harvest for fuelwood increases in share from 14% in 1998 to 17% in 2050.

Import of logs and chips is projected to increase from 0.7 to 1.5 million tons between 1998 and 2050 (1.5% per year), up from a decrease of 2.7% per year over the prior 33 years. The share of roundwood from imports increases from 0.3% to 0.5 %.

U.S. roundwood use per capita (U.S. harvest + log and chip imports) decreases from 1,900 pounds in 1998 to 1,650 pounds in 2050 (64 cubic feet and 56 cubic feet, respectively), for a decrease of 0.3% per year, a reversal from a 0.2% per year increase between 1965 and 1998 (Fig. 3).

The U.S. roundwood harvest increase of 67 million tons between 1998 and 2050 will come from the following sources (Figs. 5, 6, 7):

- Mostly from the South (78%), compared with 18% and 4% from the North and West, respectively
- Mostly from non-industrial private lands (75%), compared with 19% and 6% from industry land and public land, respectively
- All from nonsawtimber (nonsawtimber increase is 104% of the total, and sawtimber is -4% of the increase)
- Mostly from softwoods (59%), compared with 41% for hardwoods

Industrial wood productivity. U.S. Production of wood, paper, and paperboard products per unit of roundwood input (industrial roundwood) increased 35% in the past 50 years, but the rate of increase is projected to slow to 3% over the next 50 years.

- Production per unit of roundwood input has increased from 19.4 pounds product per cubic foot wood input in 1950 to 26.2 pounds per cubic foot in 1998 and is projected to increase to 27.0 pounds per cubic foot in 2050.
- Productivity increased between 1950 and 1998 due to increased use of wood mill residue for products, increased use of recovered paper, and increased product output per unit of fiber input.
- The rate of increase is projected to slow over the next 50 years because (1) wood mill residues are now largely used for products rather than being burned or discarded, and a greater shift from fuel use to product use is not expected, and (2) there will be relatively little increase in the rate of utilization of recovered paper. A greater shift toward using residue for products rather than fuel would increase industrial product output per unit of industrial roundwood input.
- Future advances will rely on increases in recycling of paper and solid wood, use of alternative fibers, and increased product (or product performance, for example, in housing) per unit of fiber input.

U.S. product consumption per capita compared with U.S. roundwood harvest per capita. Per capita consumption is projected to remain about constant while U.S. roundwood harvest per capita declines. Per capita consumption is projected to remain about constant, averaging 1,565 pounds between 1998 and 2050, while roundwood harvest per capita decreases 12%, from 1,905 pounds to 1,675 pounds. Consumption per capita can remain constant with declining roundwood harvest per capita primarily due to increased product and log and chip imports, a limited increase of product exports, and limited improvements in U.S. product output per unit of roundwood input (Fig. 3).

TOTAL ROUNDWOOD USE FOR CONSUMPTION, PRODUCTION, AND TRADE

Figure 8 displays estimates of total volume of timber harvest used to produce all forest products *consumed* in the United States (hardwood/softwood detail is shown in Table 1). In this figure the quantity of each class of product is converted to the equivalent volume of roundwood, derived from current harvest, that would be required for its manufacture. The figure estimates "new" harvest from forests and from short rotation woody crops grown on agricultural lands and does not include recovered wood and fiber. It does include the products consumed regardless of source, however, so roundwood needed to make imports are part of the total. The roundwood used to make solidwood and paper imports is estimated using U.S. conversion efficiencies.

In recent years the United States has consumed close, to 20 billion cubic feet of newly harvested wood per year for products made in the United States for domestic use and for products made in other countries and imported by the United States. (In addition, we harvest about 2.3 billion cubic feet of roundwood in the U.S. for exports.) Products made from sawlogs (lumber in its many forms) have traditionally been the largest component of roundwood we consume. They are also projected to remain a major group in the future but with limited growth until after 2030. Nonsawtimber harvested for pulpwood or reconstituted panels is the second largest consumption category at present. In the projection, nonsawtimber for pulpwood and reconstituted panels continues to show strong growth, with the largest increases in softwood species. After 2030, short-rotation woody crops from agricultural lands are used to a small degree as an additional source of fiber for paper and paperboard. The only product class for which production volume contracts is veneer logs, due to the decline in use of softwood plywood. In sum, over the 50-year projection period, total timber harvest from all sources (domestic and other countries) for domestically consumed products rises to 27.5 billion cubic feet, 40% above current levels.

Figures 9 and 10 indicate the sources of harvested timber from domestic forests, forests in other countries, and non-forest short-rotation woody crops (details are shown in Table 2). Imports contribute to consumption but do not represent a draw on domestic forests. Exports are not part of domestic consumption but do require harvests from U.S. forests.

Over the next 50 years, our projections suggest it is likely the U.S. will increase relative use of imported forest products versus U.S. roundwood harvest to meet U.S. consumption needs, although our projected consumption needs for 2040 are now estimated to be lower than we projected in 1993 (25.8 versus 26.5 billion cubic feet). The projected higher imports relative to U.S. roundwood harvest is due in part to slower projected increase in available hardwood inventory and harvest in the South. Softwood harvest is projected to increase notably with increasing area and management intensity for plantations in the South and we project higher softwood harvest than we did in 1993 (16.8 versus 16.3 billion cubic feet) (Haynes et al. 1995).

Figure 9 indicates that total softwood roundwood harvest needed for U.S. consumption is higher than U.S. roundwood harvest. Current overall estimated softwood roundwood consumption of some 12.5 billion cubic feet per year (Table 2) requires 10.7 billion cubic feet of softwood harvest from domestic forests, more than 85% of softwood roundwood consumption. By 2050, reliance on imports will increase, and domestic forests will supply about 75% of softwood roundwood needed for consumption. Total U.S. harvest of softwood timber in 2050 is projected

at 13.1 billion cubic feet, an increase of 3.0 billion cubic feet from 1996.
To totally meet U.S. softwood roundwood needs for current consumption from U.S. harvest, we would have to obtain 1.9 billion cubic feet more from U.S. lands for U.S. domestic use by redirecting harvest from exports and/or increasing U.S. harvest (1 8 percent of current U.S. softwood harvest). This amount increases to 4.5 billion cubic feet by 2050 (33 percent of 2050 U.S. softwood harvest).

As shown in Figure 10, total hardwood roundwood harvest needed for U.S. consumption has been less than actual U.S. harvest due to high exports relative to imports. This is projected to change as U.S. hardwood roundwood needs for consumption increase and U.S. harvest does not keep pace. Current hardwood roundwood needed for U.S. consumption is 7.2 billion cubic feet, but we harvest 7.5 billion cubic feet. By 2050, we will need 9.3 billion cubic feet (from domestic and overseas sources) but will only harvest 8.8 billion cubic feet.

To totally meet U.S. roundwood needs for domestic consumption from U.S. harvest, in 2050 harvest would have to obtain 0.5 billion cubic feet more from U.S. forests for U.S. domestic use by redirecting harvest for exports and/or increasing harvest (6% of 2050 harvest). Regional harvests of roundwood for softwood and hardwood are summarized in table 2.

For more of our softwood and hardwood roundwood needs to be met from domestic harvest, prices for stumpage and resulting products would need to be higher. Prices increases would need to be substantially higher for softwood products and moderately higher for hardwood products to cover roundwood needs with domestic harvest and a redirecting of roundwood used to make exports (Table 2).

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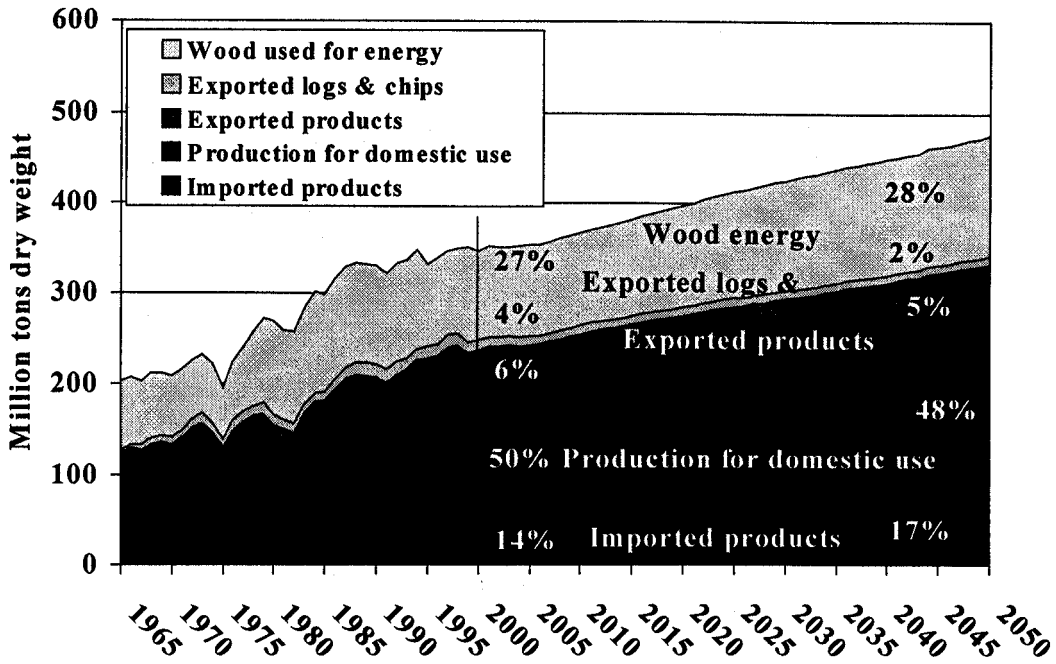

Figure 1–U.S. Production, export and import of wood and Forest products by category, 1965–1998, with projections to 2050 (million tons, dry weight)

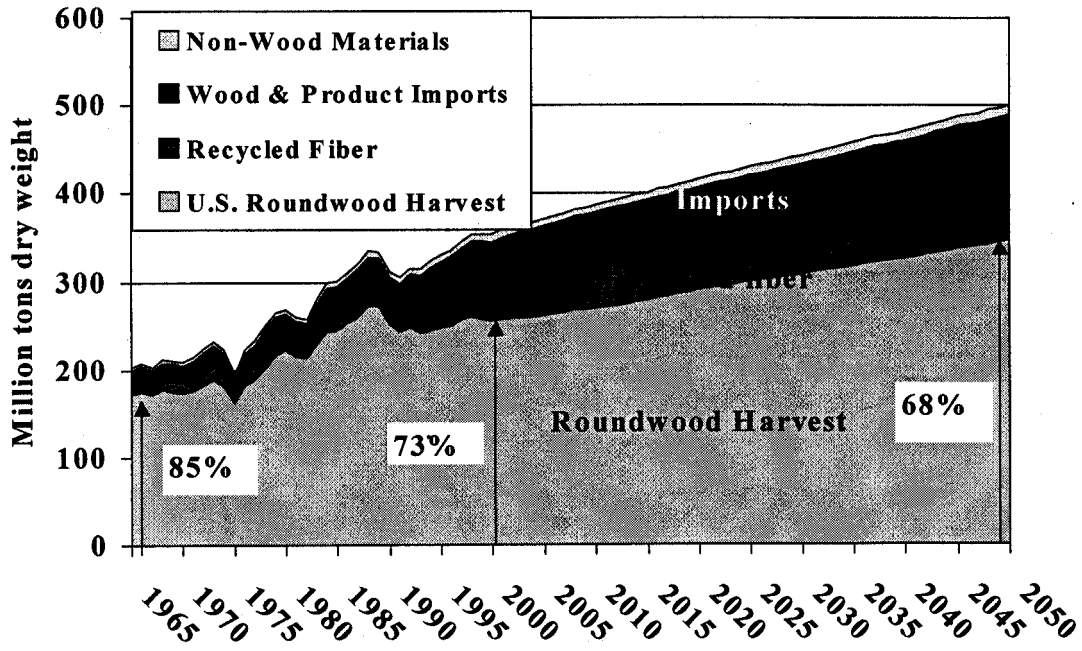

Figure 2—Materials sources of U.S. forest product consumption and exports, and percentage from roundwood, 1965–1998, with projections to 2050 (million tons, dry weight)

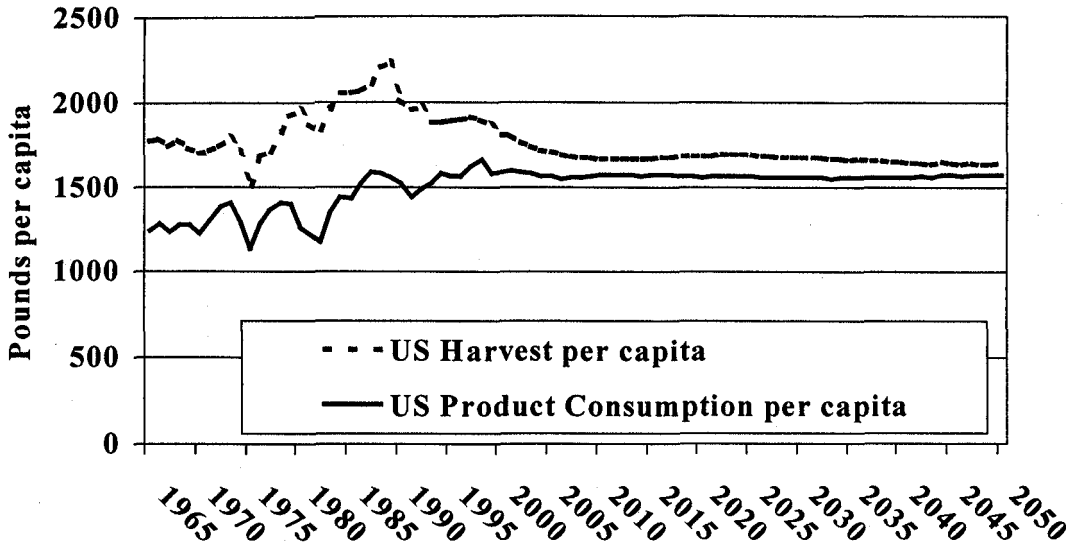

Figure 3–U.S. roundwood harvest and wood/paper product consumption per capita (pounds per capita)

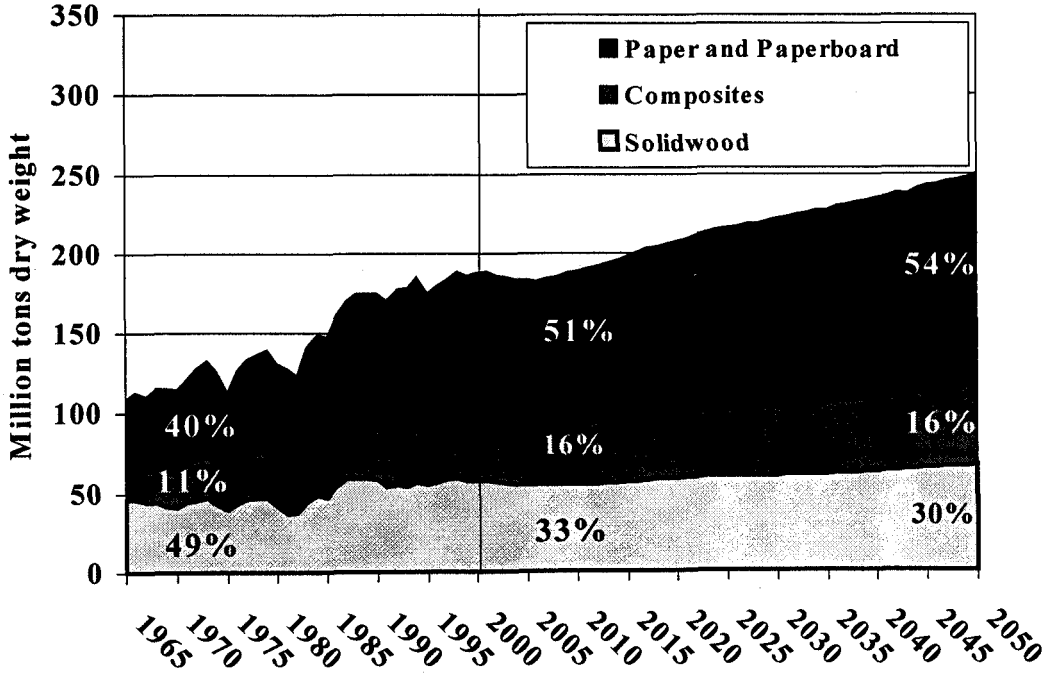

Figure 4–U.S. production of forest products by category, 1965–1998,with projections to 2050 (million tons, dry weight)

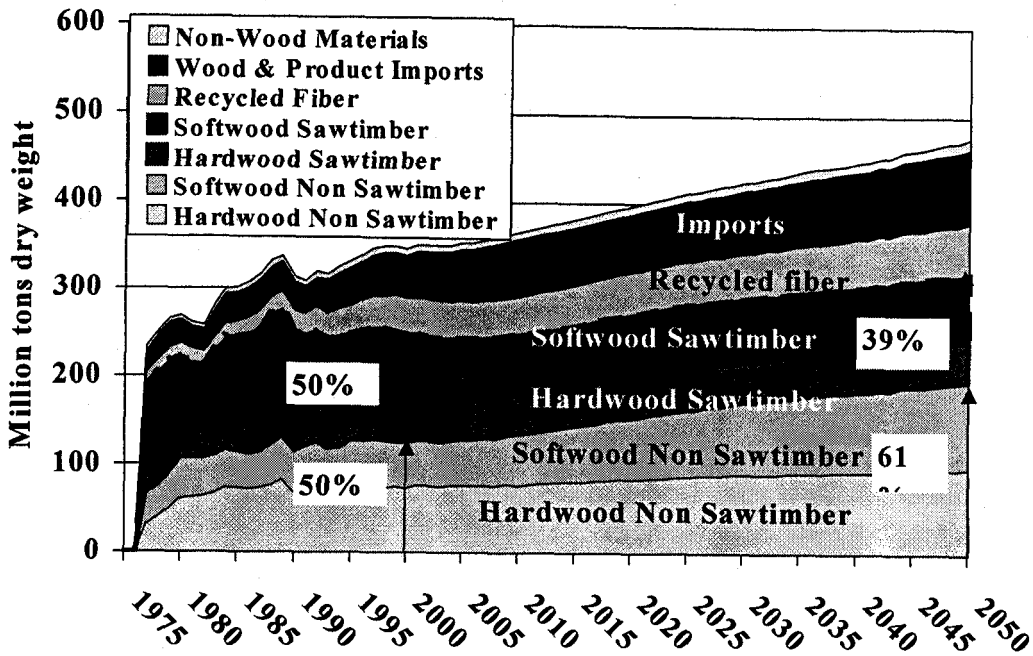

Figure 5–Material sources of U.S. forest product consumption and exports with roundwood divided by type, and percentage of roundwood by type, 1965–1998, with projections to 2050 (million tons, dry weight)

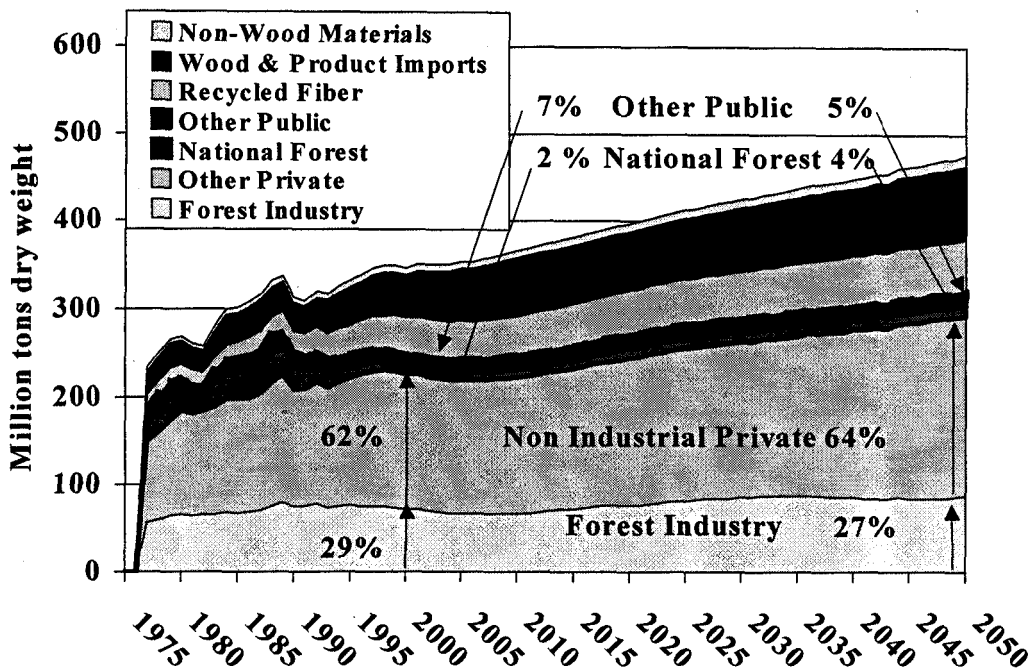

Figure 6–Material Sources of U.S. forest product consumption and exports with roundwood by owner, and percentage roundwood by owner, 1965–1998,with projections to 2050 (million tons, dry weight)

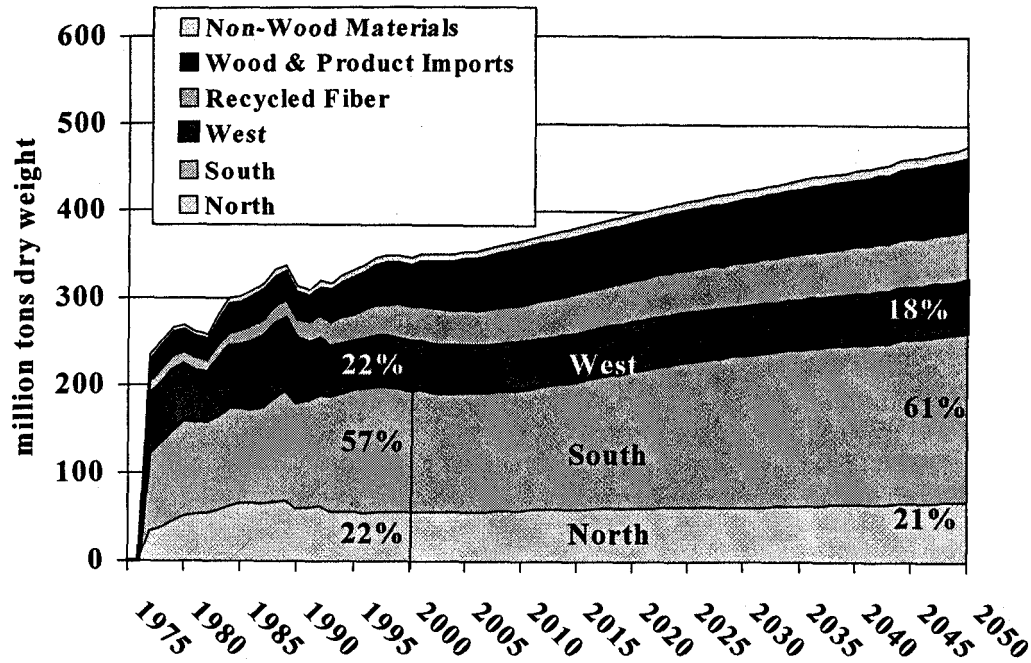

Figure 7–Material sources of U.S. forest product consumption and exports with roundwood by region, and percentage roundwood by region, 1965–1998,with projections to 2050 (million tons, dry weight)

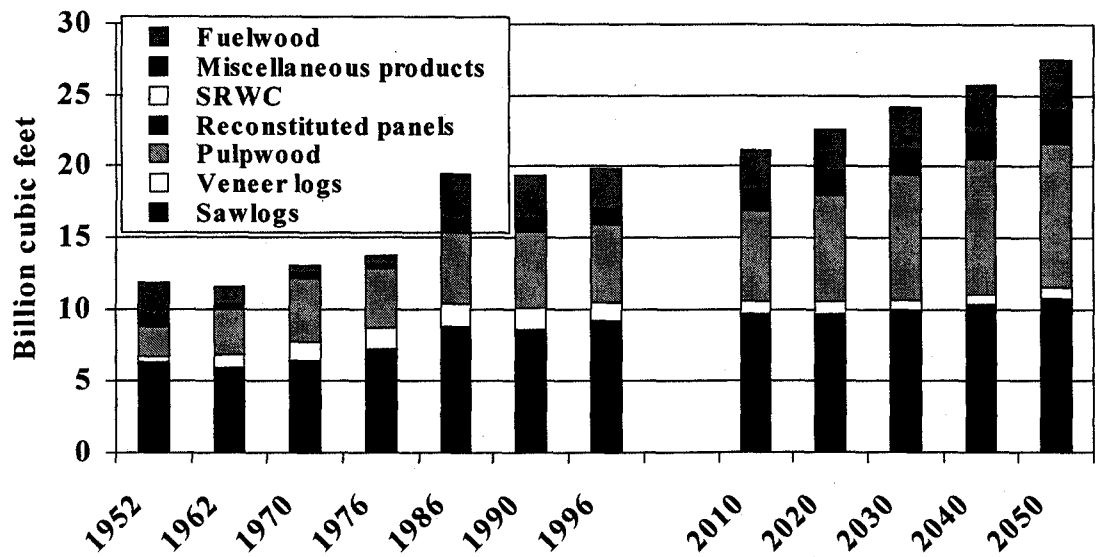

Figure 8–Timber harvest volumes required for U.S. production and net imports by category of product, with projections to 2050. SRWC is short-rotation wood crops for pulping (not visible) (billion cubic feet)

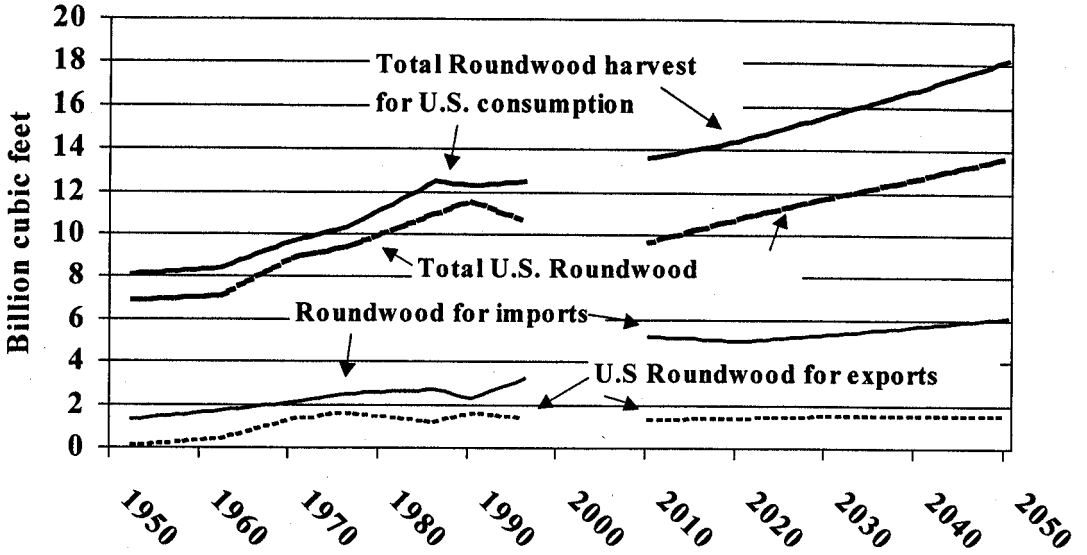

Figure 9–U.S. Softwood roundwood harvest for U.S. product consumption, for imports, and for exports, with projections to 2050 (billion cubic feet) (estimates of new harvest only, excludes recycled wood and fiber; roundwood harvest for imports based on roundwood use if products had been made in the U.S.)

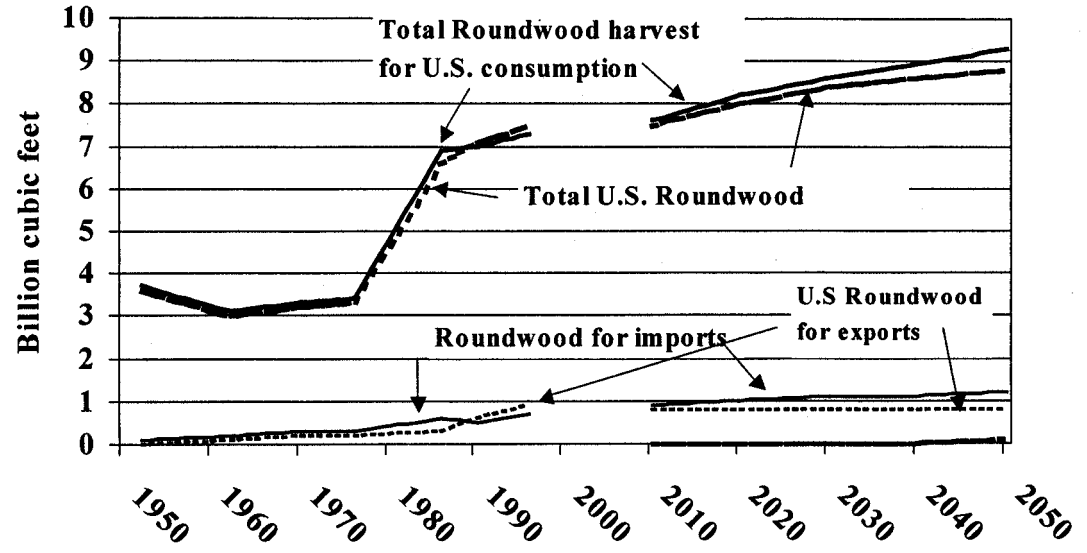

Figure 10–U.S. Hardwood roundwood harvest for U.S. product consumption, for imports, and for exports, with projections to 2050 (billion cubic feet) (estimates of new harvest only, excludes recycled wood and fiber; roundwood harvest for imports based on roundwood use if products had been made in the U.S.)

Table 1–Apparent roundwood consumption in the United States, by species group and product, specified years 1952-1996, with projections to 2050

Species group and product	Historical							Projections				
	1952	1962	1970	1976	1986	1991	1996	2010	2020	2030	2040	2050
	Billion cubic feet, roundwood equivalent											
Softwoods:												
Sawlogs[a]	5.0	4.8	5.0	5.6	7.0	6.0	7.0	7.7	7.6	7.8	8.1	8.6
Veneer logs	0.2	0.7	1.1	1.4	1.5	1.1	1.1	0.6	0.6	0.5	0.5	0.5
Pulpwood[b]	2.4	2.6	3.3	2.9	3.2	3.5	3.3	3.7	4.5	5.5	6.2	6.9
Reconstituted panels	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.6	0.7	0.8	0.9	1.1
SRWC[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Miscellaneous products[d]	0.3	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Fuelwood	0.5	0.2	0.1	0.1	0.5	0.5	0.4	0.6	0.7	0.7	0.8	0.8
Total	8.4	8.5	9.8	10.2	12.6	11.5	12.4	13.6	14.4	15.6	16.8	18.2
Hardwoods:												
Sawlogs[a]	1.1	1.0	1.5	1.4	1.8	1.8	2.1	2.0	2.1	2.2	2.2	2.3
Veneer logs	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.3	0.3	0.2	0.2	0.1
Pulpwood[b]	0.3	0.7	1.1	1.2	1.9	1.8	2.1	2.6	2.9	3.2	3.2	3.2
Reconstituted panels	0.0	0.0	0.0	0.0	0.2	0.3	0.4	0.4	0.5	0.5	0.6	0.7
SRWC[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Miscellaneous products[d]	0.4	0.2	0.2	0.1	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2
Fuelwood	1.5	0.9	0.4	0.5	2.6	2.5	2.3	2.1	2.2	2.3	2.5	2.6
Total	3.5	3.1	3.4	3.4	6.9	6.8	7.2	7.6	8.2	8.6	8.9	9.3
All species:												
Sawlogs[a]	6.1	5.8	6.5	7.0	8.8	7.8	9.1	9.8	9.8	10.0	10.4	10.8
Veneer logs	0.4	0.9	1.3	1.6	1.8	1.3	1.3	0.9	0.8	0.7	0.7	0.7
Pulpwood[b]	2.7	3.3	4.4	4.1	5.0	5.2	5.4	6.3	7.4	8.7	9.4	10.1
Reconstituted panels[c]	0.0	0.0	0.0	0.0	0.3	0.4	0.6	1.0	1.2	1.3	1.5	1.8
SRWC[d]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Miscellaneous products[e]	0.7	0.5	0.4	0.4	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5
Fuelwood	2.0	1.1	0.5	0.6	3.1	3.0	2.7	2.7	2.9	3.0	3.2	3.5
Total	11.9	11.6	13.2	13.6	19.6	18.3	19.7	21.2	22.6	24.3	25.8	27.5

[a] Includes log exports.
[b] Includes both pulpwood and the pulpwood equivalent of the net trade of chips, pulp, paper, and board.
[c] Includes roundwood used in waferboard, oriented strand board, and particleboard manufacture.
[d] SRWC = Short rotation woody crop.
[e] Includes cooperage logs, poles, piling, fence posts, round mine timbers, box bolts, shingle bolts, and other miscellaneous items.

Source: Historical data: Ulrich 1989, Howard 2001. Projections: US. Department of Agriculture, Forest Service.

Table 2–Apparent roundwood consumption, exports, imports, and roundwood harvests in the United States, by species group, specified years 1952–1996, with projections to 2050

Species group and product	Historical [a]							Projections				
	1952	1962	1970	1976	1986	1991	1996	2010	2020	2030	2040	2050
	Billion cubic feet											
Softwoods:												
Total consumption[b]	8.4	8.5	9.8	10.2	12.6	11.5	12.4	13.6	14.4	15.6	16.8	18.2
Exports[b]	0.2	0.4	0.9	1.0	1.2	1.7	1.4	1.3	1.4	1.5	1.5	1.5
Imports[b]	1.3	1.7	1.5	1.8	2.8	2.3	3.2	5.2	5.0	5.3	5.7	6.1
SRWC[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Roundwood harvest	7.3	7.2	9.2	9.5	11.1	10.9	10.5	9.7	10.8	11.8	12.7	13.7
Hardwoods:												
Total consumption[b]	3.5	3.1	3.4	3.4	6.9	6.8	7.2	7.6	8.2	8.6	8.9	9.3
Export[b]	0.0	0.1	0.1	0.1	0.3	0.7	0.9	0.8	0.8	0.8	0.8	0.8
Imports[b]	0.1	0.2	0.4	0.4	0.6	0.5	0.7	0.9	1.0	1.1	1.1	1.2
SRWC[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Roundwood harvest	3.5	3.0	3.2	3.2	6.6	7.0	7.5	7.5	8.0	8.4	8.6	8.8
All species:												
Total consumption[b]	11.9	11.6	13.2	13.6	19.6	18.3	19.7	21.2	22.6	24.3	25.8	27.5
Exports[b]	0.2	0.5	1.1	1.2	1.5	2.4	2.2	2.1	2.3	2.4	2.3	2.3
Imports[b]	1.4	1.9	1.9	2.1	3.4	2.8	3.9	6.1	6.0	6.4	6.8	7.2
SRWC[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Roundwood harvest	10.8	10.2	12.4	12.7	17.7	17.9	18.0	17.2	18.9	20.2	21.3	22.4

[a] Data are estimates of actual consumption and harvests consequently harvest data does not match similar data in Table 1.
[b] Total demand for products converted to a roundwood equivalent basis. Import roundwood equivalent computed as if imports had been made in the U.S.
[c] SRWC = Short rotation woody crop.
Note: Total Consumption = Roundwood harvest + SRWC + Imports - Exports

Source: Historical data: Ulrich 1989, Howard 2001; Projections: U.S. Department of Agriculture, Forest Service.

forestry at the great divide

PROCEEDINGS

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