WOOD RESIDUAL QUANTITIES IN THE UNITED STATES

Forest Products Laboratoy quantifies the amounts of recoverable wood available by source and type of material using various generation estimates.

David B. McKeever

WHILE much wood has been recovered from various sectors for many years, other sources, particularly the municipal solid waste stream, are just beginning to get tapped for recycling. A first step in moving wood in the waste stream to a viable resource is to quantify the amounts available. The three major sources of wood residuals in the United States are: 1) municipal solid waste; 2) construction and demolition debris; and 3) wood residues from primary timber processing. This report estimates, for 1996, total amounts of waste generated, amounts of wood residuals generated, and amounts of wood residuals potentially recoverable in 1996 from each sector.

Estimates are based on published waste generation volumes, rates and recoverability, measures of economic activity, and trends in virgin wood use in specific markets. They update similar estimates made for 1993 and 1994 (McKeever 1995, 1996). Estimates of residues left in the woods from logging or cutting operations, wood residuals from other lesser sources, and other nonwood agricultural residuals are not included here, nor are estimates of debris from catastrophic natural events.

THE MSW STREAM

Municipal solid waste (MSW), generated by residential, commercial, institutional, and industrial sources, includes durable and nondurable goods. containers and packaging, food scraps. yard trimmings and miscellaneous inorganic waste. An estimated 215.9 million tons of MSW were generated in the United States in 1996. Two categories of MSW — wood and yard trimmings — are sources for wood recovery. The total physical supply available for recovery from MSW is determined by quantifying the amounts and types of residuals generated, what is currently recovered for recycling, comporting or combustion, and what is discarded.

The wood category includes items such as wooden furniture and cabinets, pallets and containers, scrap lumber and panels from sources other than new construction or demolition activities, and wood residuals from manufacturing facilities. Not included are roundwood or unprocessed wood and repaired or recycled pallets. (An estimated 206 million pallets were recovered for recycling in 1995. Less than one percent of recovered pallet material was returned to the landfill as unusable, resulting in approximately 5.3 million tons of pallet material diverted from the MSW stream.)

In 1996, 15.4 million tons of wood residuals were generated in the United States as part of MSW (Table 1), or seven percent of all MSW generated. About 2.0 million tons were recovered for recycling or comporting the remainder were discarded. Of the discarded fraction, an estimated 3.2 million tons were sent to combustion facilities and 3.4 million tons were unacceptable for recovery because of excessive contamination, commingling with other waste, or other reasons. The remaining 6.8 million tons of wood residuals were recoverable.

Yard trimmings were the second largest single component of MSW in 1996 — 29.3 million tons or 14 percent of all MSW. Of this, 8.6 million tons were recovered for recycling or comporting. The remaining 20.7 million tons were discarded or burned. About 95 percent of all urban tree and landscape residues are woody residues (NEOS Corp. 1995). Therefore, 27.8 million tons of woody yard trimming residues were generated, with 12.8 million tons recovered or combusted: 5.0 million tons were unrecoverable. The remaining 10.0 million tons were considered available for additional recovery (56 percent of total amount discarded).

Overall, about 16.8 million tons of all solid wood waste in MSW were considered to be recoverable (Table 1). Although deemed potentially available, many factors affect their recoverability and usability, such as size and condition of the material, extent of commin-

Construction and demolition (C&D) debris, often considered a single form of waste, comes from distinctly different sources, has different characteristics, and differs in ease of separation, recovery and recyclability.

gling with other materials, contamination and physical location, and costs associated with acquiring, transporting, and processing the wood into useable raw materials. Overall economic conditions and changing recycling rates also affect supplies.

CONSTRUCTION AND DEMOLITION DEBRIS

Construction and demolition (C&D) debris, often considered a single form of waste, comes from distinctly different sources, has different characteristics, and differs in ease of separation, recovery and recyclability. Construction debris originates from the construction, repair, and remodeling of single and multifamily houses and nonresidential structures. Demolition debris originates when a building or other structure is demolished. Construction debris tends to be cleaner than demolition debris and consists of contemporary building materials. Demolition debris, on the other hand, is often contaminated with paints, fasteners, wall covering materials and insulation, and it typically contains a diverse mix of materials, some of which are no longer being used or are considered hazardous, making recovery more difficult. Construction debris can be separated readily on the job site, whereas on-site separation of demolition residuals is time consuming and costly. For these reasons, construction and demolition debris were evaluated separately in this study.

Little consistent information is available nationally on C&D generation and recovery. Data are limited to specific case studies and points in time, and exhibit a high degree of variability. Factors affecting generation rates include activity levels, types of structures being built or demolished, types of materials in these structures, age of structure being demolished, and extent to which materials are removed for reuse or recycling prior to demolition. Because of this variability, information that could be linked to national levels of construction activity and population was used to estimate C&D debris generation. The resulting estimates, although not precise, provide a good, overall indication of the C&D resource.

Construction Sources: Information on the types and amounts of construction debris generated is limited to anecdotal or case studies. Nearly all new single family and low-rise multifamily residential structures use traditional wood frame building technology. Information on this type of construction was used to develop estimates of wood residuals generated and recoverable from construction. Waste generation rates for the Portland, Oregon, metropolitan area were used to develop weighted average waste generation rates per unit of floor area built (McGregor et al. 1993). These rates were applied to total residential floor area built in the United States in 1996 to estimate residual generation and recovery in residential construction. Estimates were adjusted for residential repair and remodeling, and for nonresidential building construction and repair and remodeling.

In 1996, 1,157,000 new single family houses with an average 2,099 sq.ft. of floor area and 294,000 multifamily living units with an average 1065.7 sq.ft. of floor area were built nationally (U.S. Dept. of Commerce, Bureau of the Census 1997a). Applying average waste generation and recoverability rates resulted in an estimated 3.0 million tons of wood residuals generated and 2.6 million tons recoverable for new single family construction, and .22 million tons for new multifamily construction generation and recovery. Overall, an estimated 28.8 million tons of wood products were used in 1996 for new residential construction, based on 1988 to 1995 wood use trends (Adair 1996, Anderson and McKeever 1991, McKeever and Phelps 1994). Wood residuals were about 13 percent of all wood used to build residential structures, Conventional wisdom is that about five to 15 percent waste can be expected in new construction. These estimates confirm this expectation.

Table 1. Waste wood generated, recovered, combusted or not usable, and available for recovery in the United States, 1996

Source	*Generated (Millions of Tons)*	*Recovered, Combusted, Not Usable (Millions of Tons)*	*Available For Recovery (Millions of Tons)*	*Available For Recovery (%)*
Municipal Solid Waste				
Waste wood	15.4	8.6	6.8	18
Woody yard trimmings	27.8	17.8	10.0	27
Total	43.2	26.4	16.8	45
Construction and Demolition				
Construction	7.1	0.8	6.3	17
Demolition	26.1	18.3	7.8	21
Total	33.2	19.1	14.1	38
Primary Timber Processing				
Bark residues	30.3	27.2	1.6	4
Wood residues	86.7	77.4	5.0	13
Total	117.0	104.6	6.6	17
Total waste wood	193.5	150.1	37.4	100

Residential repair and remodeling and nonresidential building construction and repair and remodeling require large amounts of wood and generate large amounts of residuals. Information on waste generation and recovery for these types of construction are not available, but materials and construction techniques typically used are similar to those used for new residential construction. Based on waste generation and recovery rates for residential construction, an estimated 22.9 million tons of wood were used for residential repair and remodeling in 1996 (based on 1991 wood use and 1996 expenditures (McKeever and Anderson 1993; U.S. Dept. Of Commerce, Bureau of the Census 1997b)) and 8.7 million tons were used for nonresidential construction and repair and remodeling (based on 1986 wood use and 1996 expenditures (Phelps and McKeever 1990; U.S. Dept. Of Commerce, Bureau of the Census 1997a)). Residential repair and remodeling generated about 2.9 million tons of wood residuals, with 2.5 million tons potentially recoverable. Nonresidential construction and repair and remodeling generated 1.1 million tons of wood residuals, with 1.0 million tons potentially recoverable. Nonresidential wood residual generation and recovery includes only low-rise buildings. Wood is not the primary building material for most large nonresidential projects, therefore total wood residual generation and recovery should not be greatly affected by their exclusion.

Wood residual generation for all new construction was estimated to be 7.1 million tons in 1996, with 6.3 million tons available for recovery (Table 1). About 0.8 million tons of the generated wood residuals were being recovered already or were not usable.

Demolition Debris: Demolition debris is a heterogeneous mixture of building materials generated when a building or other structure is demolished. This stream typically contains aggregate, concrete, wood, paper, metal, insulation, glass and other building materials. Depending on the age and type of structure, asbestos, lead-based finishes, mercury, polychlorinated biphenyl compounds (PCBs) and other contaminants or hazardous materials may be present. Estimates of demolition debris have been made over the years for specific localities. They typically include new construction debris and are based on the size of the resident population. Generation rates reported for New York State in 1991 and demolition debris composition from a 1991 metropolitan Toronto study were used to estimate 1996 demolition debris generation (Solid Waste Assoc. of North America 1993). In 1996, 50.4 million tons of demolition debris were generated in the United States; about 52 percent was wood, resulting in an estimated 26.1 million tons of wood in demolition debris (Table 1).

Demolition debris recovery is difficult to determine. Characteristics of this debris make it more difficult to recover and recycle than construction debris. Existing demolition debris recycling operations are very sensitive to contamination; entire loads are typically rejected if contaminated. Only about 15 percent of the wood, by weight (38 percent by volume), received at a Massachusetts demolition debris recycling facility is usable, according to the operator. These figures are for a specific operation that produces a single product and are based on primary crushing of the incoming demolition debris to achieve uniform material size. Differences in treatment technology, products manufactured and source of demolition debris affect the utilization rate. Based on an assumed overall 30 percent utilization rate, approximately 7.8 million tons of wood demolition debris were recoverable in 1996 (Table 1).

Overall, about 33.2 million tons of C&D debris were generated in 1996 (Table 1). Of this, 14.1 million tons were potentially available for recovexy 19.1 million tons already were being recovered, combusted, or were not usable.

In 1996,15.4 million tons of wood residuals were generated in the United States as part of MSW. About 2.0 million tons were recovered for recycling or composting.

PRIMARY TIMBER PROCESSING MILL RESIDUES

Primary timber processing mills in the United States generate large amounts of residues in the form of bark, sawmill slabs and edgings, sawdust and peeler log cores. An estimated 30.3 million tons of bark and 86.7 million tons of wood residues were generated in 1996, based on mill residue production in 1991 and trends in industrial roundwood production (Howard 1997, Powell et al. 1993) (Table 1). Nearly all mill residues are used to produce other products, primarily paper, nonstructural panels and fuel. Just five percent of the bark (1.6 million tons) and six percent of the wood residue (5.0 million tons) were not used. This unused residue (6.6 million tons) is potentially recoverable.

OTHER SOURCES

There are many other sources of wood residuals, including chemically treated wood for railroad ties, telephone and utility poles and pier and dock timbers; and untreated wood from logging residues left in the woods, chipped brush and limbs from utility right-of-way maintenance, and industrial wood residuals outside the MSW stream. Some of these materials are being reused, burned or disposed of in hazardous waste landfills, but much are being left on site. Chemical treatments and the cost of collection make much of this material difficult to recover. The amounts of wood available from these other sources (with the exception of logging residues) are fairly small compared to MSW, C&D debris, and mill residues. For example, in 1993 approximately 0.9 million tons of railroad ties were replaced, according to the Association of American Railroads. If half of this wood were sound, then less than 0.6 million tons would be recoverable. This is about ten percent of the recoverable wood residue from primary timber processing mills, the smallest of the three major wood residual sources. Although wood

About 33.2 million tons of C&D debris were generated in 1996 (Table 1). Of this, 19.1 million tons already were being recovered, combusted, or were not usable.

from other sources eventuality may become a valuable resource, it is not included here because of the smaller volumes or obstacles to recovery.

CONCLUSION

An estimated 193.5 million tons of wood residuals were generated in the United States in 1996 from the MSW stream, C&D activity, and primary timber processing mills. Much of this was used to produce new products or fuel, or it was not suitable for recovery. Of the total amount generated, 37.4 million tons (about 20 percent) were suitable for additional recovery. In comparison, an estimated 325.2 million tons of roundwood timber were harvested in the United States in 1996. Recoverable wood residuals were therefore about 12 percent of roundwood timber harvest. Overall, about 45 percent of the recoverable wood was from MSW, 38 percent from C&D debris, and 17 percent from primary timber processing mill residues.

Technical and economic obstacles need to be overcome before much of the recoverable wood residuals can be recycled. Advances in utilization are being made constantly. For example, a manufacturer in New York City is using old pallets and other urban wood residuals to produce high quality funiture and other consumer goods. In the forest products industry, furnish consisting of up to half recycled construction debris, pallets, crating, and other wood residuals is being used to produce particleboard and hardboard at West Coast plants. Several medium-density fiberboard plants are planned that would use urban and industrial wood residuals exclusively. Demolition wood debris is being used to produce a hydromulch product in Massachusetts. Wood from the MSW stream is a valuable resource and will play an increasing role in satisfying consumer demand for wood-based products. ■

David B. McKeever, Research Forester, is with the USDA Forest Service Forest Products Laboratory in Madison, Wisconsin. The Forest Products Laboratory is maintained in cooperation with the University of Wisconsin. *This article was written and prepared by U.S. government employees on official time, and it is therefore in the public domain and not subject to copyright.*

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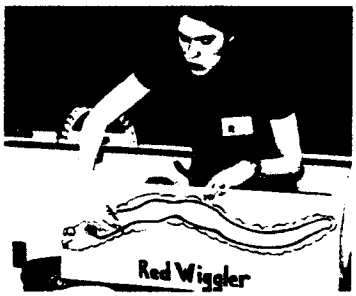
RESIDENTIAL OUTREACH



BACKYARD INITIATIVE

51 DIVERSION THROUGH COMPOST BIN DISTRIBUTION
John Foseid
Government officials in Portland, Oregon metropolitan region fine-tune outreach approach and evaluate results of residential compost bin promotion.

VERMICULTURE PROMOTION

53 HOME COMPOSTING IN BRITISH COLUMBIA
Julie Gordon
Survey provides data on usefulness of residential program in Greater Vancouver Regional District.

PRIVATIZING OPERATIONS

30 PAPER FIBERS COMPLETE YARD TRIMMINGS COMPOST RECIPE
Molly Farrell
Adding residuals from five paper mills increases efficiency at Springfield, Massachusetts yard trimmings composting site.

TWO STREAM SORT

33 ONTARIO'S WET/DRY EXPERIENCE
Glenda Gies
The wet/dry facilities in Ontario demonstrate the real and potential cost savings of cocollection, as well as the kinks of launching a new approach to solid waste management.

WOODY MATERIALS PROCESSING

37 GRINDING AFTER THE STORM
Richard A. Yach
The City of Council Bluffs, Iowa comes up with a win-win solution, rapidly processing storm debris into 24,000 tons of mulch for cattle farmers.

STRIVING FOR CONSISTENCY

39 STANDARDIZING RECYCLING MEASUREMENTS
Hope Pillsbury
Several years of study, experimentation and field testing by the U.S. EPA have resulted in a standardized methodology for measuring recycling rates.

MICROBIAL PROFILES

42 FINE-TUNING THE SOIL FOOD WEB
Karin Grobe
Characterizing soil samples for populations of fungi and bacteria helps growers evaluate soils for various crops — and identify needed microorganisms.

BOTTOMLINE STATISTICS

47 300,000,000 TONS OF MANURE
Jim Glenn
Old MacDonald may still have his farm, but now it's far more than a chick, chick here and a chick, chick there ...

RUBBER REUSE

54 RECYCLED FLOORING BOUNCES TOWARD A MARKET
Adrienne P. Touart
After 10 years of product research and development, an environmentally friendly, cushioned flooring for athletic courts is starting to turn heads in the NBA.

VERMICOMPOSTING DEVELOPMENTS

56 WORM FARM TAKES ON NEW CHALLENGES
Jim Jensen
Enclosed facility in Washington State is seed source for farm-scale and commercial vermicomposting projects.