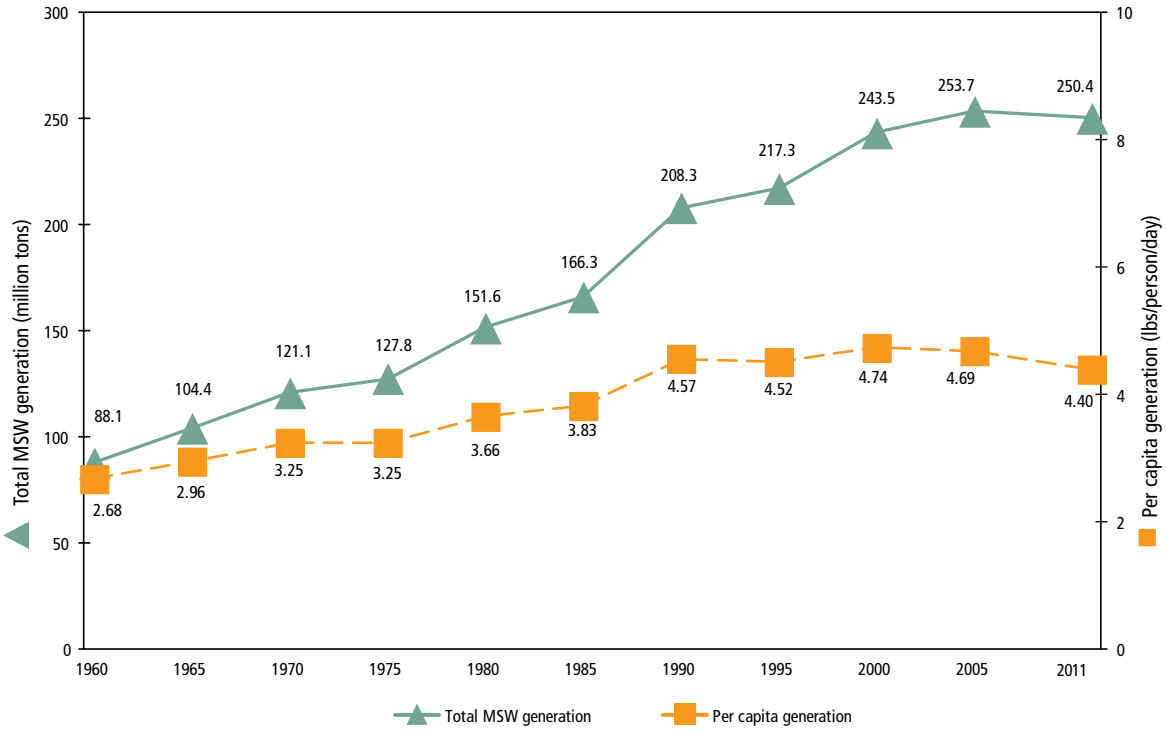
United States Environmental Protection Agency

Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2011

The U.S. Environmental Protection Agency (EPA) has collected and reported data on the generation and disposal of waste in the United States for more than 30 years. We use this information to measure the success of waste reduction and recycling programs across the country. These facts and figures are current through calendar year 2011.

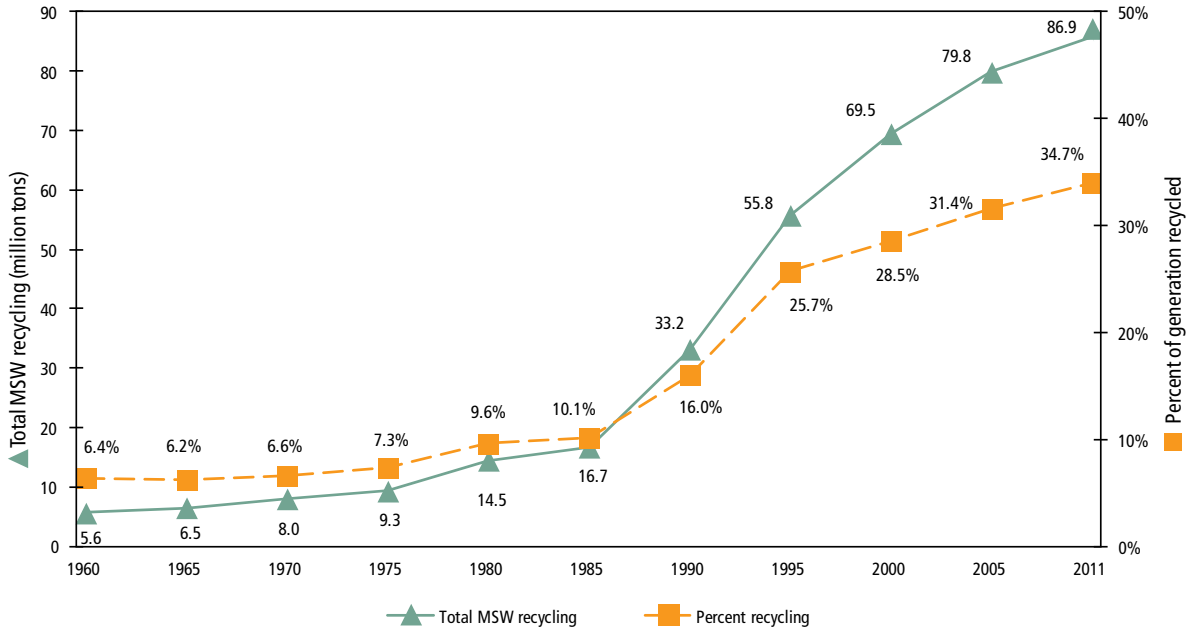
In 2011, Americans generated about 250 million tons[1] of trash and recycled and composted almost 87 million tons of this material, equivalent to a 34.7 percent recycling rate (See Figure 1 and Figure 2). On average, we recycled and composted 1.53 pounds out of our individual waste generation of 4.40 pounds per person per day.

Figure 1. MSW Generation Rates, 1960 to 2011



[1] U.S. short tons unless specified.

Figure 2. MSW Recycling Rates, 1960 to 2011



Trends in Municipal Solid Waste in 2011

Our trash, or municipal solid waste (MSW), is made up of the things we commonly use and then throw away. These materials include items such as packaging, food waste, grass clippings, sofas, computers, tires, and refrigerators. MSW does not include industrial, hazardous, or construction waste.

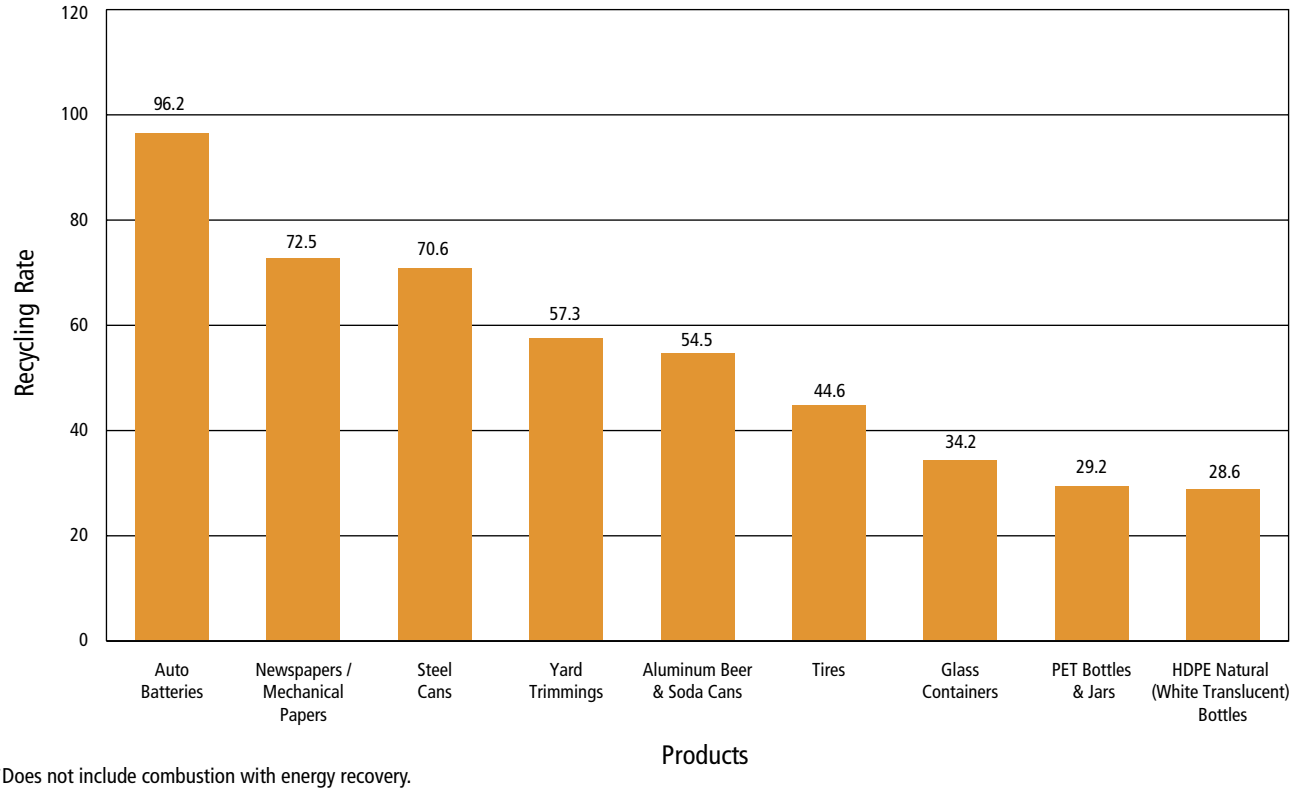
In 2011, Americans recovered over 66 million tons of MSW (excluding composting) through recycling. Composting recovered over 20 million tons of waste. We combusted about 29 million tons for energy recovery (about 12 percent). Subtracting out what we recycled and composted, we combusted (with energy recovery) or discarded 2.9 pounds per person per day.

In 2011, newspaper/mechanical papers recovery was about 73 percent (6.6 million tons), and over 57 percent of yard trimmings were recovered (see Figure 3). Metals were recycled at a rate of about 34 percent (see Table 1). By recycling, instead of landfilling and combustion, about 7.5 million tons of metals (which includes aluminum, steel, and mixed metals), we eliminated greenhouse gas (GHG) emissions totaling more than 20 million metric tons of carbon dioxide equivalent ($MMTCO_2E$). This is equivalent to removing more than 4 million cars from the road for one year.[2] About 134 million tons of MSW (53.6 percent) were discarded in landfills in 2011 (see Figure 4).

Over the last few decades, the generation, recycling, composting, and disposal of MSW have changed substantially. Solid waste generation per person per day peaked in 2000 while the 4.40 pounds per person per day is the lowest since the 1980's. The recycling rate has increased–from less than 10 percent of MSW generated in 1980 to over 34 percent in 2011. Disposal of waste to a landfill has decreased from 89 percent of the amount generated in 1980 to under 54 percent of MSW in 2011.

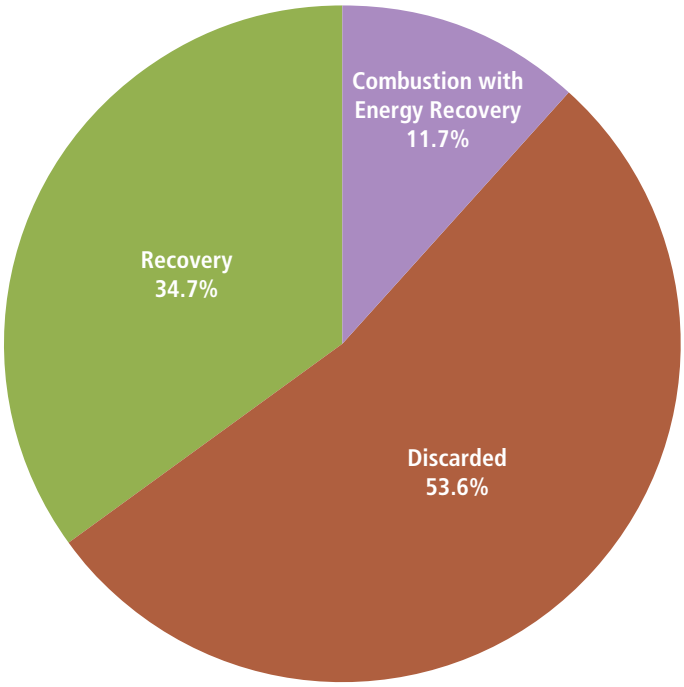
[2] All benefit calculations in this fact sheet are derived from EPA's Waste Reduction Model (WARM). Please see www.epa.gov/warm

Figure 3. Recycling Rates of Selected Products, 2011**



**Does not include combustion with energy recovery.

Figure 4. Management of MSW in the United States, 2011



Sources of MSW

Sources of MSW include residential waste (including waste from apartment houses) and waste from commercial and institutional locations, such as businesses, schools, and hospitals.

Analyzing MSW

We analyze waste by material, such as paper and paperboard, yard trimmings, food waste, and plastics, and by major product categories, which include durable goods (such as furniture), nondurable goods (such as paper or clothing), containers and packaging (such as milk cartons and plastic wrap), and other materials (such as food waste).

Nationally, we recycled and composted almost 87 million tons of municipal solid waste. This provides an annual benefit of more than 183 million metric tons of carbon dioxide equivalent emissions reduced, comparable to the annual GHG emissions from over 34 million passenger vehicles.

Materials in MSW

Total MSW generation in 2011 was 250 million tons. Organic materials continue to be the largest component of MSW. Paper and paperboard account for 28 percent and yard trimmings and food waste accounts for another 28 percent. Plastics comprise about 13 percent; metals make up 9 percent; and rubber, leather, and textiles account for 8 percent. Wood follows at around 6 percent and glass at 5 percent. Other miscellaneous wastes make up approximately 3 percent of the MSW generated in 2011 (see Figure 5).

Total MSW recovery in 2011 was almost 87 million tons. Similar to generation, organic materials are the largest component of MSW recovery. Paper and paperboard account for 53 percent and yard trimmings account for about 22 percent and food waste accounts for another 2 percent. Metals comprise about 9 percent; glass about 4 percent; and plastic and wood about 3 percent each. Other miscellaneous materials make up about 5 percent of MSW recovery in 2011 (see Figure 6).

After MSW recovery through recycling and composting, 164 million tons of MSW were discarded in 2011. Food waste is the largest component of discards at 21 percent. Plastics comprise 18 percent; paper and paperboard make up 15 percent; and rubber, leather, and textiles account for 11 percent of MSW discards. The other materials account for less than 10 percent each (see Figure 7).

Significant amounts of material from each category were recycled or composted in 2011. The highest recovery rates were achieved in paper and paperboard, yard trimmings, and metals. We recycled more than 65 percent of the paper and paperboard we generated. Over 19 million tons of yard trimmings were composted, representing almost a five-fold increase since 1990. Recycling these three materials alone kept 29 percent of MSW generated out of landfills and combustion facilities. Recycling amounts and rates (recovery as a percent of generation) for all materials in 2011 are listed in Table 1. This table also presents millions of tons of discarded materials.

Recycling and composting almost 87 million tons of MSW saved more than 1.1 quadrillion Btu of energy; that's the same amount of energy consumed by over 10 million U.S. households in a year.

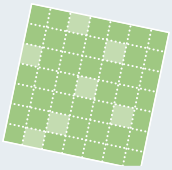


Figure 5. Total MSW Generation (by material), 2011
250 Million Tons (before recycling)

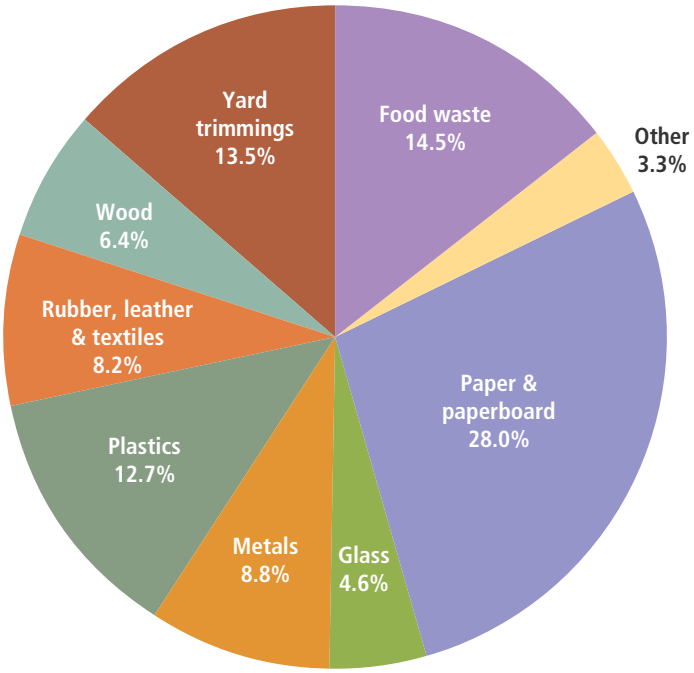


Figure 6. Total MSW Recovery (by material), 2011
87 Million Tons

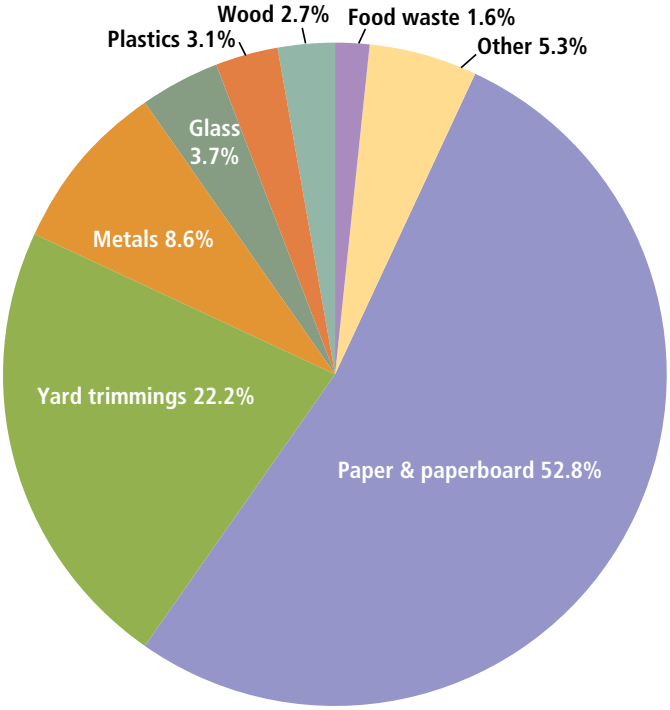


Figure 7. Total MSW Discards (by material), 2011
164 Million Tons (after recycling and composting)

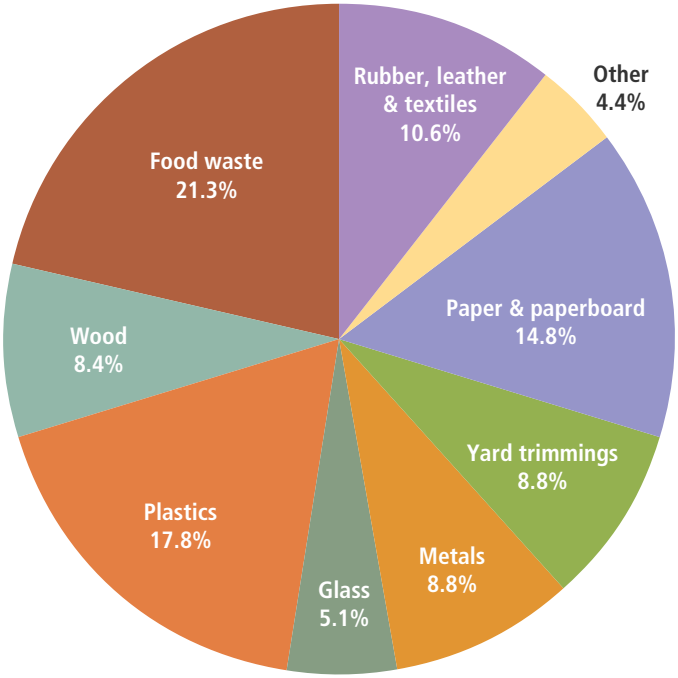
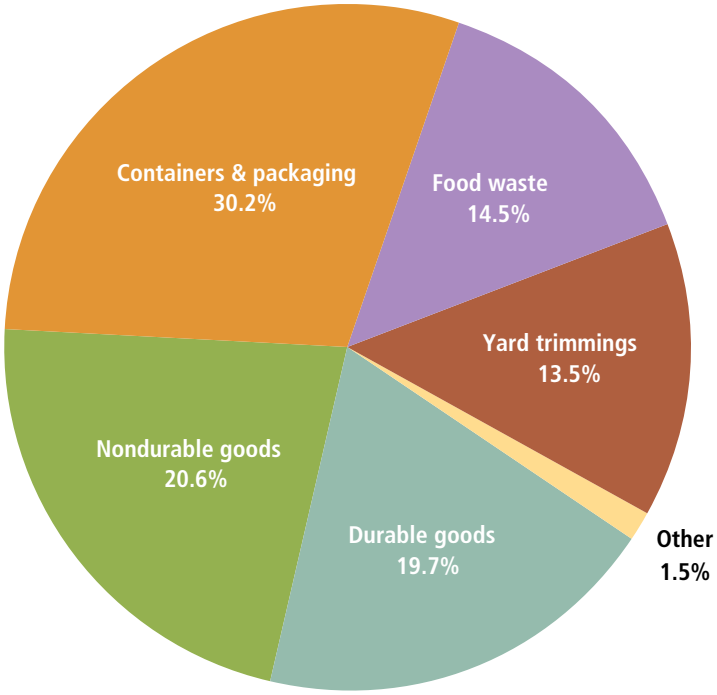


Figure 8. Total MSW Generation (by category), 2011
250 Million Tons (before recycling)



Products in MSW

The breakdown, by weight, of waste generated in 2011 by product category is shown in Figure 8. Containers and packaging made up the largest portion of MSW generated: about 30 percent, or almost 76 million tons. The second largest portion came from nondurable goods, which amounted to 21 percent, or about 52 million tons. Durable goods make up the third largest segment, accounting for about 20 percent, or 49 million tons.

The generation, recovery, and discards of materials in the product categories, by weight and recovery as a percent of generation, are shown in Table 2. This table shows that the recovery of containers and packaging was the highest of the four product categories, with over 50 percent of the generated materials recycled. Paper products, steel, and aluminum were the most recycled materials by percentage in this category. Over 75 percent of paper and paperboard containers and packaging was recycled. Seventy-two percent of steel packaging (mostly cans) was recycled. The recycling rate for aluminum packaging were about 39 percent, including almost 55 percent of aluminum beverage cans.

Over 34 percent of glass containers were recycled while about 24 percent of wood packaging, mostly wood pallets, was recovered. About 13 percent of plastic containers and packaging were recycled, mostly from soft drink, milk, and water bottles. Plastic bottles were the most recycled plastic products. Polyethylene terephthalate (PET) bottles and jars were recovered at about 29 percent. Recovery of high density polyethylene (HDPE) natural (white translucent) bottles was also estimated at about 29 percent (see 2011 MSW full report).

Overall recovery of nondurable goods was over 36 percent in 2011. Nondurable goods generally last less than three years. Newspapers/mechanical papers and other paper products were the most recycled nondurable goods. Newspapers/mechanical papers include newspapers, directories, inserts, and some advertisement and direct mail printing. About 73 percent of newspapers/mechanical papers were recovered. Collectively, the recovery of other paper products such as office paper and magazines was over 46 percent in 2011. Clothing, footwear, and other textile products are included in the nondurable goods category. These products were recovered for recycling at a rate of over 16 percent.

Overall, more than 18 percent of durable goods was recovered in 2011. Nonferrous metals other than aluminum had one of the highest recovery rates due to the high rate of lead recovery from lead-acid batteries. With a 96 percent recycling rate, lead-acid batteries continue to be one of the most recovered products. Recovery of steel in all durable goods was 27 percent, with high rates of recovery from appliances and other miscellaneous items.

Measured by percentage of generation, products with the highest recovery rates in 2011 were lead-acid batteries (96 percent), corrugated boxes (91 percent), newspapers/mechanical papers (73 percent), steel cans (71 percent), major appliances (64 percent), yard trimmings (57 percent), aluminum cans (55 percent), and mixed paper (47 percent) (see 2011 MSW full report).

Recycling Trends

In percentage of total MSW generation, recovery for recycling (including composting) did not exceed 15 percent until 1990. Growth in the recovery rate to current levels (34.7 percent) reflects an increase in infrastructure and market demand for recovery over the last decade.

Table 1. Generation, Recovery, and Discards of Materials in MSW, 2011*
(in millions of tons and percent of generation of each material)

Material	Weight Generated	Weight Recovered	Recovery as Percent of Generation	Weight Discarded
Paper and paperboard	70.02	45.90	65.6%	24.12
Glass	11.47	3.17	27.6%	8.30
Metals				
Steel	16.52	5.45	33.0%	11.07
Aluminum	3.47	0.72	20.7%	2.75
Other nonferrous metals†	1.96	1.34	68.4%	0.62
Total metals	**21.95**	**7.51**	**34.2%**	**14.44**
Plastics	31.84	2.65	8.3%	29.19
Rubber and leather	7.49	1.31	17.5%	6.18
Textiles	13.09	2.00	15.3%	11.09
Wood	16.08	2.38	14.8%	13.70
Other materials	4.59	1.28	27.9%	3.31
Total materials in products	**176.53**	**66.20**	**37.5%**	**110.33**
Other wastes				
Food, other‡	36.31	1.40	3.9%	34.91
Yard trimmings	33.71	19.30	57.3%	14.41
Miscellaneous inorganic wastes	3.87	Negligible	Negligible	3.87
Total other wastes	**73.89**	**20.70**	**28.0%**	**53.19**
Total municipal solid waste	**250.42**	**86.90**	**34.7%**	**163.52**

* Includes waste from residential, commercial, and institutional sources.
† Includes lead from lead-acid batteries.
‡ Includes recovery of other MSW organics for composting.
Details might not add to totals due to rounding.
Negligible = Less than 5,000 tons or 0.05 percent.

Disposing of MSW

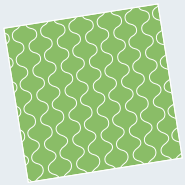
While the number of U.S. landfills has steadily declined over the years, the average landfill size has increased. At the national level, landfill capacity appears to be sufficient for our current disposal practices, although it is limited in some areas.

- Since 1990, the total amount of MSW going to landfills dropped by over 11 million tons, from 145.3 million to 134.2 million tons in 2011 (see Table 3).
- The net per capita discard rate (after recycling, composting, and combustion for energy recovery) was 2.36 pounds per day, lower than 3.19 per capita rate in 1990 (see Table 4).

The Benefits of Recycling

Recycling has environmental benefits at every stage in the life cycle of a consumer product—from the raw material with which it's made to its final method of disposal. By utilizing used, unwanted, or obsolete materials as industrial feedstocks or for new materials or products, we can each do our part to make recycling work. Aside from reducing GHG emissions, which contribute to global warming, recycling also provides significant economic and job creation impacts.

Every ton of mixed paper recycled can save the energy equivalent of 165 gallons of gasoline.



Recycling and Composting Collection Programs[3]

- Over 9,800 curbside recycling programs exist nationwide, up from 8,875 in 2002.
- About 3,090 community composting programs were documented in 2011, a decrease from 3,227 in 2002.

The energy and GHG benefits of recycling and composting shown in Table 5 are calculated using EPA's WARM methodology (see: www.epa.gov/warm). WARM calculates and totals GHG emissions of baseline and alternative waste management practices including source reduction, recycling, composting, combustion, and landfilling. Paper and paperboard recovery at about 46 million tons resulted in a reduction of 134.5 $MMTCO_2E$ in 2011. This is equivalent to removing 28 million cars from the road in one year.

In 2011, nationally, we recycled and composted almost 87 million tons of MSW. This provides an annual benefit of more than 183 million metric tons of carbon dioxide equivalent emissions reduced, comparable to removing the emissions from over 34 million passenger vehicles.

[3] Source: For 2002 data: BioCycle 2006.
For 2011 data: EPA, Municipal Solid Waste in the United States: 2011 Facts and Figures.

Table 2. Generation, Recovery, and Discards of Products in MSW, 2011*
(in millions of tons and percent of generation of each product)

Products	Weight Generated	Weight Recovered	Recovery as Percent of Generation	Weight Discarded
Durable goods				
Steel	14.34	3.88	27.1%	10.46
Aluminum	1.43	Negligible	Negligible	1.43
Other non-ferrous metals†	1.96	1.34	68.4%	0.62
Glass	2.19	Negligible	Negligible	2.19
Plastics	11.42	0.74	6.5%	10.68
Rubber and leather	6.44	1.31	20.3%	5.13
Wood	6.03	Negligible	Negligible	6.03
Textiles	3.84	0.52	13.5%	3.32
Other materials	1.69	1.28	75.7%	0.41
Total durable goods	**49.34**	**9.07**	**18.4%**	**40.27**
Nondurable goods				
Paper and paperboard	31.99	17.24	53.9%	14.75
Plastics	6.52	0.11	1.7%	6.41
Rubber and leather	1.05	Negligible	Negligible	1.05
Textiles	8.95	1.48	16.5%	7.47
Other materials	3.10	Negligible	Negligible	3.10
Total nondurable goods	**51.61**	**18.83**	**36.5%**	**32.78**
Containers and packaging				
Steel	2.18	1.57	72.0%	0.61
Aluminum	1.85	0.72	38.9%	1.13
Glass	9.28	3.17	34.2%	6.11
Paper and paperboard	38.02	28.66	75.4%	9.36
Plastics	13.90	1.80	12.9%	12.10
Wood	10.00	2.38	23.8%	7.62
Other materials	0.35	Negligible	Negligible	0.35
Total containers and packaging	**75.58**	**38.30**	**50.7%**	**37.28**
Other wastes				
Food, other‡	36.31	1.40	3.9%	34.91
Yard trimmings	33.71	19.30	57.3%	14.41
Miscellaneous inorganic wastes	3.87	Negligible	Negligible	3.87
Total other wastes	73.89	20.70	28.0%	53.19
Total municipal solid waste	**250.42**	**86.90**	**34.7%**	**163.52**

* Includes waste from residential, commercial, and institutional sources.
† Includes lead from lead-acid batteries.
‡ Includes recovery of other MSW organics for composting.
Details might not add to totals due to rounding.
Negligible = less than 5,000 tons or 0.05 percent.

Table 3. Generation, Materials Recovery, Composting, Combustion With Energy Recovery, and Discards of MSW, 1960 to 2011 (in millions of tons)

Activity	1960	1970	1980	1990	2000	2005	2007	2009	2010	2011
Generation	88.1	121.1	151.6	208.3	243.5	253.7	256.5	244.3	250.5	250.4
Recovery for recycling	5.6	8.0	14.5	29.0	53.0	59.2	63.1	61.6	65.0	66.2
Recovery for composting*	Negligible	Negligible	Negligible	4.2	16.5	20.6	21.7	20.8	20.2	20.7
Total materials recovery	5.6	8.0	14.5	33.2	69.5	79.8	84.8	82.4	85.2	86.9
Discards after recovery	82.5	113.1	137.1	175.1	174.0	173.9	171.7	161.9	165.3	163.5
Combustion with energy recovery†	0.0	0.4	2.7	29.7	33.7	31.6	32.0	29.0	29.3	29.3
Discards to landfill, other disposal‡	82.5	112.7	134.4	145.3	140.3	142.3	139.7	132.9	136.0	134.2

* Composting of yard trimmings, food waste, and other MSW organic material. Does not include backyard composting.

† Includes combustion of MSW in mass burn or refuse-derived fuel form, and combustion with energy recovery of source separated materials in MSW (e.g., wood pallets, tire-derived fuel).

‡ Discards after recovery minus combustion with energy recovery. Discards include combustion without energy recovery.

Details might not add to totals due to rounding.

Thinking Beyond Waste

EPA is helping change the way our society protects the environment and conserves resources for future generations by thinking beyond recycling, composting, and disposal. Building on the familiar concept of Reduce, Reuse, Recycle, the Agency is employing a systemic approach that seeks to reduce materials use and associated environmental impacts over their entire life cycle, called sustainable materials management (SMM). This starts with extraction of natural resources and material processing through product design and manufacturing then the product use stage followed by collection/processing and final end of life (disposal). By examining how materials are used throughout their life cycle, an SMM approach seeks to use materials in the most productive way with an emphasis on using less; reducing toxic chemicals and environmental impacts throughout the material life cycle; and assuring we have sufficient resources to meet today's needs and those of the future. Data on municipal solid waste generation, recycling and disposal is an important starting point for the full SMM approach.

Recycling just 1 ton of aluminum cans conserves more than 153 million Btu, the equivalent of 26 barrels of oil, or 1,665 gallons of gasoline.

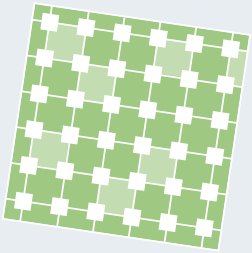


Table 4. Generation, Materials Recovery, Composting, Combustion With Energy Recovery, and Discards of MSW, 1960 to 2011 (in pounds per person per day)

Activity	1960	1970	1980	1990	2000	2005	2007	2009	2010	2011
Generation	2.68	3.25	3.66	4.57	4.74	4.69	4.66	4.36	4.44	4.40
Recovery for recycling	0.17	0.22	0.35	0.64	1.03	1.10	1.15	1.10	1.15	1.16
Recovery for composting*	Negligible	Negligible	Negligible	0.09	0.32	0.38	0.39	0.37	0.36	0.37
Total Materials Recovery	0.17	0.22	0.35	0.73	1.35	1.48	1.54	1.47	1.51	1.53
Discards after recovery	2.51	3.03	3.31	3.84	3.39	3.21	3.12	2.89	2.93	2.87
Combustion with energy recovery†	0.00	0.01	0.07	0.65	0.66	0.58	0.58	0.52	0.52	0.51
Discards to landfill, other disposal‡	2.51	3.02	3.24	3.19	2.73	2.63	2.54	2.37	2.41	2.36
Population (millions)	179.979	203.984	227.255	249.907	281.422	296.410	301.621	307.007	309.051	311.592

* Composting of yard trimmings, food waste, and other MSW organic material. Does not include backyard composting.

† Includes combustion of MSW in mass burn or refuse-derived fuel form, and combustion with energy recovery of source separated materials in MSW (e.g., wood pallets, tire-derived fuel).

‡ Discards after recovery minus combustion with energy recovery. Discards include combustion without energy recovery.

Details might not add to totals due to rounding.

Resources

The data summarized in this fact sheet characterizes the MSW stream as a whole by using a materials flow methodology that relies on a mass balance approach. For example, to determine the amounts of paper recycled, information is gathered on the amounts processed by paper mills and made into new paper on a national basis plus recycled paper exported, instead of counting paper collected for recycling on a state-by-state basis. Using data gathered from industry associations, businesses, and government sources, such as the U.S. Department of Commerce and the U.S. Census Bureau, we estimate tons of materials and products generated, recycled, and discarded. Other sources of data, such as waste characterizations and research reports performed by governments, industry, or the press, supplement these data.

Energy Recovered from Waste Combustion

- In 2011, over 29 million tons of materials, or 11.7 percent, were combusted for energy recovery.
- MSW combustion for energy recovery has decreased from about 34 million tons in 2000 to 29 million tons in 2011.

Table 5. Greenhouse Gas Benefits Associated with Recovery of Specific Materials, 2011*
(in millions of tons recovered, $MMTCO_2E$ and in numbers of cars taken off the road per year) **

Material	Weight Recovered (millions of tons)	GHG Benefits $MMTCO_2E$	Numbers of Cars Taken Off the Road per Year
Paper and paperboard	45.9	134.5	28 million
Glass	3.17	1	210 thousand
Metals			
Steel	5.45	9	1.9 million
Aluminum	0.72	6.4	1.3 million
Other nonferrous metals†	1.34	5.2	1 million
Total metals	**7.51**	**20.6**	**4.2 million**
Plastics	2.65	3.1	640 thousand
Rubber and leather‡	1.31	0.6	130 thousand
Textiles	2	5.1	1 million
Wood	2.38	4.2	1 million
Other wastes			
Food, other^	1.40	1.1	230 thousand
Yard trimmings	19.3	0.8	170 thousand

* Includes materials from residential, commercial, and institutional sources.

** These calculations do not include an additional 1.28 million tons of MSW recovered that could not be addressed in the WARM model. $MMTCO_2E$ is million metric tons of carbon dioxide equivalent.

† Includes lead from lead-acid batteries. Other nonferrous metals calculated in WARM as mixed metals.

‡ Recovery only includes rubber from tires.

^ Includes recovery of other MSW organics for composting.

Source: WARM model (www.epa.gov/warm)

The benefits of recycling and composting, such as elimination of GHG emissions, are calculated using EPA's WARM methodology. Please see: www.epa.gov/warm.

WARM calculates and totals GHG emissions of baseline and alternative waste management practices including source reduction, recycling, composting, combustion, and landfilling. The model calculates emissions in metric tons of carbon equivalent (MTCE), metric tons of carbon dioxide equivalent ($MTCO_2E$), and energy units (million Btu) across a wide range of material types commonly found in MSW. EPA developed GHG emissions reduction factors through a life-cycle assessment methodology. EPA's report, *Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks* (EPA-530-R-02-006), describes this methodology in detail (www.epa.gov/climatechange/wycd/waste/downloads/fullreport.pdf).

Full data tables on MSW characterization that support this Report and Summaries of the MSW characterization methodology and WARM are available on the EPA website along with information about waste reduction and recycling. Please see:

www.epa.gov/epawaste/nonhaz/municipal/msw99.htm

www.epa.gov/recycle.

United States
Environmental Protection
Agency

United States Environmental Protection Agency
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