

2023 Oregon Material Recovery and Waste Generation Rates Report

Materials Management Program
Land Quality Division

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Document information

This document was prepared by Oregon Department of Environmental Quality

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Executive summary

The Oregon Department of Environmental Quality's Materials Management program takes a holistic view of environmental impacts of materials. It considers the impacts that occur across the full life cycle of materials, including resource extraction, design and production, use, and end-of-life management, including solid waste disposal and recovery.

This report details how Oregon manages materials at the end of their useful lives, via disposal and recovery.

- Disposal refers to all materials placed in landfills and many materials burned in incinerators.
- Recovery refers to recycling, composting and some incineration with energy recovery.
- Generation is the sum of disposal and recovery and represents the total tonnage of the waste stream.
- The recovery rate is the percentage of generation recovered.

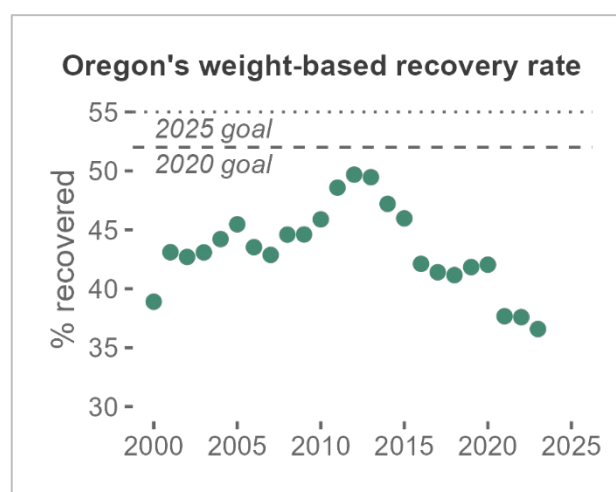
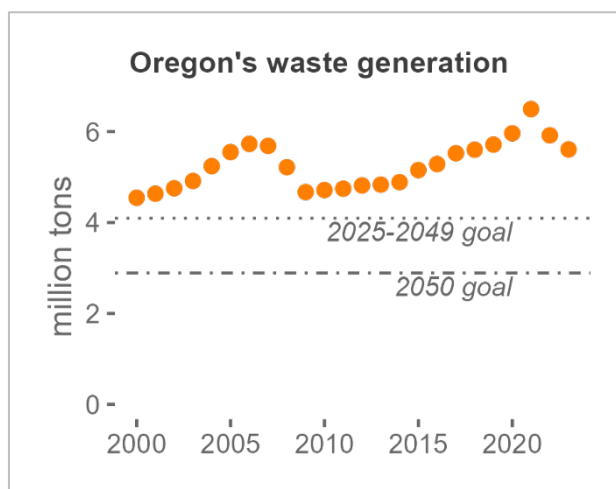
In 2023, people in Oregon:

- Generated 5,607,714 tons of waste, down 5.2 percent from 2022;
- Disposed of 3,554,234 tons into landfills and incinerators, down 3.7 percent from 2022; and
- Recovered 2,053,480 tons of material, down 7.7 percent from 2022.
- The weight-based recovery rate is 36.6 percent, a decrease of one percent from 37.6 percent in 2022.

The total recovered tons decreased 171,867 tons in 2023 when compared to 2022. Materials showing the largest decreases in recovery were scrap metal (-83,868.25 tons) and cardboard (-48,438.52 tons); while organics (+9,364.81 tons) and plastics (+1,357.02 tons) recovery increased. Lead acid batteries continued to decline (-4,065.68 tons), as well as paper fiber (-12,220.68 tons) and container glass (-9,474.54 tons) compared to 2022.

State goals for solid waste:

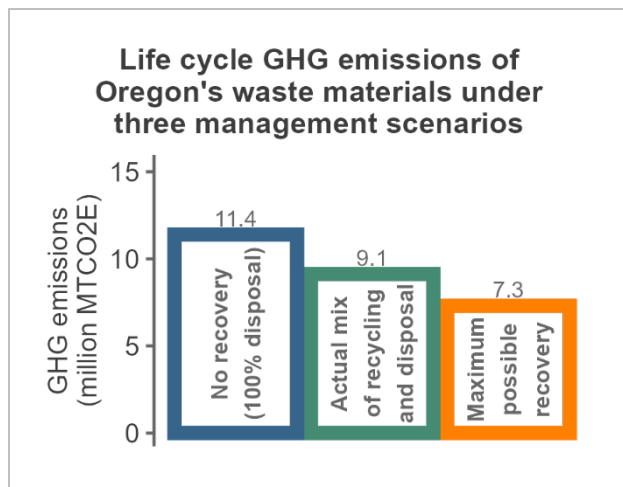
Waste generation continues to fail to meet the goal set for 2009-2024 by the Oregon



Legislature. Weight-based recovery rates are lower than the legislated goals set for 2020 and 2025.

Recovery and environmental impacts:

Recovery via recycling and other means has environmental value. DEQ estimates that in 2023, material recovery reduced greenhouse gas emissions by 2.3 million metric tons of carbon dioxide equivalents (MTCO₂E), compared to a scenario where all waste was disposed. Another 1.8 million MTCO₂E in reductions are possible if recovery rates could be raised in an optimal fashion for reducing greenhouse gas emissions.



Even with maximized recovery, the GHG impacts of materials in the waste system would be considerable, around 7.3 million MTCO₂E. For context, in 2023 Oregon's total GHG emissions from all sources were either 58 or 91 million MTCO₂E, depending on the inventory method.

Recovery presents an opportunity for environmental impact reductions, but only a limited one. To achieve deeper reductions in the environmental impacts of materials and waste, DEQ and its partners will need to take actions across the entire materials life cycle, such as redesigning products and reducing overall materials use.

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Introduction and purpose

This report describes results and methodology for Oregon’s Material Recovery Survey for the calendar year 2023. Material recovery includes all materials collected for recycling or composting, and, for a subset of materials, incineration with energy recovery. Each year, the Oregon Department of

Environmental Quality compiles data on municipal post-consumer waste recovery. DEQ sends a survey to all collection service providers and private recycling companies that handle materials for recycling, composting and energy recovery.

Survey data is combined

with data gathered from quarterly and annual disposal site reporting forms. Together, recovery and disposal numbers make up the amount of waste generated by people in Oregon each year.

DEQ uses this information to estimate energy savings and greenhouse gas reductions, two important environmental benefits from material recovery. Additionally, this information allows DEQ to calculate material recovery rates and waste generation values. The recovery rate is the percentage of the total waste generated in Oregon that is recycled, composted, or recovered for energy. Waste generation is the amount of waste recovered plus the amount of waste disposed. Recovery, disposal, and generation data, as well as recovery rates, are calculated for the state and for each of Oregon’s 35 individual wastesheds¹.

Individual wastesheds also use this information to implement and improve their waste prevention and material recovery programs.

This is the thirty-first year that DEQ has used the survey to gather this data. The 1991 Oregon Legislature enacted requirements (see [Oregon Revised Statute 459A](#)) for this annual survey and

Total Recovered		
2,053,480 tons		
Total Generated	=	Recovery
(Total Recovered + Total		Rate
Disposed)		36.6%
5,607,714 tons		

1 A "wasteshed" is defined in Oregon law as being an area of the state that shares a common solid waste disposal system, or an appropriate area in which to develop a common recycling system. For the most part, individual Oregon counties are designated as wastesheds. Three exceptions are that:

The greater Portland tri-county area, consisting of Clackamas, Multnomah and Washington Counties, is designated as the Metro wasteshed.

Milton-Freewater, a city within Umatilla County, is designated as a separate wasteshed.

For most cities such as Albany that have populations in two counties, the entire city was included in the wasteshed that included the larger portion of the city population. The exception is Salem, where most of Salem is in the Marion Wasteshed, but West Salem is included in the Polk Wasteshed.

set goals for state and local recovery rates. These recovery goals were amended by the Legislature in 2001, and then again in 2015. Wasteshed goals range from 15 percent (Lake Wasteshed) to 64 percent (Metro and Marion Wastesheds) by 2025. The statewide recovery goals are 52 percent recovery by 2020 and 55 percent recovery by 2025.

In 2001, the Legislature also established statewide goals for reducing waste generation. These goals were revised by the Legislature in 2015. The waste generation goals require that the generation of solid waste in the years 2025 to 2049 be 15 percent below the amount of solid waste generated in 2012, and for 2050 and beyond, the generation goal is 40 percent less than the waste generated in 2012.

Requirement to report

Oregon law requires that all publicly and privately operated recycling and material recovery operations complete a Material Recovery Survey form. This includes landfills, local recycling collectors, private recycling collection companies and depots, transfer stations, material recovery facilities, composters, local governments, and any other operation that handles post-consumer recoverable materials. One exception, due to the difficulty of separating post-consumer scrap metal from commercial and industrial scrap metal, are companies handling only scrap metal. These companies are not required to report on privately obtained post-consumer scrap metal, but many do report on a voluntary basis.

The survey requires that companies report all recyclable materials they handle, including the amount of each material collected, the county of origin, the company they received any transfers from, and where or to whom the materials were marketed.

Oregon law further requires DEQ to keep confidential the information reported by private recyclers. This includes customer lists and specific amounts and types of materials collected or marketed by individual companies. For private recyclers, only aggregated information may be released to the public.

Materials included in the analysis

Oregon's analysis of the environmental benefits from material recovery and the recovery rates includes only post-consumer materials generated in Oregon for recycling, composting or energy recovery. Per Oregon's recycling law (ORS 459A.010 (3)(a)), waste from manufacturing and industrial processes (pre-consumer materials), reconditioned and reused materials, material that can be disposed of as clean fill without being put in a landfill such as brick and concrete, and waste originating out of state (but handled in Oregon) are excluded. Some scrap metals, including discarded vehicles or parts of vehicles and metal derived from major demolition activities handled by scrap metal dealers, are also excluded. Scrap metal collected at disposal sites by collection service providers, at community recycling depots or through municipally sponsored collections events counts as recovered material.

The first Material Recovery Survey for the 1992 calendar year included 30 types of materials. Since then, some new materials have been added and other materials consolidated, so that the survey now contains 33 types of material. The major materials for 2023 are:

- Yard Debris
- Metals – Tinned cans, aluminum, and other scrap metals
- Cardboard
- Wood Waste
- Paper Fiber – Other paper fiber (combined high-grade paper, newsprint and mixed scrap paper) not including cardboard
- Container Glass
- Food Waste – Residential and commercial food waste
- Other – Including tires, used motor oil, antifreeze, batteries of all types, gypsum, asphalt roofing materials, textiles, paint, and animal waste and grease
- Plastic – Rigid plastic containers, plastic film, other plastics and composite plastics (including carpet pad)
- Electronics

A complete list of materials recovered is included in Table 8, at the end of this report.

Recovery and reductions in environmental impacts

Summary of analytical results

Oregon's recovery activity in 2023 can be associated with:

- 2.3 million metric tons carbon dioxide equivalents (MTCO₂E) of reductions in greenhouse gas emissions; and
- 29 trillion British thermal units of savings in energy demand.

These savings in energy and greenhouse gas impacts are lower than the values reported for 2022 (39 trillion BTU and 3.1 million MTCO₂E). Differences from previous years are likely the result of changing wastestream composition, changing markets for recycled materials, and improvements in DEQ's impact modeling.

If recovery could be increased from its current rate (about 37 percent by weight) to rate corresponding with a maximum reduction in greenhouse gas emissions (about 56 percent by weight), it can be estimated that:

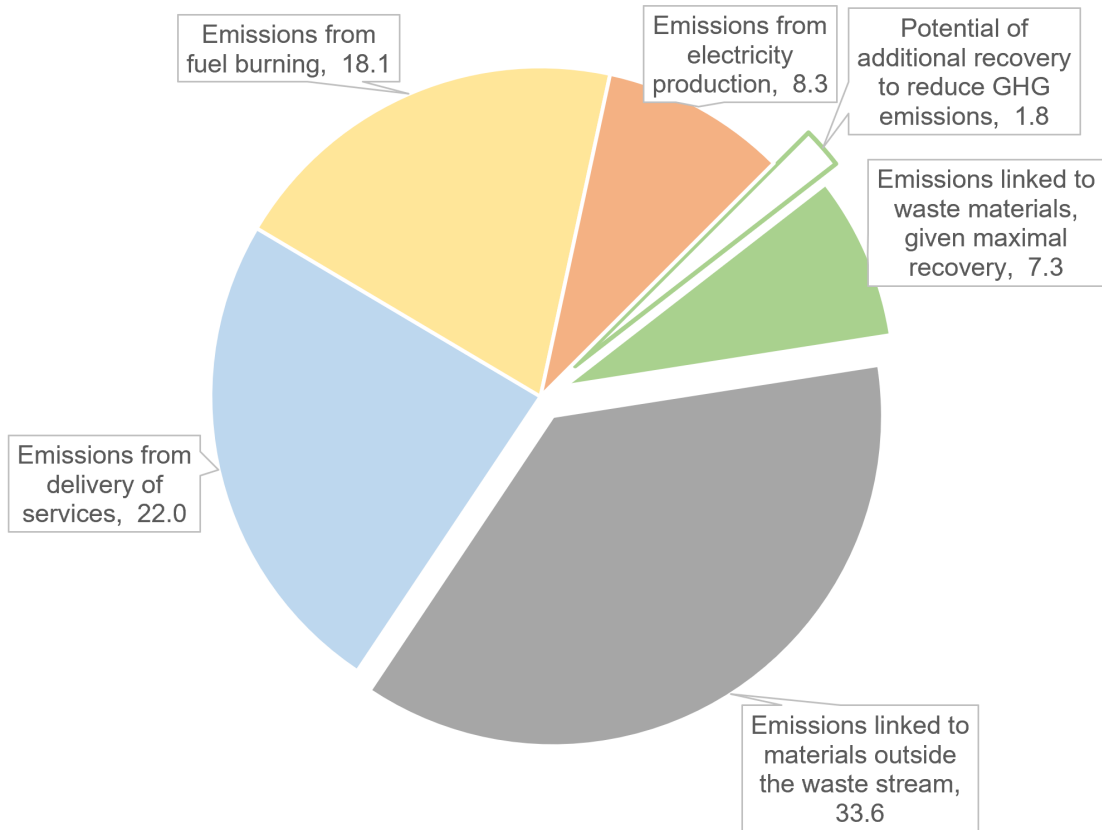
- GHG emissions would decline an additional 1.8 million MTCO₂E; and
- Energy expenditures would decline an additional 37 trillion BTU.

Such savings must be placed within the context of the state's total environmental impacts.

- Oregon's total GHG emissions are much higher than the waste component suggests. A recent [DEQ report](#) lists yearly totals as 58.5 million MTCO₂E, from a sector-based method, and 91.0 million MTCO₂E, from a consumption-based method.
- Oregon's overall direct energy expenditures are around 866 trillion BTU per year, in a recent [Oregon Department of Energy report](#).

The pie chart on the following page combines results from the consumption-based emissions inventory with estimates of the impacts of waste. It shows that while increased recovery does present an opportunity for environmental impact reductions, the opportunity is limited. Increased recovery, by itself, cannot provide the sizeable decreases in impacts anticipated by the state's greenhouse gas reduction goals ([Oregon Revised Statute 468A.205](#)), or the [2050 Vision](#). Achieving greater reductions in environmental impacts of materials will require other materials management strategies, such as the redesign of products and reduced material use.

**Potential of maximized recovery to reduce statewide GHG emissions
in MMTCO₂E**

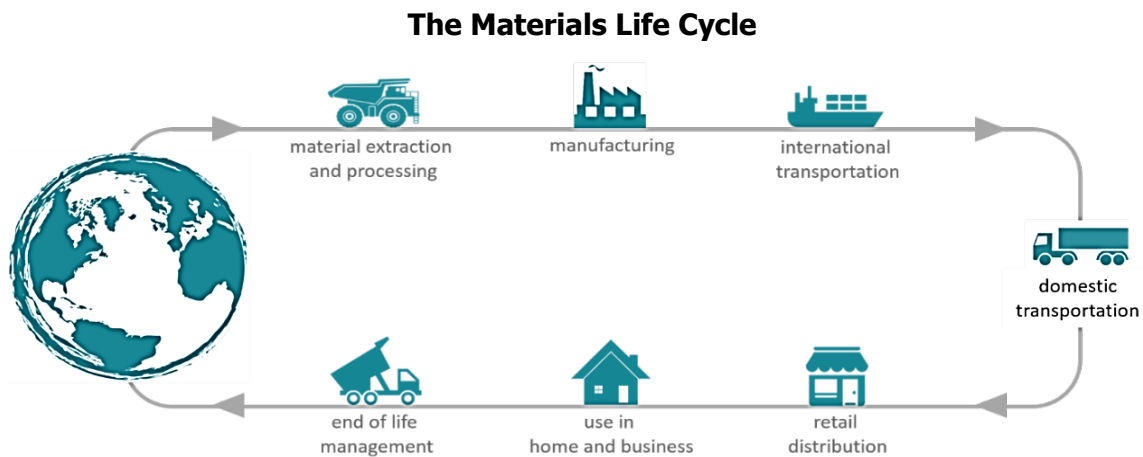


Sources of GHG emissions in Oregon, in MMTCO₂E, according to the state's consumption-based inventory, combined with results from a life cycle assessment of the solid waste stream. The impact of waste materials (in green) already includes the current benefits of recovery. Additional recovery (above current levels) offers 1.8 million MTCO₂E in possible further impact reductions. The remaining GHG impacts of materials are either not preventable by recovery (7.3 million MTCO₂E), or not represented by the solid waste stream at all (33.6 million MTCO₂E).

Understanding impact reductions

All products and materials can be seen within the context of the materials life cycle. Everything people touch or use has been created somehow—usually via “extraction” from the earth or soil, followed by production, distribution, consumption, and use, and “end-of-life” processes such as disposal or recycling. Environmental impacts occur at every stage of this life cycle. For example, extracting ore or operating a farm uses machinery that emits GHGs and expends energy. The sum of impacts associated with the materials life cycle are called the “life cycle impacts.”

Recovery activities such as recycling and composting also create impacts. For example,



recycling trucks emit GHGs and expend energy as they collect material, as does processing collected recyclables to create new products.

Nonetheless environmental benefits can be associated with recycling and other recovery activities.

DEQ assumes, as is conventional in the field of life cycle assessment, that use of recovered materials prevents production from newly extracted material, or otherwise prevents some undesired environmental impact. For example, production of a metric ton of glass from recycled sources may save about 300 kg of GHG emissions, *compared to the emissions of production from newly extracted material*.² Similarly, while aerobic composting does lead to CO₂ emissions, composting may still represent a savings *compared to the methane emissions that could result from disposal in a landfill*.³

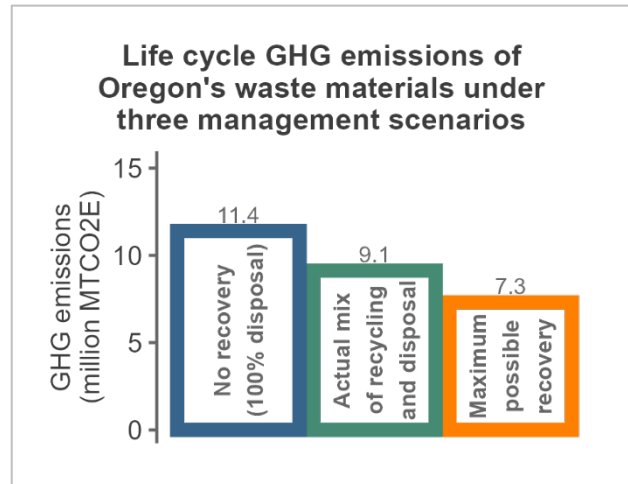
² David A. Turner, Ian D. Williams, and Simon Kemp, “Greenhouse Gas Emission Factors for Recycling of Source-Segregated Waste Materials,” *Resources, Conservation and Recycling* 105, Part A (December 2015): 186–97, <https://doi.org/10.1016/j.resconrec.2015.10.026>.

³ US EPA, “Organic Materials Chapters [Documentation for Greenhouse Gas Emission and Energy Factors Used in the Waste Reduction Model (WARM)],” February 2016, www.epa.gov/sites/production/files/2016-03/documents/warm_v14_organic_materials.pdf.

Accordingly, impact reductions or savings are not direct measurements, but *projections* of how impacts could differ if materials had been managed differently at end-of-life.⁴

It is important to note that these impacts may occur over multiple years and may occur in areas outside of Oregon. Though we associate the materials in the waste stream with a particular place (Oregon) and time (for example, 2023), the life cycle impacts of those materials are not always so localized.

An item recycled in 2023 in Oregon may have been created in another state or country in a different year. An item disposed in 2023 may decay in a landfill, but slowly over a period of many years. Environmental impacts, and savings, are spread out over time and space.



Methodological details, in brief

DEQ calculates impact reductions through a multi-step process. First, it characterizes Oregon's solid waste stream, which includes both disposed and recovered materials, by weight and end-of-life disposition (for example, recycling, composting, or landfilling). Next, it links those weights to impact factors that convert weights into environmental impacts for both production processes and end-of-life dispositions. Appropriate credits are given for recovery activities when it can be presumed that recovery has prevented some other, greater environmental impact, as described earlier. Then it sums life cycle impacts for three possible management scenarios:

- Actual: the life cycle impact of materials in the solid waste stream, given the current mix of recovery and disposal.
- No recovery: the life cycle impact of materials in the solid waste stream if no recovery had taken place and all materials had been disposed.
- Maximum possible recovery: the life cycle impact of materials in the solid waste stream, if all materials were recovered in the fashion that reduced total life cycle GHG emissions the most.

Note that in all scenarios, the weights of materials are the same. The scenarios differ only in the end-of-life dispositions of those materials. The *maximum possible recovery* scenario assumes that recovery has been maximized in the way that produces the lowest total life cycle greenhouse gas impacts, which corresponds to a recovery rate of about 56 percent by weight.

⁴ The assumptions behind such projections are important to note. Such calculations, including DEQ's, presume that demand for materials is unaltered by the presence of recycled materials, and that collected recyclables actually replace newly extracted materials at a high rate, often 1:1. Authors such as Zink and Geyer question both these assumptions – see [doi://10.1111/jiec.12545](https://doi.org/10.1111/jiec.12545) and [doi://10.1111/jiec.12355](https://doi.org/10.1111/jiec.12355).

(The figure is less than 100 percent because some materials have no realistic recycling path, and for others recycling does not reduce greenhouse gas emissions.)

Finally, impact reductions or savings are calculated as differences between the scenarios. The currently realized savings are the difference between the *no recovery* impact and the *actual* impact. The additional savings, which might be realized by maximizing recovery, are the difference between the *actual* impact and the *maximum possible recovery* impact.

For example, the currently realized GHG savings of 2.3 million MTCO₂E, and the additional potential savings of 1.8 million MTCO₂E, were calculated by comparing life cycle emissions for the three scenarios, totaling 11.4, 9.1, and 7.3 million MTCO₂E.

The weight data describing Oregon's waste stream comes from several sources.

- Quantities and dispositions of recovered materials come from DEQ's Material Recovery Survey for 2023.
- Quantities of disposed materials are derived by combining the total amount of material disposed in Oregon in 2023, from DEQ's disposal records, and the [Waste Composition Studies](#) for 2016/17 and 2023, which list proportions of disposed waste in various material categories.

Impact factors come from Oregon DEQ's Waste Impact Calculator model. The Waste Impact Calculator was created by Oregon DEQ specifically to match assumptions appropriate to Oregon and was independently reviewed by Dr. Christoph Koffler of the life cycle consulting firm Sphera. The WIC model, its documentation, and Koffler's review are available on [github](#).

For further information about how DEQ calculates impact reductions contact Martin.Brown@deq.oregon.gov.

Recovery rates

The recovery rate is the percentage of total waste generation that is recovered. DEQ calculates both the statewide recovery rate and a recovery rate for each of the 35 individual wastesheds in the state.

Oregon State Recovered Tons and Recovery Rate

Year	Tons Recovered	Tons Disposed	Recovery Rate
1992	843,917 ¹	2,263,370 ¹	27.1
1993	974,685	2,277,754 ¹	29.9
1994	1,118,912	2,327,093 ¹	32.6
1995	1,257,204	2,358,896 ¹	34.7
1996	1,340,228 ¹	2,495,854 ¹	34.9
1997	1,470,941 ¹	2,631,398 ¹	35.7
1998	1,604,985	2,692,603 ¹	37.3
1999	1,627,493 ¹	2,785,621 ¹	36.8
2000	1,764,711 ¹	2,775,313 ¹	38.9
2001	1,976,469 ¹	2,654,436 ¹	43.1
2002	2,029,253 ¹	2,744,368 ¹	42.7
2003	2,116,730 ¹	2,809,543 ¹	43.1
2004	2,317,064	2,923,462	44.2
2005	2,523,358 ¹	3,026,202 ¹	45.5
2006	2,494,050	3,235,678 ¹	43.5
2007	2,437,569	3,213,013 ¹	42.9
2008	2,325,944 ¹	2,890,739 ¹	44.6
2009	2,082,553 ¹	2,588,661 ¹	44.6
2010	2,162,651 ¹	2,549,694 ¹	45.9
2011	2,305,937 ¹	2,476,864 ¹	48.6
2012	2,390,933 ¹	2,434,864 ¹	49.7
2013	2,384,778 ¹	2,513,404 ¹	49.5
2014	2,299,195 ¹	2,635,581 ¹	47.2
2015	2,369,256 ¹	2,786,170 ¹	46.0
2016	2,226,025 ¹	3,060,873 ¹	42.1
2017	2,287,125	3,237,379 ¹	41.4
2018	2,306,922 ¹	3,295,508 ¹	41.2
2019	2,407,483 ¹	3,321,623 ¹	42.0

Year	Tons Recovered	Tons Disposed	Recovery Rate
2020	2,501,461 ¹	3,453,436 ¹	42.0
2021	2,410,245 ¹	4,046,936	37.3 ¹
2022	2,225,348 ¹	3,690,938	37.6 ¹
2023	2,053,480	3,554,234	36.6

¹These figures are corrected from previously published values.

2023 statewide recovery rate

In 2023, the state recovered 2,053,480 tons of material. This represented 36.6 percent of the municipal post-consumer waste stream, well below the statewide goal of 52 percent recovery by the year 2020. Recovered tons decreased by 7.7 percent from the previous year surveyed, 2022.

From 1992 through 2005, tons of material recovered increased regularly each year. From 2006 through 2009, recovered tons declined even though recovery rates were steady, as declining consumption of newspapers and magazines, followed by a general decline in overall consumption due to the recession, reduced the amount of material available to be recovered. In 2010, Oregon experienced an increase in recovery, as the economy gradually recovered from the recession. Recovery rates peaked in 2012 at close to 50 percent, but then fell, leveling off at about 42 percent in 2016 and remaining at that level through 2020 before dropping again in 2021 and 2022. In 2023 cardboard recovery decreased by 48,438 tons from 2022 and wood waste increased 41,415 tons over 2022 levels. Paper fibers continue to decrease, setting another record low of 148,502 tons recovered and tires saw a decrease of 25,658 tons from 2022.

How DEQ calculates the statewide recovery rate

DEQ combines information about quantities of material collected from privately-operated recycling and material recovery facilities with recovery information from collection service providers and disposal site collections, in a manner that eliminates double counting of material that is passed on from collectors through processors to end-users. This determines the total weight of material recovered.

Next, DEQ adds the total weight of material recovered to the total weight of material disposed, obtained from disposal site reports. This sum is the total weight of material generated. The total weight of material recovered is divided by the total weight generated. This results in the calculated recovery rate.

How DEQ calculates individual wasteshed recovery rates

The total weight of material recovered is allocated to the wasteshed of origin. Direct collectors of materials are the primary and best information source for the collected materials' wasteshed

of origin. When information from direct collectors is not available, or when a survey respondent does not know the watershed of origin for the collected materials, DEQ uses information from the companies receiving materials from the collectors to allocate material back to watersheds. Material is allocated back to watersheds based on population in rare cases when survey respondents and market information is insufficient.

DEQ also uses information from disposal site reporting forms to determine the total weight of material disposed to the watershed of origin. For each watershed, total weight of material disposed is added to total weight of materials recovered to ascertain the amount of waste generated in the watershed. The total weight of material recovered is divided by the total weight generated to determine the calculated recovery rate for each watershed.

Marion county adjustment

As home to the state's only municipal waste-to-energy incinerator, Marion County's recovery and disposal tonnages are revised each year to include certain wastes burned for energy as recovered, as directed by the 2001 Legislature. For 2023, two materials that could be counted toward the recovery rate when burned for energy were wood waste and yard debris. In 2023, 9,427 tons of these materials burned for energy in the county's incinerator were counted as recovered instead of disposed. Marion County also recovered 4,363 tons of scrap metal from the incinerator ash. DEQ subtracted the scrap metal tonnage from the Marion County disposed tons so that the same tons would not be counted as being both disposed and recycled.

Watershed recovery rates

Oregon has 35 individual watersheds, each with its own recovery rate and goal. Based on the new goals established by Senate Bill 263, nine watersheds are already at or above their goal for 2025.

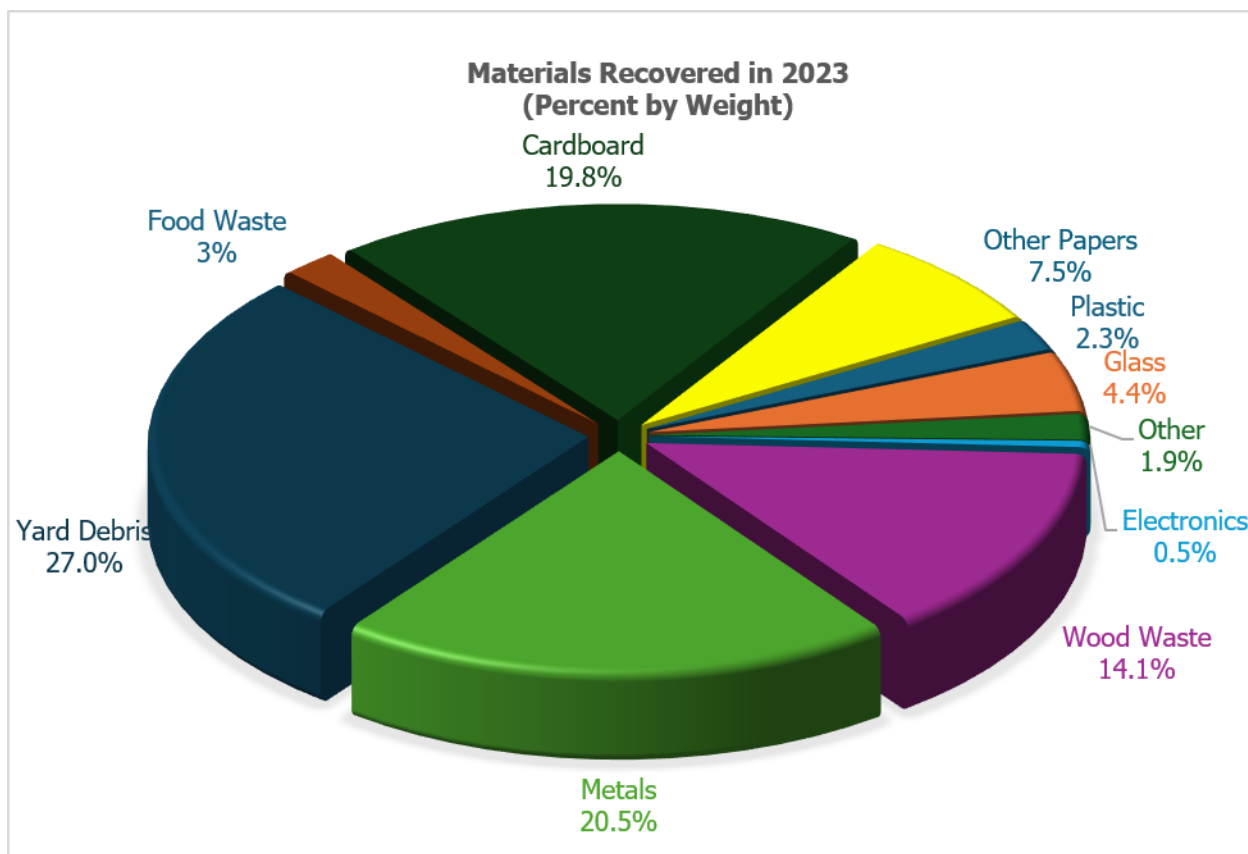
The Survey Report Tables listed on page 29 of this report show 2023 recovery rates for each watershed (Table 1), tons of materials recovered in 2023 by watershed (Table 2), and tons of solid waste disposed by watershed in 2023 (Table 3).

For a historical look at recovery, disposal, and generation data in Oregon, see Survey Report Tables 4, 5, 6 and 7, which provide the most recent and updated recovery rates, recovered material tons, disposal tons, and tons of solid waste generated each year since the Material Recovery Survey began in 1992.

Materials recovered

Oregon's material recovery rate for 2023 includes materials that were recycled, composted (including yard debris, food waste and some wood waste), and burned for energy (including tires, fuels, oil-based paint, used oil, wood waste and some yard debris). Fifty-nine percent of the material recovered was recycled, 27 percent was composted, and 14 percent was burned for energy.

The chart below shows major categories of materials recovered in 2023 and the percentage of total recovery (by weight) for each category. Specific materials included in these categories are listed on page four.



Factors affecting material recovery in 2023

For the most part, recent trends continued in 2023. The generation, disposal, and recycling of printing and writing paper continued to decrease, continuing a decade-long slide with less printing and writing paper collected each year. The sales of newspapers and magazines has fallen drastically since 2008. A DEQ study of residential curbside recycling in 2004/05 found that newsprint made up 42 percent of the material that households put out at the curb for recycling. In contrast, the [2023 Oregon Inbound Commingled Recycling Study](#) found that newsprint made up only 3.4 percent of the residential curbside commingled mix statewide in 2023. Magazines

have also fallen, from about 11 percent in the 2004/05 study to 4.5 percent in the statewide residential commingled recycling in 2023. Cardboard, on the other hand, has increased in residential recycling, from 15 percent of the curbside residential material in 2004/2005 to 45.5 percent statewide in 2023. Some of the increase in cardboard on a percentage basis is simply due to the drop in newspaper, magazines, and other printing and writing paper, but the absolute amount of cardboard has also increased in residential recycling, as households receive much more cardboard through home delivery than they did in the past. However, residential cardboard is only a small portion of the total cardboard recycled, with most coming directly from commercial sources. Total cardboard recycled tonnage peaked in 2021 but has since fallen back to levels from around 2017.

The recycling of rigid plastic containers has been fairly stable since 2019, but the recycling of other rigid plastic dropped to the lowest value since 2004. Film plastic recycling increased slightly in 2023 but otherwise is still lower than the tonnage of film plastic recycled from 2005 to 2021. Other rigid plastics and film plastics are not included in any curbside or commingled recycling program in Oregon, and so most of the recycling of these materials is done through commercial or private programs or some drop-off recycling. Both film plastics and other rigid plastics had huge drops in recycling tonnage in 2017/18 when China banned the importation of these materials, resulting in a global decrease in the market price paid for recycling. The price for film plastic has since increased to nearly where it was in 2016 according to RecyclingMarkets.net, but the tons of film plastic recycled is still less than 50 percent of the tons recycled in the peak year of 2016.

Beverage container recycling under the Bottle Bill also continued recent trends. The tonnage of aluminum under the Bottle Bill reached new all-time highs, more than recovering from the drop in recycling in 2020 caused by stores being allowed to refuse accepting containers back much of that year due to the pandemic. Bottle Bill plastic dropped slightly from the previous year, although remaining high. Bottle Bill glass tons recycled, on the other hand, continued to fall as the sales of beverages in glass containers dropped another 7.7 percent since 2022 and 32.6 percent since its peak in 2018, according to data reported to the Oregon Liquor and Cannabis Commission.

As seen in the graphs, the tonnage of beverage containers recycled took big steps up following the doubling of the refund value of containers to 10 cents in April 2017 and the addition of juices, teas, sports drinks, and many other beverages as of January 1, 2018. There was a brief drop in 2020 due to the Covid-19 pandemic, but redemption rates have since rebounded. These data agree closely with the [OLCC data on](#)

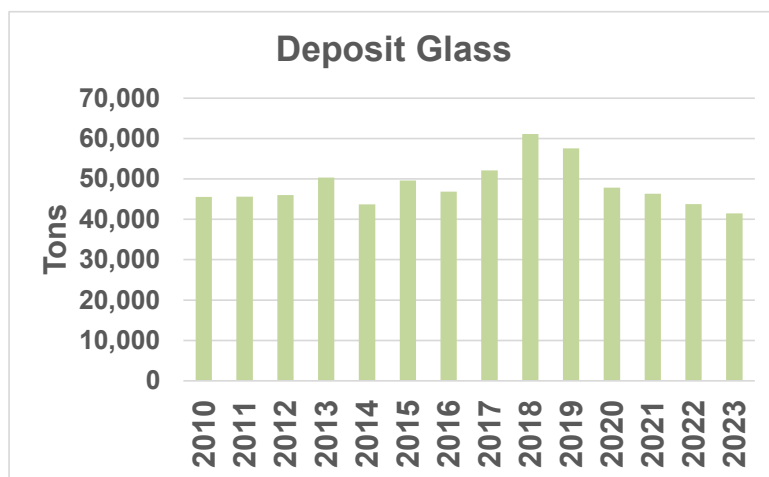
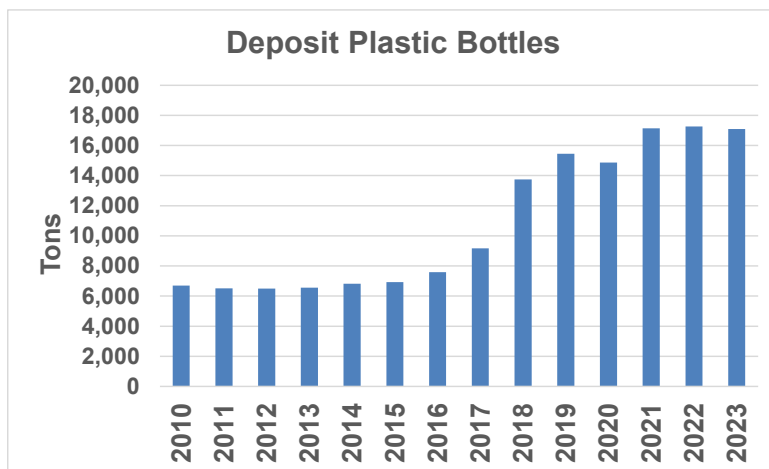


[beverage container sales](#) and redemptions, which showed that redemptions in 2023 were 87 percent of sales – the highest return rate in decades.

Increases in recycling tonnage since 2017 under the Bottle Bill come from two sources:

- More containers being redeemed instead of being disposed or littered, and
- Containers being redeemed instead of being placed out for curbside collection or recycled at depots.

Moving containers from disposal or litter clearly has major environmental benefits. However, even moving containers from depots or on-route collection also results in a greater tonnage of material recycled, as Bottle Bill recycling is much less contaminated than is true for materials collected commingled, resulting in a higher yield of material actually recycled into new products or packaging.



Year to year changes in material collected

Electronics. Electronics recovery saw an increase of 6.3 percent in 2023 compared to 2022.

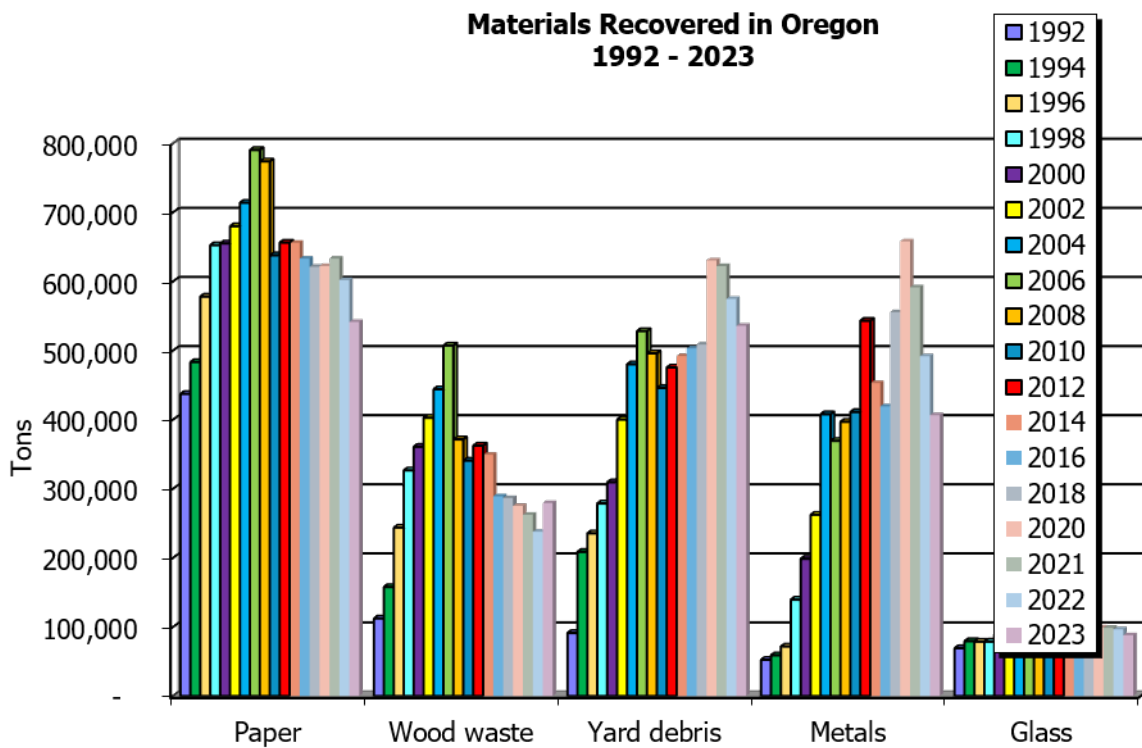
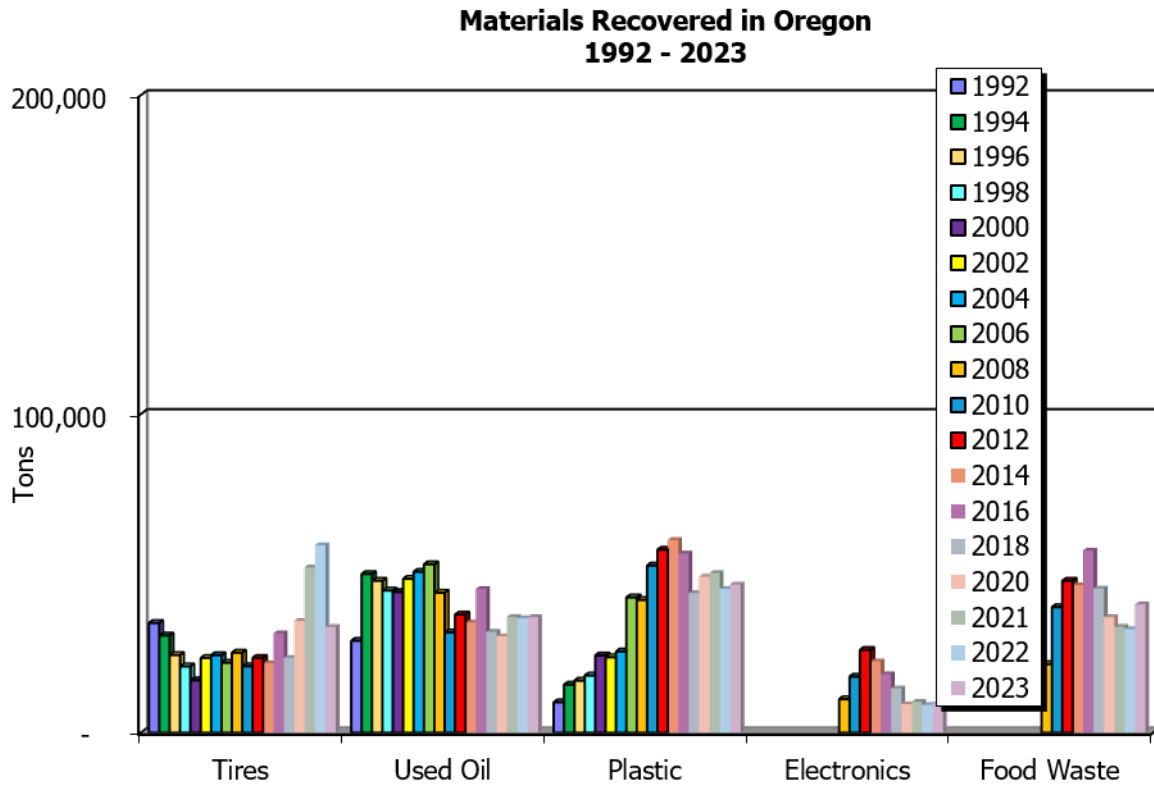
Paper (including cardboard). There was an overall decrease in recovery for paper fibers by ten percent in 2023; printing, writing and other papers continued their decline by nearly eight percent, a decrease of 12,221 tons from 2022. Cardboard recovery saw a decrease by 48,438 tons, 11 percent down from 2022. It's possible the cardboard decrease is connected to supply chain issues due to continued inflation through 2023.

Plastics. A total of 30,704 tons of rigid plastic containers were collected for recycling in 2023, compared to 29,445 tons in 2022. Plastic Film increased by 479 tons, from 7,151 tons in 2022 to 7,629 tons in 2023.

Metals. The total amount of metals decreased by 17 percent in 2023 compared to 2022. Scrap metals saw a decrease of nearly 19 percent. Tinned cans increased by 86 tons in 2023 from 5,763 tons in 2022, while aluminum saw a four percent decrease to 38,285 tons in 2023.

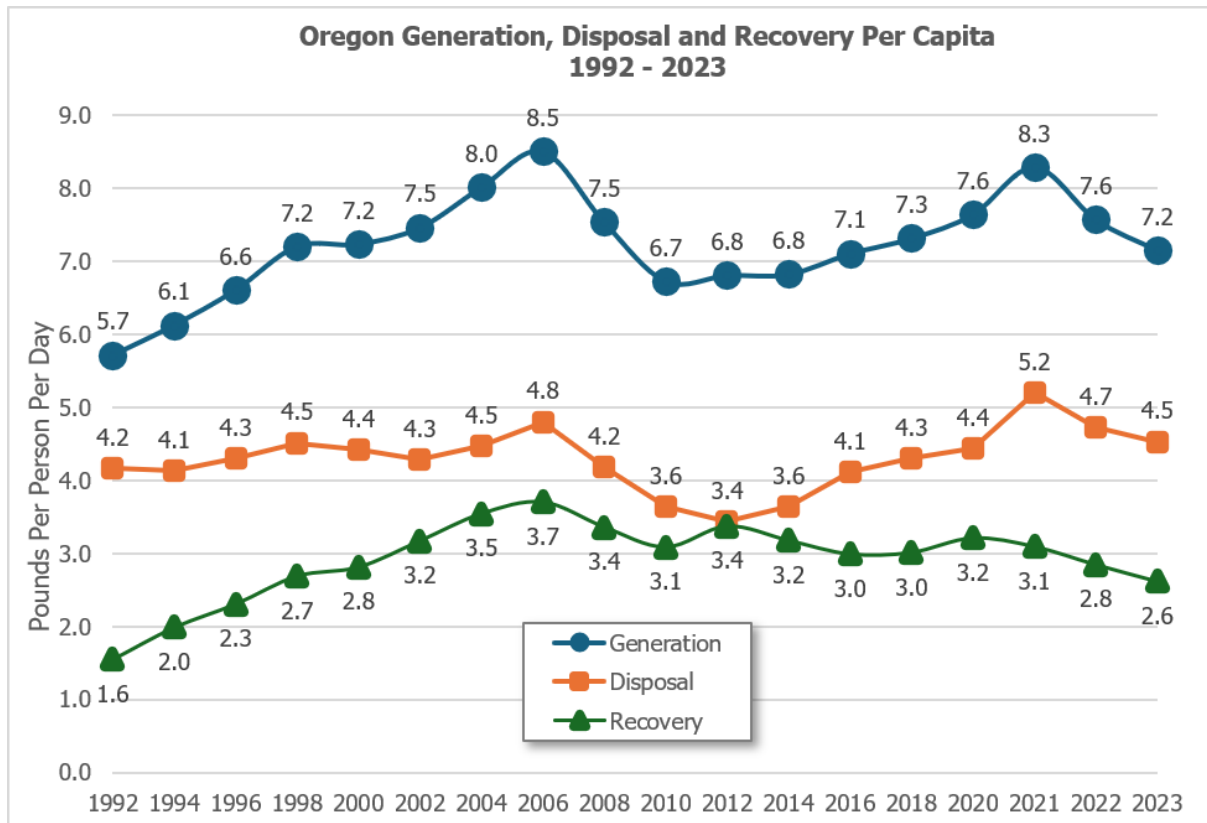
Organics. The total recovery of organics (which includes animal waste/grease, wood waste, yard debris, and food waste) increased by one percent in 2023. There was a decrease of 39,000 tons of yard debris compared to 2022; and a continued decrease in animal waste/grease recovered by nearly six percent from 2022.

The following charts compare the materials recovered over the past three decades.



Waste generation

Changes in the total amount of municipal solid waste generated (materials recovered plus waste disposed) in Oregon over time tell an interesting story. From 1992 to 2006, total waste generation increased every year, often steeply. Waste generation then declined slightly in 2007 and sharply in both 2008 and 2009, coinciding with the economic recession. Between 2009 and 2014, waste generation started growing again, but at a very slow pace, averaging less than one percent increase per year. In 2023 Oregon generated 5,607,714 tons of municipal solid waste, a decrease of 5.2 percent from 2022. This equates to a per-capita generation of 2,610 pounds per person (7.2 pounds per day), a 5.5 percent decrease from 2,763 pounds per person (7.6 pounds per day) in 2022. Total waste generation in 2023 was a decrease (-122,164 tons) from its peak in 2006, a decrease of 2.1 percent in total waste generation between 2006 and 2023, which turned out to be a 15.9 percent decrease in the per-capita amount. This decrease in waste generation is likely due to a combination of the economic decline and because there weren't any significant disasters like the wildfires in late 2020.



Note: Some years within the chart above have been hidden for readability.

The following table shows the disposition of the municipal solid waste generated in Oregon in 2023. See Table 9 for individual watershed dispositions.

Disposition of Waste Generated in Oregon in 2023

Disposition	Percent by weight
Disposed*	63.4
Recycled	21.5
Composted	9.9
Recovered for Energy*	5.2

***For the Marion County's waste-to-energy facility only the portion of waste that counts toward the county's and state's recovery rates is included here in "recovered for energy" (see Marion County Adjustments on page 18). Other wastes burned at the facility are counted here as disposed.**

Discussion

In 2015, Oregon adopted new statutory goals of 52 percent recovery by 2020 and 55 percent by 2025. Oregon did not meet the 2020 goal, as its 2023 recovery rate was 36.6 percent, and its 2022 rate 37.6 percent.

Several historical factors contributed to lower-than-anticipated recovery.

- In 2015, DEQ did not anticipate the closure of the paper mill later that year that by far was the largest user of post-consumer wood waste as a fuel, nor the discontinuance of the use of wood by other mills, strongly impacting the ability to recover and use wood.
- Similarly, DEQ did not anticipate that Oregon and the world would experience disruptions in the markets for most plastics and for mixed paper, as China, the largest importer of recyclable material in the world, restricted the importation of these materials and has banned the importation of unsorted paper and all unprocessed post-consumer plastics in 2018.

Such disruptions motivated a new law, the *Plastics Pollution and Recycling Modernization Act*, which took effect Jan. 1, 2022, and will significantly affect recycling operations starting July 2025. The law has numerous aims and expands the concept of successful recycling beyond the weight-based generation and recovery rates described in this report. The law's goals include making recycling easier for the public to use, expanding access to recycling services, upgrading recycling facilities, and reducing social and environmental harms. In 2025 and beyond, this report may look substantially different.

Adjustments to reports from previous years

DEQ continues to review and use survey data even after publishing the final report each year. Occasionally, we encounter and correct errors in previously reported results. Thus, tonnages published in this report for previous years may not match the tonnages originally reported for that year.

DEQ made the following adjustments for the 2023 report:

- Adjustments were made to scrap metal tons for 2022 and 2021 based on a recycler's internal review of data submitted in 2023, lowering the scrap metal recovered tons by over 100,000 tons in 2022 and over 68,000 tons in 2021.
- A correction was made to some animal waste/grease tons due to some misreporting of non-counting collections in 2022.

DEQ corrected data in previous years, for the following reasons:

- An adjustment was made to wasteshed allocations for lead acid batteries reported for the 2021 and 2020 survey period.
- A correction to recovered tonnage of some materials reported by a recycler was made to the 2021 survey period, due to some double counts discovered.
- A correction to food waste and yard debris tons recovered in the Metro Wasteshed in 2020 was made due to a formula calculation error.
- A correction to recovered tonnage of some materials reported by a recycler was made to the 2020 survey period, due to some double counts discovered.
- A correction to animal waste/grease tons reported in 2020 and 2019 was made due to a conversion rate error used by the recycler.
- A correction was made to a landfill for allocated tire disposal in 2020.
- A correction to food waste reported in 2019 as recovered was revised to "reuse," removing those tons from the total recovered for 2019.
- A correction to disposal tonnage, the non-reporting of some disposal tons going out-of-state and the misreporting of counting solid waste tons was made to the 2019 survey period.
- A correction to disposal tonnage, the non-reporting of some disposal tons going out-of-state was made to the 2018 survey period.
- A correction to recovered tonnage of some materials reported by a recycler was made to the 2017 survey period, due to some double counts discovered.
- Based on the recyclers reporting in 2018, some materials were not reported due to unknown markets. These materials will be revised during the 2019 reporting period.

- A correction to recovered tonnage of cardboard was made to the 2017 survey period, due to a double count discovered.
- A revision was made to the breakdown of food waste and yard debris mix from the curbside tons collected and composted. Prior to 2018 reporting, the breakdown was 90 percent yard debris and 10 percent food waste; the revised breakdown is split between metro area collections (89.3 percent yard debris, 9.5 percent food waste and 1.2 percent solid waste) and non-metro area collections (94.1 percent yard debris, 4.8 percent food waste and 1.2 percent solid waste). This breakdown revision resulted in an overall increase of yard debris and an overall decrease in food waste; as well as a slight decrease in overall organic tons by accounting for the 1.2 percent solid waste.
- A significant correction to disposal for several wastesheds, increased the total tons disposed in Oregon and dropped the recovery rate from 42.8 percent to 42.1 percent for 2017. This also resulted in the publishing of a revised 2017 report in March 2019.
- A correction to recovered tonnage of yard debris was made to the 2015 and 2016 survey period, due to a double count discovered.
- A correction was made to some asphalt roofing tons that were found to be used as alternative daily cover at a local landfill but that had been reported as recovered. "Alternative daily cover" is material used to cover garbage daily at a landfill instead of using soil, is considered to be a form of disposal rather than recovery. This correction was made to 2015 and 2016 data.
- The yard debris and asphalt roofing corrections resulted in adjustments to the previous year's recovery rates; the recovery rate for 2015 dropped from 46.2 to 46.0 percent, the recovery rate for 2016 dropped from 42.6 to 42.2 percent.
- A correction to recovered tonnage of yard waste was made to the 2015 survey period, a reporting facility for 2016 sent in a missing 2015 report.
- In 2016 a correction was made to some "plastic other" and "plastic film" incorrectly converted to tons from pounds, this increased the total recovered for both materials.
- A couple of 2015 disposal reports were revised. This adjustment increased disposal tonnage for 2015, which dropped the state recovery rate from 46.5 percent to 46.2 percent for 2015.
- A correction to recovered tonnage of wood waste in two wastesheds was made to survey years 2014 and 2013, as some tonnage was determined to be pre-consumer material.
- Adjustments were made to 2014 and 2013 animal waste/grease collection amounts, as well as correctly identifying wastesheds of origin, based on revised reporting by an end-user.
- Disposal tonnage was reported for the wrong wasteshed. This adjustment increased disposal tonnage for 2014 for one wasteshed; which changed the wasteshed rate of the two wastesheds involved. This did not affect the state's recovery rate.
- An error in reporting was discovered by one of the recycling processors; a large amount of newspaper was double counted in the previously published 2004 results. The paper was counted both at the processing facility and at the paper mill.
- An enforcement action carried out by Metro showed that most of the brick reported as being recycled by one facility was falsely reported. DEQ subsequently decided that brick more

closely resembled other inert materials such as cement and asphalt. Since these are not counted toward the recovery rate, brick was removed from all previous recovery tonnages.

- New information showed that corrections needed to be made to tonnages for roofing and non-container glass in 2003 and 2004, as well as other minor adjustments in other categories.
- Field visits showed that some plastic for 2005 had been reported as 'Plastic Other' and that this material was actually 'Rigid Plastic Containers.' The 2005 numbers have been adjusted for this change, along with a few other minor adjustments.
- Field visits and continued investigation showed that previously reported 'Wood Waste' collections for 2006 were actually collected in three years – 2004, 2005 and 2006. These years are now correct.
- The 2006 and 2007 plastics numbers were adjusted between grades of "Rigid Plastic Containers," "Plastic Other," and "Plastic Film." This may have led to small changes in the recovered tonnages for these materials.
- Investigation of disposal numbers at two landfills led to deductions in the amount of SW disposed – these were really Industrial Waste, non-counting for the purposes of this survey.
- Some changes were made in 2006 and 2007 to disposition of materials. Changes were made to composted, burned for energy recovery and disposed amounts.
- Adjustments were made to the 2007 collection amounts, correctly identifying the wasteshed of origin.
- For 2006 and 2007, some non-counting slaughterhouse material was deleted from the recovered tonnage.
- Sawdust material from manufacturing was deleted for 2006 and 2007.
- Beginning with 2006, material previously identified as "CD – Construction and Demolition" was separated out into individual materials.
- Textiles previously counted were determined to be re-used, which does not count for recovery. 2006, 2007, 2010 and 2011 recovered tonnage was decreased.
- Some gypsum sent for disposal was included in the 2006 and 2007 tonnage – this was removed.
- Bottle Bill materials, container glass and aluminum had better reporting for 2009, and DEQ made some adjustments to those materials for 2008.
- Municipal solid wastes from another landfill were determined to be industrial and were deleted from the 2007 and 2008 counting tonnages.
- Minor disposal adjustments were made to two wastesheds for 2006 data with incorrectly reported county of origin.
- Yard debris numbers contained a large double counting for the Metro region – the correction caused a decrease in recovered tons
- Some roofing material was deleted - it was determined to be industrial material.
- Added in disposal tonnages for 2009 and 2010 for material sent out of state for disposal.
- Corrected the disposition methods for food waste and yard debris in 2011.
- Fixed the disposal tonnages originally recorded for the incorrect wasteshed in 2011.

- An error in food waste reporting discovered by DEQ showed a large amount of food waste was double counted in the 2011 and 2012 reports. The food waste was counted both by the composting facility and by the recycling collectors.
- More accurate reporting identified corrections needed in tonnages for used oil, antifreeze, solvents and used oil filters in 2011 and 2012.
- Adjustments were made to 2013 and 2012 collection amounts, as well as correctly identifying wastesheds of origin.
- Municipal solid waste from one landfill was reported incorrectly as out-of-state waste, this adjustment increased the “counting” disposal tonnage for 2013. This in turn adjusted the state recovery rate from 54 percent for 2013 to 53.4 percent.

2023 survey report tables

List of data tables one through nine used for this report.

Table 1: Wasteshed Recovery Rates, 2023

Table 2: Amount Recovered in 2023 by Wasteshed

Table 3: Solid Waste Disposed in 2022 by Wasteshed

Table 4: Oregon Calculated Recovery Rates by Wasteshed, 1992-2023

Table 5: Oregon Amount Recovered by Wasteshed, 1992-2023

Table 6: Oregon Solid Waste Disposed by Wasteshed, 1992-2023

Table 7: Oregon Solid Waste Generated by Wasteshed, 1992-2023

Table 8: Oregon Materials Recovered, 1992-2023

Table 9: Disposition of Recovered Materials, 2023