

Oregon Wasted Food Study



Summary of Findings

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Submitted
January 15, 2019
Revised
April 22, 2019

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Acknowledgements: The authors would like to thank PSU Community Environmental Service student staffers Jennifer Stefanick and Taylor Stone, Darby Hoover of NRDC, Tom Quested of WRAP, Ashley Zanolli of US EPA, and David Allaway and Elaine Blatt of Oregon DEQ for their contributions to this study.

Executive Summary

Vast amounts of financial and environmental resources are used to produce food for human consumption. At the same time, it has been estimated that as much as 40 percent of the food grown in or imported to the US for human consumption is never eaten.¹ Reducing the amount of food that is wasted offers significant potential for economic and environmental benefits.

Wasted food, that is throwing away food that could have been eaten, is preventable. Indeed, prevention - avoiding the wasting of food in the first place - has far greater potential to reduce environmental impacts than recovery methods such as composting or anaerobic digestion. For example, The Drawdown Project² identified reducing food waste as having the third greatest potential for reducing greenhouse gas emissions worldwide, estimating a potential to reduce 70.53 gigatons of carbon dioxide equivalent, if current food waste levels were cut in half by 2050. In this country, the US EPA estimates that one ton of prevention has a greenhouse gas benefit equivalent to 6 – 7 tons of food waste recovery.

With the large scope of benefits of prevention in mind, the Oregon Department of Environmental Quality funded the Oregon Wasted Food Study in 2017 and 2018, to investigate the quantities, types and causes of wasted edible food in the state. This report brings together field studies as well as literature reviews specific to wasted food from *households*. A companion report presents the results of wasted food assessments and reduction efforts in fifteen case studies of a cross-section of Oregon food service businesses.

Households are estimated to be the largest source of food waste in the United States (ReFED, 2016), yet consumer-level food waste research is fragmented, with relatively little information about the causal mechanisms underlying the significant amount of food discarded in homes (Roodhuyzen et al, 2017). Additionally, previous studies that report household-level food waste in the U.S. tend to focus on urban areas (NRDC, 2017) or do not disaggregate urban and rural areas, which may have different causal mechanisms (e.g. ReFED, 2017). Finally, there is a recognized need to include more qualitative methods in food waste research to better understand the complex dynamics and interrelationships that contribute to the larger phenomena of wasted food (Roodhuyzen et al, 2017; Hebrok and Boks, 2017). As part of this, there also is a call to consider wasting of food as not only an individual phenomena, but also a sociocultural one which includes understanding how the larger food supply chain, sociocultural, and other factors influence decisions made at the household and individual level. Largely missing from the existing literature are policy frameworks or solutions that call for changes beyond the level of individual behavior change (Schanes et al, 2018).

¹ Wasted: How America is Losing Up to 40 Percent of Its Food from Farm to Fork to Landfill, Natural Resources Defense Council, August 2012

² For more info on the Drawdown Project see, <https://www.drawdown.org/solutions/food/reduced-food-waste>

The Oregon Wasted Food Study sought to address many of the gaps in household food waste literature in the United States. This study tracked wasted food in both urban and rural households and combined quantitative and qualitative research methods to provide a more holistic and robust understanding of how much, what, and why food is discarded by households in Oregon. Additionally, this research was structured to be comparable to research undertaken by the Natural Resources Defense Council (NRDC), in order to compare results. Lack of comparability has been widely cited as a problem in food waste research, due to differing boundaries and definitions for food waste and wasted food.

**Household Study Design In Brief –
Phases I, II, and III**

All phases: Urban and rural Oregon communities

Phase I: In-depth interviews

Phase II: Statewide phone survey

Phase III: Mixed methods

- Waste Sort
 - Curbside trash and compost sorted
- Kitchen Diary
 - Seven day record of all food discarded in household
- Pre- and Post-Diary Surveys

Primary findings of this three phase study include:

- 71% of food waste thrown away by households to all destinations (including trash, organic waste collection, home composting, down the drain, and fed to pets) could have been eaten by humans (at one point). That is, 71% of food waste is in fact “wasted food” and is a candidate for prevention.
- Although this finding is limited to food waste from households, it is remarkably consistent with statewide waste composition (sorting) of waste from all sources, which for 2016-2017 found that 68% of all food waste disposed of in mixed garbage, from all sources, was previously edible food.

Of the food waste we throw away ...



- On average, Oregon households throw away 6.3 pounds wasted food per household per week or 2.3 pounds per capita, as reported in a diary tracking activity.
- Of that, 4.9 pounds of wasted food per household per week (or 1.9 pounds per person per week) goes to trash and curbside compost. The remainder goes to disposal pathways that are not normally counted in Oregon, including in-sink disposal, home composting, and as pet food.
- Inedible parts of food, such as peels and shells, are only 29% (from diary records) or 32% (from household waste sorts) of food waste. The remainder of food waste consists of food that was edible at some point.
- Fruits and vegetables are the most commonly discarded foods that could have been eaten (wasted food), followed by prepared meals and leftovers.
- Wasting of food is common across all demographic groups evaluated. This study did not find significant differences in levels of wasted food generated according to demographic groups such as household size or type, urban or rural location, or income.
- The top three loss reasons for throwing away food were 1) food is moldy or spoiled, 2) household members didn't like or were tired of eating a food, and 3) food was not good as leftovers.
- Management problems, such as losing track of food in the fridge, and making or buying too much were top 'root' reasons that led to the more immediate reasons noted above for throwing away food. Smaller households commented in interviews that availability of only large package sizes contributed to their buying too much food.

Findings focused on behaviors and attitudes related to wasted food include:

- Planning
 - Very few participants planned most of their meals, yet most households eat similar meals each week. A majority of respondents prepare meals using what's available on hand.
 - Some behaviors associated with prevention of wasted food, such as planning, may have differential effects based on household characteristics. For instance, increased planning may reduce wasted food for some households, but potentially increase it for other households, for example those with time management and scheduling challenges.
- Shopping
 - A majority of households reported shopping for food 2-3 times per week at all types of food retailers.

- Nearly every household purchases at least some of their food at grocery stores.
- Urban households were more likely than rural households to shop at farmers' markets and spend more money eating out.
- Rural households shop more often at superstores and spend relatively more on food eaten at home. In the interviews, rural households reported not only purchasing more food and shopping less frequently, but also that some set up informal or formal sharing networks between neighbors.
- Most households use date labels for purchasing meat and dairy but otherwise, do not rely on date labels to make determinations about whether to discard food, opting instead to use a variety of approaches (smell, taste, time in the refrigerator) to make such decisions.
- In the kitchen diary study, when food was thrown out because too much was bought, it was usually because the package was too large. Many interviewees, especially single-person and small households, mentioned a "portion size mismatch" when shopping at grocery stores. Specifically, shoppers wanted smaller portions.
- Food management
 - Survey data found that most households never or rarely use a designated area in the refrigerator to store items that need to be eaten sooner. Unsurprisingly, food being "lost" in the fridge was a top reason for throwing away food (23.6%).
- Leftovers
 - The most common approach to handling leftovers is to eat them as is, for another meal. Households that have two or more adults without children were more likely to say they always eat leftovers as is (as another meal) as compared to households that only have one adult or have children under 18. Respondents in the 18-34 year age group were statistically significantly more likely to say they never or rarely eat leftovers as another meal without alteration than respondents in the older age groups.
 - Households were more likely to always prioritize eating or freezing leftovers if they spent \$100 or less on food eaten at home each week, when compared to households that spend more money on food.
 - Interviewees acknowledged that saving their leftovers reduced their guilt and anxiety related to wasting food. However, the saved food was frequently forgotten or became undesirable to eat for some other reason.
- Guilt and related beliefs

- In the phase III survey, two-thirds (68%) of respondents felt less guilty about storing leftovers than simply throwing them away, even if they are thrown out later (e.g., delayed disposal).
- About the same percentage of respondents felt less guilty about throwing out food that had been in the fridge for a long time (67.6%).
- Nearly three-quarters (71.8%) feel less guilty about throwing out food that is composted. Composting is often seen as something *different* from “wasting food.” This may represent a cognitive disconnect in how people perceive the amount of food they “waste” if they also participate in composting,
- A majority of survey respondents believe that they both *should* reduce how much food they discard while also believing that they waste less than the average American, similar to other studies (see, Neff et al., 2015).
- Adults living alone and households of 2 or more adults without children *believe* they throw out less than the average American. Yet there were no significant differences in waste generated by household types, with or without children, on a per capita basis.

Focusing on measuring food waste and improving guidance for states and municipalities:

- The amount, types, and proportions of foods wasted, as well as loss reasons, reported in the kitchen diary activity of this study are similar to a NRDC study of households in three US cities, building evidence towards a consensus in understanding household wasted food in the US context. With this knowledge, state and local governments can make more informed decisions about how to assess food waste in their communities.
- Under-reporting is common in diary tracking methods. In the Phase III kitchen diaries, households under-reported their food waste at a rate of 35% less than was found in waste sorts of curbside garbage and compost at the same households. This is slightly lower but comparable to other food waste studies (NRDC, 2017; WRAP, 2018)

In addition to the research findings, this report also provides guidance and protocols for other entities, such as local governments or other states, interested in assessing the causes, types or amounts of wasted food in their communities. This guidance is provided to help entities decide what types of measurement should be undertaken based on resource availability and study goals.

Terminology

Definitions of food waste and wasted food have been subject to repeated discussions, including commonly cited definitions by Food and Agricultural Organization of the United Nations (FAO) and the United States Department of Agriculture (USDA). To encourage transparency as described in the Food Loss and Waste Accounting and Reporting Standard³, the following terminology and definitions are used throughout the report.

Throughout this study we differentiate between ‘food waste’ and ‘wasted food.’ The edible portion of food waste, or ‘wasted food’ is differentiated because it is considered avoidable and is the target of waste prevention initiatives and interventions.

Food Waste: All food (including beverages) and associated inedible parts of food disposed of in landfills or incinerators, source separated and sent for recovery by composting and anaerobic digestion, or rescued edible food for donation or redistribution⁴. Other discard routes, including drain disposal and feeding animals, are also included. “Food waste” excludes food materials grown specifically for biofuels or animal feed.

Wasted Food: Includes only edible food and is a subset of ‘food waste.’ Edible refers to food that ‘could have been eaten,’ but was discarded due to reasons such as spoilage, food safety concerns, individual preference, or cooking knowledge. *Edible does not mean that it was safe to eat at the time of discard.* For example, moldy bread, while inedible now, was once intended for consumption and is therefore considered wasted food. In contrast, banana peels and eggshells are generally not considered edible as human food; they contribute to food waste but are not wasted food.

The difference between these two terms, and the percentage breakdown of edibility of food waste found in this study, is illustrated below:

³ More information about the Food Loss and Waste Accounting and Reporting Standard can be found at <http://www.flwprotocol.org/>

⁴ In contrast to other parts of the country, Oregon uses the term “recovery” to cover composting and anaerobic digestion, as well as diversion for industrial uses and to feed animals. Oregon uses the term “rescue” to denote food donation and redistribution to people.

Of the food waste we throw away ...



Figure 1: Food waste includes wasted food (food that could have been eaten at some point) and is often the majority of the food thrown away

Purpose & Structure of Report

In 2017, the Oregon Department of Environmental Quality (DEQ) funded a four-part study of wasted food in Oregon. One part of this study explored barriers and opportunities for waste prevention in the non-residential sector, culminating in a set of fifteen case studies of waste prevention in food service and retail settings. That non-residential element is not the focus of this report.⁵ The other three parts of the study (which are the subject of this report) focused on wasted food in Oregon households and used a mixture of qualitative and quantitative methods to identify:

- Quantities and types of edible, wasted food;
- Self-reported perceptions of reasons, barriers, and alternative behaviors in the areas of food procurement, planning, preparation and management, leftover use, and disposal that relate to the generation or prevention of wasted food;
- Knowledge and attitudes in relation to motivations to reduce wasted food in Oregon;
- Structural barriers that contribute to the generation of wasted food.

The first phase of the residential sector study was comprised of 32 open-ended interviews of urban and rural households in Oregon. Each interview lasted approximately one hour and addressed topics related to planning, shopping, storing, preparing, eating, and eventually discarding food. The results provide robust information on people’s relationship with food and how food becomes waste in households. However, these results are not representative of the State of Oregon due to the small sample size and sampling method. The results from phase I were used in subsequent phases to inform what survey questions were posed.

Phase II of the residential study was a statewide phone survey of 486 people. These results are representative of the population of the State of Oregon. The third phase was a multi-method project to collect information on total food waste generation using kitchen diaries and a sort of curbside materials coupled with a survey for 164 households. Detailed results of these three phases have been described in individual reports and can be found at <https://www.oregon.gov/deq/mm/food/Pages/Wasted-Food-Study.aspx>. See, Table 1 for a summary of research phases and sample sizes.

Table 1: Phases of Household Level Research for the Oregon Wasted Food Study			
	Phase I: Interview Study	Phase II: Statewide Phone Survey	Phase III: Mixed Methods Household Measurement

⁵ A separate report on those case studies is posted on DEQ’s website at <https://www.oregon.gov/deq/mm/food/Pages/Wasted-Food-Study.aspx>

Table 1: Phases of Household Level Research for the Oregon Wasted Food Study

<p>Methods and Sample</p>	<p>Open-ended interviews with 32 households about planning, shopping, preparing, eating, and eventually discarding food</p> <p>Included both urban and rural Oregonians</p>	<p>Statewide phone survey of 486 people on attitudes and behaviors related to wasting food</p> <p>Included both urban and rural Oregonians</p>	<p>230 participants had their curbside trash (and organic waste, where applicable) sorted and weighed</p> <p>182 participants completed seven days of a kitchen diary to record all food discarded in households, including drain disposal and feeding animals</p> <p>216 participants completed a pre-diary survey, and 184 completed a post-diary survey of attitudes and behaviors related to wasting food</p> <p>164 households completed all four activities (waste sort, diary, and two surveys)</p> <p>Included both urban (3) and rural (2) Oregon communities</p>
<p>Notes</p>	<p>Not statistically representative of statewide Oregon population</p>	<p>Representative of statewide Oregon population</p>	<p>Not statistically representative of Oregon statewide population</p> <p>Self-reported kitchen diaries are known to result in underreporting</p>

This report brings these three phases together to provide a synthesis of findings across both qualitative and quantitative research methods. The report is structured to first provide background on the issue of food waste. The next section starts with a comparison of phase III findings with findings from similar studies performed by the Natural Resources Defense Council (NRDC) and Waste Reduction Action Programme (WRAP). This is followed by a

synthesis of the qualitative and quantitative results describing attitudes, behaviors, and knowledge related to discarding food in households. The final section provides insights and protocols for measuring and evaluating food waste to be used by other cities or researchers.

Background

Global Focus on Wasted Food

Globally, it has been estimated that one-third of edible food produced for human consumption is wasted (Gustavsson et al., 2011). In the United States and other Western countries, a majority of wasted food is generated at the consumer-level (Gustavsson et al., 2011; Buzby et al., 2014). The U.S. Department of Agriculture estimates that 21% of the available food supply becomes wasted food at the consumer-level, which includes households, institutions, and the food service sector (Buzby et al., 2014). ReFED⁶ used WRAP and USDA⁷ data to estimate that over 40% of food wasted in the supply chain in the U.S. is generated by households (ReFED, 2016). Given the evidence that a significant portion of wasted food is generated in households, there is an increasing focus on preventing food from being wasted in the first place. Notably, the United Nations adopted Sustainable Development Goal (SDG) 12.3 which sets the goal of reducing retail and consumer level wasted food by 50% by 2030.⁸ The United States Environmental Protection Agency EPA and USDA jointly adopted this goal.⁹ It should be noted that the UN goal only includes the edible portion of food waste, or wasted food, thus **the focus is on wasted food prevention, not diversion from landfill via composting or digestion.**

Prioritizing Prevention

Understanding how to **reduce the generation of wasted food** is the primary priority of this study. Oregon's Wasted Food Hierarchy (Figure 2) illustrates that source reduction (reduction of the generation of wasted food also called "wasted food prevention") is the most preferable outcome before rescue (i.e. donation), use for animal feed, recovery of energy or nutrients through anaerobic digestion or composting, or landfilling. Management methods at the top of the hierarchy, including source reduction, feeding hungry people and animals, are generally aimed at edible parts of food. Lower management methods are applicable to food waste generally. Source reduction is the highest priority as the majority of economic and environmental impacts associated with wasted food happen before consumption, during the production, processing, transportation, storage and preparation of food. For example, the greenhouse gas impact of producing foods purchased by Oregon consumers is almost 60 times higher than the impacts from landfilling food waste (10.73 million metric tons CO₂e in 2015 for production vs. 0.18 million metric tons CO₂e from

⁶ ReFED is a multi-sector stakeholder group that has identified 27 opportunities to reduce wasted food in a *Roadmap to Reduce U.S. Food Waste*. More information about ReFED can be found at <https://www.refed.com>

⁷ USDA data includes food eaten away from homes. This means that the USDA study considers post-consumer food waste in consumer facing businesses as generated by households, something no other studies assume.

⁸ <https://www.un.org/sustainabledevelopment/sustainable-consumption-production/>

⁹ <https://content.govdelivery.com/accounts/USDAO/bulletins/11a2c78>

disposal).¹⁰ Focusing on interventions downstream of consumption (such as donation or waste recovery) does not prevent these upstream costs. However, post-consumption interventions will be key to reducing the disposal impacts of the inedible fraction of food waste, along with any wasted food that is not prevented.

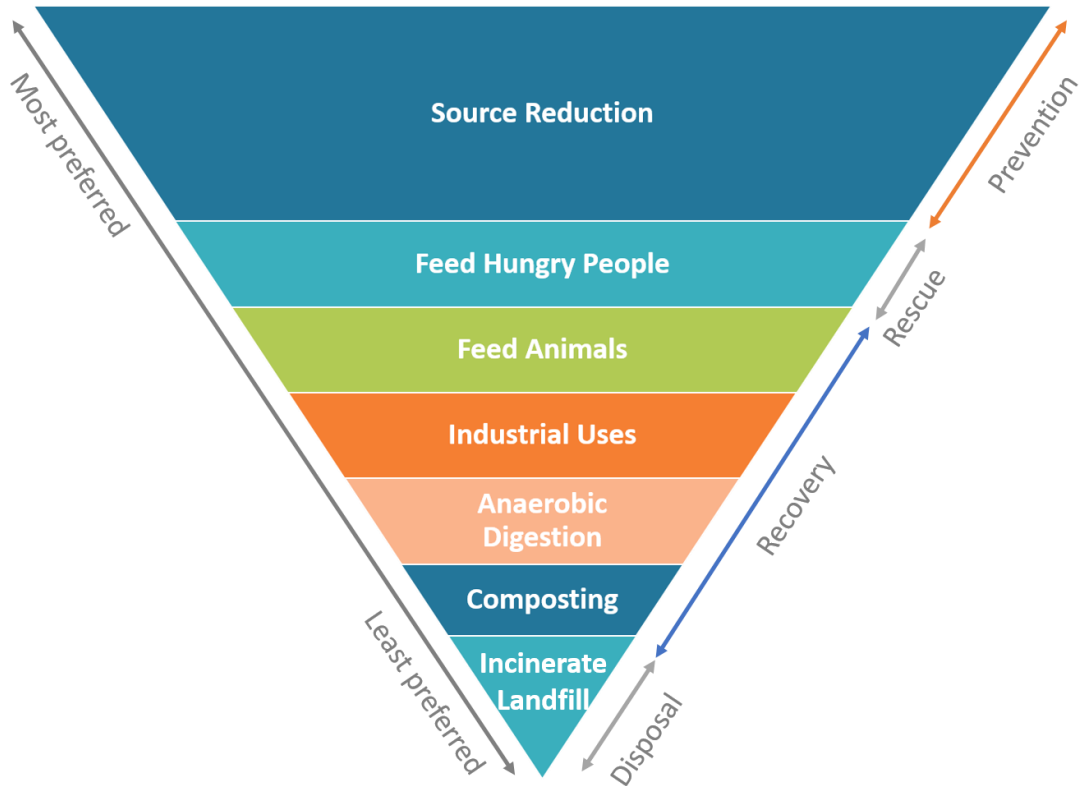


Figure 2: Wasted Food Hierarchy, from waste prevention to landfill disposal, with elements higher in the pyramid being economically and environmentally preferable to the lower elements.¹¹

Understanding What, How Much, and Where: Research Gaps & Methods

While it is relatively well established that households are one of the largest, if not the largest, contributors of wasted food in the U.S., there is less information on the details of what, how much, and where food is discarded. Traditional waste composition studies are relatively common, but tend to provide information at aggregate levels of total food or total organics

¹⁰ Table B-2 in Appendix B of Oregon GHG Emissions Inventory Report: <https://www.oregon.gov/deq/FilterDocs/OregonGHGreportAB.pdf>

¹¹ Oregon Department of Environmental Quality

disposed. Until very recently, most waste composition studies also have not distinguished inedible food waste from wasted food. Waste composition studies also do not capture all potential discard destinations -- most notably absent is information on drain disposal, home composting, and feeding wasted food to animals or pets.

Other estimates of household food waste use modeling or proxies to estimate amounts of wasted food. For example, the USDA estimates wasted food at the retail and consumer levels in the United States using their Loss-Adjusted Food Availability (LAFA) data series. The USDA derives this data from their Economic Research Services' food availability data to get a more accurate estimate of actual food intake. Food availability data is taken from government and private sources on raw and semi-processed agricultural commodities.¹² While this estimate theoretically includes all discard destinations, it does not estimate where food is discarded. Additionally, data is provided by commodity type, but food discarded at the consumer level is often a mixture of multiple commodity types. For instance, a discarded pasta dish could be a mixture of many commodity types including grains, fruits, vegetables, meats, and oils. At the household level, this level of information is not as useful as more highly categorized data for understanding the social and physical structures and behavior norms that enable wasted food inside or outside the home. Furthermore, more localized and detailed information could be useful for designing interventions to reduce wasted food as well as to assess programs over time at a community or state-wide scale.

To obtain more detailed information on wasted food in households, kitchen diaries can be used to track food discarded in households for short amounts of time. Kitchen diaries have many benefits compared to other wasted food measurement methods, including the ability to track discard destinations and loss reasons by specific food item. Drawbacks to using kitchen diaries include cost and underreporting bias, and short reporting periods can make extrapolation difficult due to seasonal and other differences (see, the section *Measuring & Evaluating Food Waste and Wasted Food: Insights and Protocols* of this report for more detailed information on methods).

Understanding Why: Research Gaps & Methods

Even less is known about the underlying factors and causes of wasted food at the household level.¹³ Focusing on consumer level behavior is common in wasted food research, especially

¹² For more information on sources of USDA's food availability data see, <https://www.ers.usda.gov/data-products/food-availability-per-capita-data-system/food-availability-documentation/#data> and uses and history of LAFA <https://www.ers.usda.gov/data-products/food-availability-per-capita-data-system/food-availability-documentation/>

¹³ For a full review of findings in the consumer food waste literature, see Schanes et al. on planning (3.3.1), shopping (3.3.2), storing (3.3.3), cooking (3.3.4), eating (3.3.5), managing leftovers (3.3.6), assessing edibility (3.3.7), disposal (3.3.8), and differences between socio-demographic groups (3.4). Limits of this review include that it omits much of the "grey", non-academic literature, many of the studies reviewed use self-reported measures, which can give spurious

focusing on increasing knowledge or sharing information about tips and tricks to reduce wasted food in household kitchens. However, there is a call to look at larger food and consumption systems, beyond the individual, to better address the issue of wasted food in households (Schanes et al, 2018). The location where food is discarded should not be conflated with the cause of discard. More specifically, for this study, it should not be assumed that individuals in the household are solely responsible for all food discarded in households. Rather, wasting food is a complex behavior influenced by many interacting factors, including choices made previously in the food supply chain (e.g., packaging or portion size), structural contexts (e.g., access to a car for food shopping), and sociocultural factors (e.g., perceptions of good food) (Hebrok and Boks, 2017; Roodhuyzen et al, 2017). A better understanding of leverage points along food supply chain as well as structural factors is needed to identify interventions upstream of the consumer (e.g., packaging or retailing changes) that could help reduce the generation of wasted food at the household-level, generation being defined as the total amount of all wasted food sent to all disposal destinations, including composting and anaerobic digestion (Schanes et al, 2018).

Qualitative research methods, such as open-ended interviews and focus groups, can help provide a deeper understanding of complex purchasing, preparation, storage, consumption and disposal behaviors associated with wasting food. Many of these behaviors can become ingrained or automatic and, once habituated, can become difficult to change (US EPA, 2016). Quasi-ethnographic methods, such as shop-alongs or in-home visits, provide a unique view into behaviors associated with discarding food because the researcher can observe behaviors as they are influenced by others and their surroundings (Hebrok and Boks, 2017).

results, and does not review the potential variation of behaviors in demographic groups by culture or country of residence.

Findings

The Oregon Wasted Food Study utilized open-ended interviews, kitchen diaries, waste sorts, and surveys to explore what, how much, and why food is discarded in Oregon households. The methods and questions explored grew from findings in both in academic publications and non-academic reports¹⁴ on the levels and drivers of wasted food. Studies from the US, UK, and EU suggest that key contexts, structures, sets of knowledge and behaviors contribute to the high levels of wasted, edible food. Specifically, the following topics related to wasted food were explored:

- Procurement (Shopping)
- Planning
- Leftovers
- Disposal
- Food Use, Preparation, and Management

In this section, we bring together significant findings from the Oregon residential wasted food study and compare them to other major studies. The first part compares results from the waste sort and kitchen diary methods with a previous waste composition study for the State of Oregon. The second part compares quantitative results of the Oregon Wasted Food Study with studies done by the Natural Resources Defense Council (NRDC) in Nashville, Denver, and New York City and the Waste Reduction Action Programme (WRAP) in the UK.¹⁵

¹⁴ Main sources include the Natural Resources Defense Council (NRDC), Waste Reduction Action Programme (WRAP), EU FUSIONS, BioCycle, and ReFED.

¹⁵ WRAP is a UK organization that conducts applied research to improve resource efficiency with a campaign focused on reducing wasted food.

Oregon’s Estimates of Wasted Food

As part of phase III of the residential study, waste from 230 households¹⁶ in Oregon was sorted to better understand the presence of wasted food in household curbside trash and curbside organics (compost) carts.¹⁷ It was found that **edible food made up 68% of food thrown away. On average, households threw out 4.9 pounds of edible food per household or 1.9 pounds per person per week to trash and compost.**

In the diary tracking method, the percentage of edible food thrown away was similar, accounting for 71% of all food waste thrown away. This resulted in an estimated 6.3 pounds of wasted food per household per week or 2.3 pounds per capita (See, Table 2).

In Brief – Study Phase III
Urban and rural Oregon communities

Waste Sort

- 230 households had their curbside trash sorted
- 58 of these households had compost sorted

Kitchen Diary

- 182 households completed seven days of a kitchen diary to record all food discarded

Pre and Post-Diary Surveys

- 164 households completed waste sort, diary, and two surveys

Table 2: Weight of Wasted Food (in pounds) in Waste Sorts and Diaries for One Week, Oregon Wasted Food Study

	Waste Sort ¹		Diary ²	
	Garbage & Compost only	All discard destinations	Garbage & Compost only	
Total Edible Food (% of Total Food) ³	68%	71%	68.6%	
Mean Food Waste Per Household	7.1	8.9	3.2	
Mean Edible Food Per Household	4.9	6.3	4.1	
Mean Food Waste Per Capita	2.9	3.3	2.5	
Mean Edible Food Per Capita	1.9	2.3	1.5	

¹ Waste sort: Household n = 230. Per capita n = 535. Curbside collection includes landfill/incinerator bound waste, and compost where available.

² Diary: Household n = 182. Per capita n = 493 household members. All discard destinations include landfill/incinerator bound waste, curbside collected compost where available, home and other compost, down the drain, fed to pets, and other destinations.

³ Percentage of edible food is based on total weights of food. It is not calculated using mean household or per capita weights.

¹⁶ Waste sort: Household n = 230. Per capita n = 535. Curbside collection includes landfill/incinerator bound waste, and compost where available.

¹⁷ Please see the *Measuring & Evaluating Food Waste and Wasted Food: Insights and Protocols* section of this report for additional guidance on measurement.

As expected, kitchen diaries result in a higher total estimate of wasted food because, unlike waste sorts, they include food discarded to all destinations (trash, compost, home compost, down the drain, fed to animals and other). Edible food disposed to trash and curbside compost was lower in weight in the diary, 4.1 pounds per household or 1.5 pounds per capita. However, again, the ratio of edible food to total food waste was nearly the same (68.6%). The difference in weight represents a tendency for underreporting in the diary method, in this study.¹⁸ Similar tendencies have been reported in previous studies (e.g., NRDC 2017; UK WRAP 2015). However, the fairly consistent estimate of food considered ‘edible’ across all methods may suggest that while kitchen diaries result in underreporting by total weight, they may be fairly accurate in terms of proportion considered edible or inedible.

Table 3 shows that the proportions of food types within wasted food are also similar, between waste sorts and diary methods in the Oregon study.

Table 3: Household Food Waste in Oregon by Food Category, 2017 Diary and Waste Sort Data

% of Food Waste	Oregon Wasted Food Study Diary	Oregon Wasted Food Study Waste Sort
Inedible	29%	32%
Fruits & Vegetables	28%	24%
Baked Goods	4%	12%
Meat & Fish	4%	8%
Prepared Foods & Leftovers	16%	7%
Liquids, Oils, Grease	8%	6%
Snacks, Condiments, Sauces	3%	4%
Dry Foods	5%	2%
Dairy & Egg	2%	2%
Unidentifiable ¹	n/a	2%
Per capita edible (pounds/week)	2.3	1.9
Per capita inedible (pounds/week)	1.0	1.0

Percentages do not add up to 100% due to rounding.

Diary data are for *all disposal destinations*: garbage, curbside compost, home and other compost, fed to pets, down the drain, and other. Diary data were *not* adjusted for underreporting.

Waste sort data are for curbside garbage and compost streams only.

Both diary and waste sort methods measured a seven-day period.

¹⁸ Per capita and household means for food thrown away, tracked with the diary method, and the method for determining diary reporting rates and resulting rates in the Oregon Wasted Food Study are reported in detail in the *2017 Oregon Wasted Food Study: Residential Sector Waste Sort, Diary, and Survey Study*. You can find this at <https://www.oregon.gov/deq/mm/food/Pages/Wasted-Food-Study.aspx>.

The diary method also allows identification of specific food items. The top wasted edible food items recorded in the Oregon study are listed in Table 4 below:

Table 4: Top Wasted Edible Foods in Oregon Wasted Food Study, from Diary Tracking for 182 households for One Week

	Wasted Food	Equivalent to....
1	Unidentifiable edibles	--
2	Soup	103 servings
3	Coffee	64 cups
4	Milk	96 glasses
5	Red meat dish	--
6	Bread	41 loaves
7	Non-meat dish	--
8	Beans	103 servings
9	Potatoes	52 potatoes
10	Mixed fruits & vegetables	--

Reference amounts derived from the US Food and Drug Administration Reference Amounts Customarily Consumed (RACCs) Guide. Retrieved from:

<https://www.fda.gov/downloads/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/UCM535370.pdf>

Servings of soup = 245 g or approximately 8 fl oz

Cups of coffee = 12 fl oz

Glasses of milk = 8 fl oz

Servings of beans = 130 g per serving or .5 cup of cooked beans

Loaf of bread = 1 lb (Derived from standard size in retail)

One potato = 8 oz (average size of a medium potato), Derived from <https://idahopotato.com/uploads/media/IPC-carton-count-size-guide.pdf>

Types and Levels of Wasted Food: Comparison to Other Studies

Selected results of the Oregon Wasted Food Study are compared below to results from a NRDC study of over 600 households in Nashville, Denver, and New York City (Hoover & Moreno, 2017a) as well as 2012 results from research by WRAP of households in the UK as re-stated in their 2018 report (Gillick & Quested, 2018). Both of these studies, like the Oregon Wasted Food Study, used similar methods, employing a combination of kitchen diaries, waste sorts, and surveys. The categories used in the NRDC study were intentionally replicated in the design of the Oregon Wasted Food Study to allow for comparison. In order to understand key similarities and differences, total estimates of food waste, including breakdowns by food type and loss reasons, are compared for all three studies.

Table 5: Comparison of Methods for Oregon Wasted Food Study, NRDC, and UK WRAP

	Oregon Wasted Food Study Diary	Natural Resources Defense Council (NRDC)	UK Waste Reduction Action Programme (WRAP)
Main Methods	Kitchen diaries, surveys, waste sorts	Kitchen diaries, surveys, waste sorts	Kitchen diaries, surveys, waste sorts
Discard Destinations	Curbside trash, curbside compost, home compost, drain disposal, feeding animals	Curbside trash, curbside compost, home compost, drain disposal, feeding animals	Curbside trash, curbside compost, home compost, drain disposal
Year of Study	2017	2015/2016	2012
Underreporting Rate in Diary	35%*	47%**	40%
Geographic Area	Urban and rural Oregon	Nashville, TN Denver, CO New York City, NY	United Kingdom

*The underreporting rate for this study was calculated using data only from households that participated in both the diary and waste sort portions of the study.

** In the NRDC Study comparing kitchen diaries to household-level waste audits showed an underreporting rate of 47% (Hoover & Moreno, 2017a). As there are several different methods of calculating underreporting, the NRDC study underreporting rate was calculated using a slightly different method than the one used by this study. If the NRDC underreporting rate is recalculated using the same method as this study, the result is an underreporting rate of 36%, comparable to the figures in this study (Conversation with NRDC, unpublished data).

The percentages of food types assessed in this study are compared to the NRDC (2017) and WRAP data (2012) below, see, Table 6. Inedible food makes up the highest proportion of food waste in all three studies, with all studies reporting it at around 30% of total food waste, followed by fruits and vegetables, accounting for 24 to 28% across the three studies.¹⁹ The most notable difference is in prepared foods and leftovers, where the Oregon and NRDC studies report similar percentages, but where WRAP’s findings in the UK are much lower. This may be accounted for by a wider availability of smaller portion size options for prepared foods in the UK or a difference in the definition for “All Other Foods” in the WRAP data which may overlap with Oregon and NRDC definitions of prepared foods and leftovers.

¹⁹ Oregon results using the waste sort method were similar, documented in the *2017 Oregon Wasted Food Study: Residential Sector Waste Sort, Diary, and Survey Study*. Inedible parts of food were the largest category of food type thrown away to trash (landfill/incinerator stream), constituting 27% of the food thrown away. Fruits and vegetables were the next largest type, and the largest amount of edible wasted food at 22.8%. Prepared foods and leftovers were the second largest edible category, at 14.3%.

At the aggregate level, the quantity and kinds of food thrown away and the amount of wasted food, both edible and inedible, are comparable for all of these studies (see, Table 6). Some of the more notable differences may be attributed to differences in definitions of food categories used in the UK study versus the US studies, e.g., prepared foods and leftovers and unidentifiable. Overall, this suggests that the structures that promote the wasting of food and the behaviors of Oregonians may be similar to others in the US and UK. It should be noted that differences in regulation, culture, and other factors likely result in different underlying causes or potential areas for intervention, even if results are similar. Additionally, there may be significant differences in measurement outcomes as a result of seasonal differences, which have not been explored in any of these studies.

Table 6: Comparison of Per Capita Proportions of Total Household Food Waste by Food Category for Three Datasets

% of Food Waste	Oregon Wasted Food Study Diary (2017)	NRDC Diary (2015/16)	UK WRAP Diary (2012)
Inedible	29%	31%	30%
Fruits & Vegetables	28%	27%	24%
Baked Goods	4%	4%	8%
Meat & Fish	4%	4%	4%
Prepared Foods & Leftovers	16%	19%	6%
Liquids, Oils, Grease	8%	6%	11%
Snacks, Condiments, Sauces	3%	2%	n/a
Dry Foods	5%	1%	n/a
Dairy & Egg	2%	5%	6%
Unidentifiable ¹	n/a	<.01%	11%
Per capita edible (pound/week)	2.3	2.5	3.1
Per capita inedible (pound/week)	1.0	1.0	1.4

Percentages do not add up to 100% due to rounding.

Oregon Wasted Food Study: Diary data from 2017 are for all disposal destinations: garbage, curbside compost, home and other compost, fed to pets, down the drain, and other. Diary data were *not* adjusted for underreporting.

NRDC: Kitchen diary data from household in 2015/16 in three cities (Denver, NYC, Nashville) including inedible and edible portions as well as all discard destinations. NRDC diary data was adjusted to account for underreporting.

UK WRAP: Kitchen diary data from households in 2012 (as restated in their 2018 report) including inedible and edible portions of food collected at the curbside, drain disposal, and home composting. "Meals" in the WRAP report was used as equivalent to "Prepared Foods & Leftovers." "Drink" in the WRAP report was used as equivalent to "Liquids." The WRAP category of "All Other Food and Drink" was classified as "Unidentifiable." WRAP diary data was adjusted to account for underreporting.

Diving deeper into specific, wasted edible foods, the diary method allows us to identify the top ten foods thrown away, by weight. Table 7 shows the top ten wasted edible foods thrown away over seven days by 182 participant households in Oregon compared to the top wasted foods found by NRDC (Denver only) and WRAP. While the per capita estimates of wasted food were similar for all three studies, the top 10 most wasted items were not as comparable. Potatoes, bread, and milk showed up on all three lists. Red meat items (e.g. red meat dish and pork) as well as other vegetables (e.g. salad, carrot) also showed up on every list. In both studies conducted in the U.S., coffee and soup made the top 10 list, but not in the UK. This might suggest that while there are similarities between Western countries such as the U.S. and U.K., there are also differences, resulting in the two U.S. studies being more comparable.

Table 7: Comparison of Top Edible Wasted Foods for the Three Household Studies

Rank	Oregon Wasted Food Study Diary (2017)	NRDC Diary- Denver (2015/16)	UK WRAP Diary (2012)
1	Unidentified edibles	Coffee (Liquid)	Potatoes (Fresh)
2	Soup	Milk	Bread
3	Coffee	Bread	Milk
4	Milk	Chicken	Composite Meal
5	Red Meat Dish	Potatoes	Carbonated Soft Drink
6	Bread	Apple	Fruit Juice and Smoothies
7	Non-Meat Dish	Soup	Pork/Ham/Bacon
8	Beans	Pork	Poultry
9	Potatoes	Salad	Carrot
10	Mixed Fruits & Vegetables	Pasta	Potato (Processed)

*Top wasted foods list are not completely comparable due to slightly different classifications of food.

Oregon Study: In kitchen diaries, participants were asked to record one food item at a time, including a description that researchers then used to create standardize food names. If a participant recorded several food items together or omitted a complete description, researchers coded the entry as a composite category (e.g., unidentifiable edibles, red meat dish, and mixed fruits and vegetables).

NRDC: Kitchen diary data from household in 2015/16 Denver including all discard destinations. See NRDC report to see Top 10 Lists for Nashville and New York City.

Table 8 shows the breakdown of food waste by loss reason for households in Oregon compared to the results from the study conducted by NRDC. In both studies, the top loss reason is food going moldy or being spoiled, representing approximately one-third of edible food being thrown away.

Table 8: Comparison of Breakdown by Loss Reasons for Two Datasets

Household Loss Reason	% of Wasted Edible Food	
	Oregon Wasted Food Study Diary (2017)	NRDC Diary (2015/16)
Moldy/Spoiled	32.1%	36%
Don't like/tired of eating	16.4%	9%
Not good as leftovers	14.1%	20%
Other	10.2%	4%
Past date	8.4%	7%
Too little to save	7.8%	7%
Worry about illness	7.4%	n/a
Contaminated¹	1.4%	n/a
Damaged (stale, soggy, freezer burned)¹	1.1%	n/a
Improperly cooked	1.0%	<1%
Unrefrigerated too long¹	<0.1%	13%

Percentages do not add up to 100% due to rounding.

¹ Contaminated, Damaged, and Unrefrigerated too long are post-hoc categories, created from analyzing participant submissions for 'Other'. 195 Remaining 'Other' reasons did not have text explaining them and these entries make up the category 'Other' in the table above.

Oregon Wasted Food Study: Diary data from 2017 are for all disposal destinations: garbage, curbside compost, home and other compost, fed to pets, down the drain, and other.

NRDC: Kitchen diary data from household in 2015/16 in three cities (Denver, NYC, Nashville), excluding items that were identified as "inedible" by respondents. "Don't want as leftovers" in the NRDC report was considered equivalent to "Not good as leftovers." "Doesn't taste good" was considered equivalent to "Don't like/tired of eating." n/a indicates that this category was not included in describing loss reasons.

WRAP also assessed loss reasons in their diary study but used only four reasons plus an "other" category, making it not possible to directly compare these findings to the Oregon study. Reasons for throwing food away in the UK as reported in the 2012 WRAP results are presented in Figure 3 below.

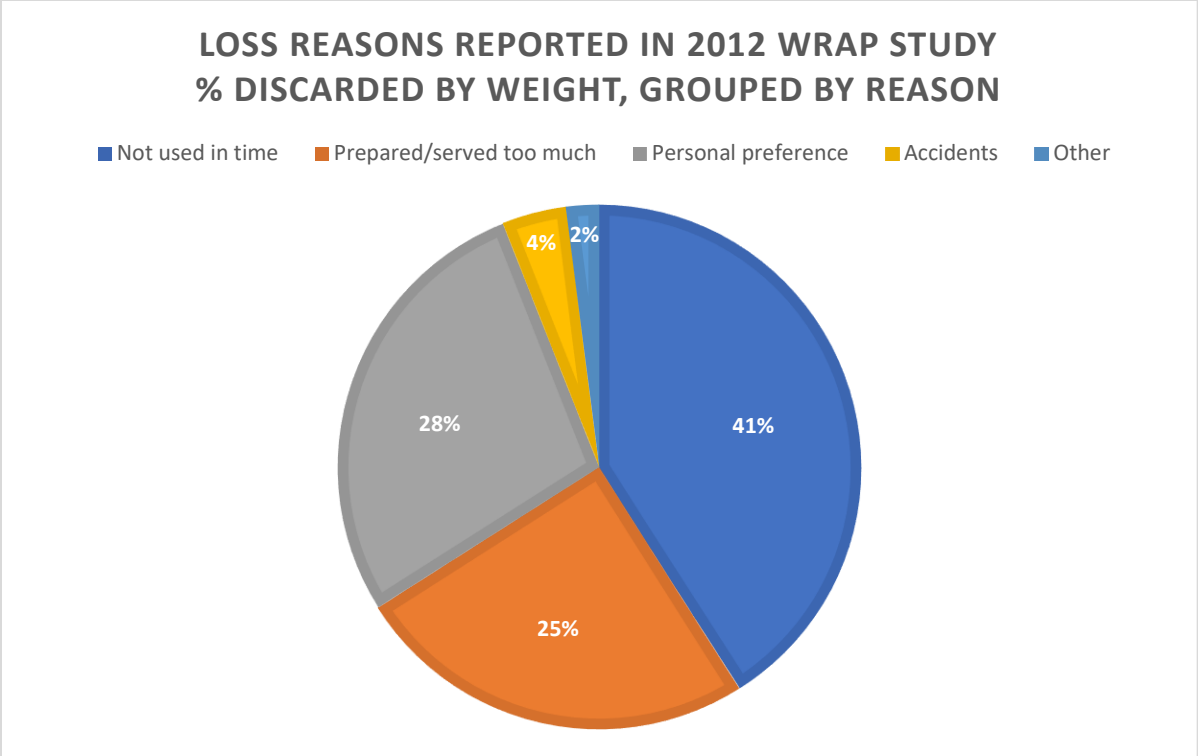


Figure 3: Loss Reasons in 2012 WRAP Study

While the categories in the WRAP Study are not exactly the same as those used in the Oregon and NRDC studies, “not used in time” is likely comparable to “moldy/spoiled” and is the most significant loss factor across all three studies. In the Oregon Study, we conducted further analyses of aggregated categories, for both immediate loss reasons and the “root” loss reason that led to the immediate loss reason closer to the actual point of disposal. Management problems, such as losing track of food in the fridge were cited most often as the root loss reason for food thrown away due to a “yuck factor,” which included “moldy/spoiled.” “Making or buying too much” was the second most common cause of food falling into the “yuck” category. These studies taken together may point to how these different loss reasons may work together to generate wasted food; for example, making too much can contribute to losing track of food and not using it in time.

One anomaly among the datasets is the much lower percentage of respondents reporting “don't like/tired of eating” in the NRDC study as compared to the percentage reporting this response in the Oregon Study and those counted in WRAP's personal preference category.

A final similarity between Oregon, NRDC, and WRAP is the respondent-reported impact of participating in a study tracking their discarded food. As cities and states consider using kitchen diaries to help their citizens identify and track their wasting of food, it is notable that the diary tool appears to have a split effect. Forty-five percent of Oregon Study participants (post-diary survey) reported they waste more food than they realized, while 33% of Oregon Study participants (post-diary survey) reported the exact opposite, that they realized they

waste very little food and are good at managing food. This mixed experience is consistent with NRDC and WRAP findings (Hoover & Moreno, 2017b; Quested & Luzecka, 2014). As noted earlier, the diary does appear to motivate people to want to plan more meals, and they report that they eat more of their leftovers, though more research is needed to understand whether these intentions and behaviors (e.g., wanting to plan more meals and the actual planning of meals), and in what contexts, actually reduce wasted food.

Synthesizing Qualitative and Quantitative Results in the Oregon Wasted Food Study

The Oregon Wasted Food Study began with a set of interviews to collect qualitative data on the contexts for wasted food in Oregon and to inform the development of the surveys used in the subsequent phases of the residential sector study. The study included three surveys – a state-wide phone survey conducted in phase II and pre-diary and post-diary surveys conducted as part of phase III.²⁰ The pre-diary survey replicated the questions in the phone survey. The post-diary survey included a few new items to assess any change in attitudes or knowledge due to the diary as well as to collect feedback on the diary exercise itself.

The data collected in the statewide phone survey and pre-diary survey were combined to allow for an analysis of demographic groups that were too small for analysis in each survey independently. Data was weighted on three variables: household type, urban/rural classification, and age group of respondents. The recruitment and sampling methods for the phase II and III surveys were very different. Phase II recruited households randomly using a sample of phone numbers. Phase III recruited households on specific waste hauling routes in five sites. This approach yielded findings in all areas studied in the surveys (e.g., procurement, planning, etc.), reported below. We would like to note that combining the data of two samples recruited in such different ways and whose data was collected differently does introduce a potential for error due to selection bias. Testing for differences between the two samples, we found that they did differ significantly by age, gender, and education level. The samples also did not differ in terms of household type or income. Since the three variables that differed were individual level, not the household level, these differences between a statewide random sample and a non-random, site constrained sample are not surprising. The two household level demographic variables were not significantly different between the two samples which is a positive finding as the study was done at the household level. Tables of results of these statistical analyses from the combined surveys can be found in the appendix and are described below, where relevant. Results of the surveys individually can be found in detail in the previously published reports on phases II and III.

In this section, quantitative results from the kitchen diaries and phase II and III surveys are synthesized with qualitative results from the interviews to provide a more robust explanation of behaviors relating to discarding foods and potential areas for intervention. While the qualitative interviews are not intended to be generalized to a broad population, they provide insights into the survey results and the underlying mechanisms behind some behaviors. Combining quantitative findings with qualitative results helps provide a more robust picture of how and why food is discarded in households in order to provide more insight into prevention opportunities and broaden engagement beyond a limited focus on alternative

²⁰ Complete results of phase II reported in the *2107 Oregon Wasted Food Statewide Phone Survey* and phase III pre- and post-diary surveys are reported in the *2017 Oregon Wasted Food Study: Residential Sector Waste Sort, Diary, and Survey Study*. Both can be found at <https://www.oregon.gov/deq/mm/food/Pages/Wasted-Food-Study.aspx>

disposal options. Combining quantitative and qualitative results is relatively uncommon in food waste research.

To help organize this section, it is split up by food-related behavior or topic: planning; shopping for food; food management and storage; food preparation and use; leftovers; beliefs and attitudes; and areas for future research.

Planning

“Better” planning is often suggested as a strategy to reduce wasted food, assumed to reduce over-purchasing or ensure that all food items are eaten. Planning behaviors include planning meals ahead of time, estimating quantities of items needed prior to shopping, checking to see what is already on hand, and making shopping lists. A majority of respondents in both phase II and III surveys reported that they check their supply of food to estimate quantity needed before shopping. Of those who don’t, a majority in the phase III survey would like to do this more. Using the combined sample of the phase II and III surveys, it was found that respondents in the 35-64 year and 65 years and older age groups were more likely to report often or always checking to see what they already have before going shopping as compared to respondents in the 18-34 year age group. Single adult households also were more likely to report that they always estimate how much of each item they need to buy before shopping for food as compared to other household types. Notably, participation in the kitchen diary seemed to have an impact on respondent desires to plan, with the proportion of those who did not estimate quantities but would like to plan more increased significantly, from 66.1% to 81.5%, after tracking wasted food with the diary.

Very few participants in either the phase II or III survey planned almost all of their meals, yet most households eat similar meals each week. Respondents in the 18-34 year age group in the combined survey sample reported that they plan meals ahead of time less often than the older age groups. The majority of all respondents in both surveys prepare meals using what’s available on hand.

The desire to plan shopping trips and meals more frequently was also explored in the open-ended interviews. Those interviews found that many households aspire to plan more or better, linking planning to saving money and time, eating healthier, and wasting less food. For some households, planning was very successful in accomplishing their goals. For others, however, adhering to the plan was not always easy, given a person’s lifestyle, stress, need for convenience, available resources, and other factors. If the plan is not adhered to, it could actually lead to more waste. For example, a household that has an unpredictable schedule may not be able to rigidly plan all meals beforehand. If they do, some planned meals may go uneaten, due to unplanned eating out or other changes in schedules. This concept is also supported in the combined survey sample with respondents in the 18-34 year age group agreeing more often that “work and social life can make managing food at home difficult, leading to food going uneaten” than the other two age groups, with the 65 years or older age

group more often disagreeing. Further research is needed to understand how factors such as habits, lifestyles, and internal household dynamics affect planning and wasted food.

Shopping for food

Food shopping behaviors are commonly recognized as an important area for intervention to prevent over-purchasing, and thus reduce wasted food. In both the phase II and III surveys, the majority of households reported shopping for food 2-3 times per week at all types of food retailers, and nearly every household purchased at least some of their food at grocery stores. Notably, shopping behavior was one of the only areas that showed a significant difference between urban and rural respondents. Urban households are more likely to shop at farmers' markets and spend more money eating out. Rural households shop more often at superstores and spend more on food eaten at home. These results are supported by interview findings that rural households not only purchased more food and shopped less frequently, but also that some set up informal or formal sharing networks between neighbors. These combined findings likely point to contextual and structural differences in urban and rural settings – more farmers' markets are held in urban areas and there are more restaurants in cities, while in rural areas, distances to food stores are greater and stocking up at a superstore, where available, can reduce the number of shopping trips. Additionally, the increased role of sharing networks in rural areas may indicate different sociocultural structures that could provide different opportunities for intervention than in urban areas.

There were several findings that can help retailers understand how packaging, labeling and appearance can contribute to wasted food. The phase II and III surveys found that a majority of households said they use date labels when shopping to determine their choices for meat and dairy, but otherwise, do not use date labels often. Looking at demographic differences, combined survey respondents in the 18-34 year age group were less likely to agree that “date labels are a key source of information when they purchase dairy and meat” than older age groups (see, Table 18 in appendix). However, overall, most households do use date labels for purchasing meat and dairy, and this finding was also echoed in the open-ended interviews where many respondents considered date labels mainly when choosing a specific item to purchase (i.e., they would choose the milk with the latest date to maximize its shelf life). When deciding whether to throw away items, most interviewees noted the date label as just one of multiple sources of information (e.g., smell, time in fridge) that they used. Another finding in both phase II and III surveys related to purchasing choices is that the majority of households opt for purchasing fruits and vegetables without blemishes.

According to kitchen diary findings, when food was thrown out because too much was bought, the most frequently cited reason for why too much was bought was that the package was too large. Additionally, the phase III survey showed that people who spend less on food are less likely to buy it in larger quantities, pointing to a potential intersection between spending less or having less money available to reducing waste produced by purchasing too large portions of food. Many interviewees, especially single-person and small households, mentioned a “portion size mismatch” when shopping at grocery stores. Specifically, the

portion the shoppers wanted was not available and generally resulted in the over-purchasing of food. For many households, this over-purchased food would regularly go uneaten. Additionally, several interviewees mentioned the size of fruits and vegetables as a key factor in choosing a specific food item and linked it to waste. Generally, interview respondents expressed a preference for smaller items because they were a better portion size for eating and helped prevent the habitual wastage of food items. For example, larger apples were noted as regularly resulting in a portion of them not being eaten, whereas smaller apples were seen to reduce this avoidable waste.

While one stated cause of over-purchasing was the size of food items available, other reasons include considering shopping unpleasant or a hassle and purposefully purchasing more in case of unexpected guests or needs. Combined phase II and III survey analysis found that respondents in the 65 or older group were more likely to disagree that grocery shopping is a hassle. Respondents who spend more than \$101 a week on food eaten at home were more likely to agree or somewhat agree that “I buy more than I need because I like my fridge to be full,” and that they buy more than they need in case of unexpected guests. Again, these findings are consistent with the qualitative findings from the interviews. Some interviewees indicated that they would purchase more to ensure their family and friends were well-fed as an expression of love and care.²¹ Additionally, some interviewees noted that having a variety of meal and snack options at home also was convenient and allowed for flexibility based on cravings and desires. Finally, some interviewees noted that trying new foods or buying a rarely used ingredient for a new recipe can lead to waste as they weren’t able to use up or didn’t like the amount purchased.

These findings point to several opportunities for retailers to work with customers to reduce waste by: 1) focusing efforts to clarify date labels on meat and dairy products, by prioritizing safety labels and omitting quality labels, whenever possible, as a means of reducing waste at the store level when consumers fail to purchase meat or dairy that might otherwise be fine to consume; 2) encouraging customers to take whatever produce they touch to minimize bruising and to accept product that isn’t perfect; and 3) offering smaller package options or unpackaged, bulk products so customers can choose the amount they need.²² It is worth noting that “buying too much” is not a phenomenon that is simply caused by unintended or “forced” over-purchasing. People may purposefully purchase more than they need to express love and care and to allow for flexibility in meal choice based on time and cravings. There may also be a connection to purchasing ingredients for specific recipes with no plans or cooking knowledge about how to use leftover ingredients, which can lead to more wasted food. Understanding these underlying causes is important to understanding potential interventions that reduce the wasting of food that could have been eaten.

²¹ Porpino, et al. (2016) identified love and affection as drivers of food waste in a separate qualitative study.

²² <https://www.oregon.gov/deq/FilterDocs/PEF-Packaging-FullReport.pdf>

Food management and storage

Food management behaviors, including refrigeration and storage, are widely considered areas for intervention to reduce wasted food. Properly storing food items to maximize shelf life, as well as techniques to prioritize eating leftovers and older food are suggested as potential interventions (see section specifically on leftovers for more information). The diary data provides insight into how mismanagement is tied to specific instances of food loss. The most common immediate loss reason for discarding edible food was due to its being moldy or spoiled (32.1%). Reported loss reasons were combined into factors according to themes. Food being moldy or spoiled was the predominant reason in the “yuck” factor theme, and mismanagement was cited most often as the root reason why food landed in the “yuck” category.

The second most common root reason reported in the kitchen diary data for discarding food was that food items were “lost” in the fridge (23.6%). Supporting this finding, survey data found that most households (55.6%) never or rarely use a designated area in the refrigerator to store items that need to be eaten sooner.

Another important aspect of food management is deciding whether food is “good” or “bad,” which encompasses issues of food safety, taste, and preference. In the phase III survey most households use the time food has been in the fridge and the time food is left out of the refrigerator to determine whether it is safe to eat. In both phase II and III surveys, smelling or looking at food was the most common approach used to determine if food was still good for all foods except canned foods.

Food preparation and use

Food preparation and cooking is another area of intervention for reducing wasted food. Common suggestions for reducing wasted food include removing ‘bad’ parts of fruits and vegetables instead of discarding the whole item, and prioritizing meals that use food that has already been purchased. In the phase II and III surveys, a majority of households remove the bad parts of fruit and vegetables and eat the remaining portion instead of throwing the entire item away.

Both surveys indicate a majority of households rarely or never use peels and bones when cooking, suggesting most households do not make full use of foods. Using the combined survey sample, we found that households who reported going to farmers markets were more likely to often or always use vegetable peels and stalks in cooking and using bones in cooking more often than those who didn’t go to farmer’s markets (see, Tables 43 and 45 in the appendix). Additionally, households who had a backyard garden reported often or always using vegetable peels and stalks in cooking significantly more than those who did not (see, Table 44 in the appendix). In the open-ended interviews, some respondents mentioned that they were more likely to peel or scrub fruits and vegetables if they were conventional produce than if they were organic produce. These results suggest that the source and type of

food item (e.g. conventional vs. organic) may affect what parts of the food item are eaten. This raises questions for future research as to whether 1) messaging about peeling produce to reduce chemical exposure contradicts messaging to reduce wasted food by eating the peels, 2) there is a stronger connection to the source of the food item through farmer's markets or backyard gardens and whether it is linked to eating vegetable peels and stalks, or 3) there are individual differences related to cooking skills and food source preferences.

Cooking too much food is a common reason for throwing away food immediately or after it is saved as leftovers but becomes moldy or spoiled before it can be eaten. Thinking others would eat more food but didn't was the most cited reason for making too much in the kitchen diary. This finding points to an issue with either misestimation of portions, problems with cooking skills (e.g., food prepared poorly), or mismatch in expectations of what is desired to be eaten. Based on interview findings and limited market research conducted by NRDC, some of these aspirational planning and preparation issues may be connected to identifying as a "good caretaker" for family members or "good host" for planned or even unexpected guests.

Another aspect of food preparation and eating that might have an impact on whether food is wasted is the desire to eat healthier. In both phase II and III surveys, most respondents stated that they agreed or somewhat agreed that they'd like to eat healthier, for example, eating more fruits and vegetables. While a direct relationship couldn't be tested here, this aspiration is notable as fruits and vegetables are the largest category of wasted edible food. In the open-ended interviews, many respondents also aspired to eat healthier, either for themselves or for their family. To achieve the goal of eating better, people mentioned cooking more at home and purchasing healthier foods such as fruits and vegetables. However, many respondents also noted that they were often not able to follow through with eating the healthy food – due to stress, time constraints, or food preferences – resulting in discarded food.

Leftovers

As previously reported, leftovers and prepared foods were the second most reported discarded edible food by weight in the Oregon kitchen diaries. As such, increasing the likelihood that leftovers are eaten is an area for potential intervention. As reported in both phase II and III surveys, the most common approach to handling leftovers is to eat them as is, for another meal. In the phase III survey, the average proportion of leftovers reported to be eaten was quite high at 73.4%. After using the waste tracking diary, this rate rose slightly, but significantly, to 77%. Note, this is a self-reported rate and seems surprising, given that prepared foods and leftovers were the second largest category of edible food thrown out in the waste sorts and kitchen diaries. The high rates of leftovers disposal call into question the self-reported rates of leftover consumption. This may reflect a lack of awareness of habits, self-reporting bias, or it might be true that participants do eat most of their leftovers, but that the remaining portion is still significant compared to other wasted foods. More research

is needed to determine more precisely how many leftovers are actually eaten versus thrown away.

Results from the combined survey sample suggest that household composition as well as income level impact the frequency that leftovers are prioritized to be eaten compared to disposed. For example, households were more likely to always prioritize eating or freezing leftovers if they spent \$100 or less on food eaten at home each week than other income groups. Also, households that have two or more adults without children were more likely to say they always eat leftovers as another meal without alteration or other food added as compared to households that only have one adult or have children under 18. Respondents in the 18-34 year age group were statistically significantly more likely to say they never or rarely eat leftovers as another meal without alteration or other food added than respondents in the older age groups. Again, this is self-reported behavior and more research is needed to assess the gap between reported and actual behavior.

In the open-ended interviews, most people expressed guilt about wasting food and took steps to avoid it. One of the main methods undertaken to reduce wasting food was saving leftovers for later. While saving leftovers sometimes results in the food being eaten at a later date, it was also found that this frequently resulted in food being saved, but not eaten. Instead, it was discarded at a later date after it was spoiled or was considered low quality (e.g. acquired freezer burn). People acknowledged that saving their leftovers reduced their guilt and anxiety related to wasting food, however, the saved food was frequently forgotten or became unfit to eat for some other reason. Sometimes saving leftovers was just an intermediate step prior to disposal at a later date. David Evans (2011) identified this idea of “delayed disposal” of food using quasi-ethnographic methods in households in the United Kingdom. The role of freezing leftovers and fridge cleanouts in the context of consuming leftovers warrants additional research.

Beliefs and attitudes

Previous studies on attitudes and behaviors associated with food waste have found that guilt is a predominant emotion in people’s experiences of waste (Qi & Roe, 2017, Quested et al. 2013; Neff et al.), that people tend to underestimate how much food they discard, and tend to overestimate actions they take to reduce wasted food. The phase III pre-diary survey supports these findings with almost three-quarters (73.7%) of respondents agreeing that they *should* reduce the amount of food they throw away, yet almost two-thirds (64.3%) believing they throw out less than the average American. Results in the phase II, statewide phone survey show a slightly lower proportion (59.6%) agreeing that they *should* reduce the amount of food they throw away and a higher percentage (73.4%) believing they throw out less than the average American. This indicates a mixed picture of perceptions of different norms (i.e., what one should do and what ‘everyone’ does) around throwing edible food away where most people believe they should throw out less but also that they already throw out less than average.

In a study of self-reported attitudes and behaviors, Visschers et al. (2016) identified increasing perceived behavioral control, that is, how much a person thinks they can have an effect on a situation, as a key area of opportunity for preventing wasted food. Findings related to perceived behavioral control in this study (specifically, phase III) were mixed: 1) less than a quarter (16.2% pre-diary) thought they *could* throw out a lot less, 2) the sample was split on how easy or difficult it would be, 3) a little less than half (41.8%) agreed that their household's actions would *not* make a meaningful difference in food thrown out in the country, and 4) 65.8% reported that reducing the food they throw out would save natural resources. Respondents were also split on whether wasted food affected their household financially.

Combining the survey samples, respondents in the youngest age group (18-34 years) and respondents who identified as male were more likely to report it would be very easy to reduce food going to waste than the older age groups and respondents who identified as female. Households with an income of less than \$25,000 were more likely to report reducing food waste as very difficult, households with incomes of \$100,000 or more were more likely to say it would be somewhat easy to reduce food waste, and households with incomes of \$75,000 - \$100,000 were more likely to report that reducing food waste would be very easy as compared to the other income groups.

This study also found that some practices seem to help alleviate the guilt associated with wasting food. In the phase III survey, two-thirds (68%) of respondents felt less guilty about storing leftovers than simply throwing them away, even if they are thrown out later. About the same percentage of respondents felt less guilty about throwing out food that had been in the fridge for a long time (67.6%). Nearly three-quarters (71.8%) feel less guilty about throwing out food that is composted. Using the combined survey data, there was a small gender difference, with respondents who identified as male more likely to agree that they felt less guilty about throwing out food that has been in the refrigerator for a long time than respondents that identified as female.

Most people who participated in the open-ended interviews and who had either previously or currently composted preferred to compost food items rather than send them to landfill. Composting has been successfully marketed as a better alternative to landfilling and is contributing to diverting food waste from landfill; it is also linked to reducing guilt associated with discarding food items. However, composting may also contribute to increased *generation* of wasted food by alleviating some guilt around throwing food items in the trash. Some respondents justified their over-purchasing by explaining that they would compost the extra food items so it wasn't actually wasting. This suggests, in addition to guilt alleviation, that composting also is seen as something *different* from "wasting food" either by throwing it down the drain or in the trash. This may represent a cognitive disconnect in how people perceive the amount of food they "waste" if they also participate in composting, resulting in people underestimating how much food waste they generate. This is echoed in a finding from the NRDC study where 58% of respondents agreed at least somewhat that they feel less guilty about wasting food if they compost it. Additionally, in the New York City

study site, NRDC kitchen diary participants who composted generated more total food waste than households that did not participate in composting (Hoover & Moreno, 2017a). However, this relationship between increased waste generation and composting was not seen in the Oregon study.

Demographic factors

Using the phase III survey, waste sort, and diary record data, this study did not find significant differences in per capita levels of wasted food generated based on the household demographics assessed (i.e., household size or type, income, and money spent on food at home and away from home). One related finding was that adults living alone and households of 2 or more adults without children *believe* they throw out less than the average American. Yet these two household types throw out more edible food, though it is *not* significantly different on a per capita basis.

In the open-ended interviews, single-person and small households indicated that they frequently felt like food was wasted as a result of ‘forced’ over-purchasing and over-preparation, especially if they didn’t want to eat the same leftovers for several days. When preparing food at home, portion sizes available for purchase at grocery stores, quantities required in recipes, and size of cookware were all mentioned as barriers to preparing smaller amounts of food. Even if interviewees could identify “hacks” to overcome some of the barriers, such as cutting a recipe in half, these actions are seen as burdensome in terms of time and convenience. When discussing portion sizes available at stores, both packaged and non-packaged items (e.g. cabbage or cauliflower) were mentioned as too large for single-person households unless they don’t want variation in their diet.

Areas for Future Research

This study and similar studies (NRDC and UK WRAP) have contributed to our collective understanding, not only of what and how much is wasted, but the mechanisms behind the transformation of “food” to “waste” at the household level. Despite this contribution, there are still many aspects of these questions that need to be further explored, and interventions need to be designed and tested. From this research, the following have been identified as areas where further research is needed:

- How upstream decisions in the food supply chain (e.g., decisions about package sizes, retail practices such as ‘buy one get one free’ sales) impact consumer-level food waste and potential changes to reduce wasted food;
- The role of delayed disposal and composting as guilt alleviation mechanisms;
- The role of perceptions of “edibility” in contributing to wasted food;
- Flexible planning solutions for households with unpredictable schedules;
- Improved understanding of underlying drivers of wasted food, including how socio-structural and cultural factors impact wasted food at the household level.

- Whether physical structures, such as smaller refrigerators or refrigerators with different shelf configurations, can reduce wasted food and in what context.

To design effective interventions, we need to better understand the diversity and complexity of behaviors and practices related to wasting foods in addition to improving monitoring of their impacts. Stöckli et al. (2018) reviewed wasted food interventions tested in the academic literature, finding there are very few interventions that have evidence-based research to understand their direct impact on food waste generation and support their use. And, of the few current studies, very few, if any, are longitudinal studies that would contribute to understanding impacts over time.

Many of these areas for future research would benefit from a multidisciplinary perspective incorporating at least sociology, urban planning, engineering, nutrition/public health, and environmental science. Additionally, equity issues associated with wasted food should be considered, especially as potential interventions are designed and implemented.

Finally, as an increasing proportion of food is eaten away from home, at restaurants and corporate cafeterias, additional research should be done to understand how this contributes to consumer-level food waste.

Measuring & Evaluating Food Waste and Wasted Food: Insights and Protocols

Importance of Measurement & Assessment

While data on how much food is wasted is growing, there remains a need for more consistent measurement, from different contexts and sources. States and municipalities also need robust baseline measurements before rolling out waste reduction measures.

Understanding the quantities and types of food wasted, how much of that food was edible, and why it was wasted provides actionable data that can be used to develop better baseline data, evaluate actions to prevent wasted food and assess progress more meaningfully.

Currently, most cities and states track “food waste” as single category in their waste composition studies, assuming they collect any data on food waste at all. Some go further and also quantify or estimate the amount of food waste recovered via composting or digestion. For agencies that only have authority to address the impacts of solid waste, the focus is on reducing methane emissions from landfills by finding alternative disposal options for food waste, instead of strategically finding ways to incentivize reductions in overall generation of uneaten food. Without measures focused on reducing the total generation of wasted food, well-intentioned states and cities might have a success story citing progress towards a goal of sending zero food waste to landfills, when in reality the amount of wasted uneaten food may be increasing. This dynamic is not visible when measurement approaches are isolated to “food waste” or “organics” sent to landfill as the only material category measured, and the only goal is to keep food waste out of landfills. If the overall amount of food disposed to all destinations is increasing, so are the environmental, economic, and social burdens associated with that wasted food and in particular, the large upstream impacts of production, which are typically unseen or not considered in traditional waste-based measurement or assessment.

Commitments from government or businesses to minimize the negative environmental, economic, and social impacts of wasted food align directly with goals to reduce the generation of food waste, like Oregon’s goal to reduce the generation of wasted food by 40% by 2050.²³ This goal prioritizes prevention strategies and compliments the state’s goal to recover 25% of food scraps through composting or anaerobic digestion. This generation goal also supports the Sustainable Development Goal 12.3 and US Goal to cut food waste in

²³ DEQ Strategy to Prevent the Wasting of Food: <https://www.oregon.gov/deq/FilterDocs/foodstrategic.pdf>

half by 2030, which can be achieved through any combination of prevention, rescue, and recovery solutions. Consistent with those goals, the State of Oregon, along with California, Washington, British Columbia and a handful of large west coast cities (including Portland) recently adopted a regional goal to halve food waste by 2030 (from a 2015 baseline), with an emphasis on prevention over recovery.²⁴

Deciding What Type of Measurement to Undertake

One goal of this study was to learn from the data collection experience to provide insights to states, municipalities and other entities interested in measuring residential sector wasted food in their communities. In this section, we share lessons learned related to: (1) collecting data from households, which may be relevant to municipalities developing their own residential sector wasted food prevention programs, and (2) the methods used to assess waste and identify loss reasons.

The following quantitative and qualitative methods can be used to develop actionable baseline data and track progress over time:

- Surveys (self-reported) to track attitudes, behaviors, and loss reasons.
- Diaries (self-reported) to quantify edible and inedible food waste amounts and types of foods sent to all disposal destinations along with associated immediate and root causes for that waste (i.e. loss reasons).
- Waste Composition (aggregated sampling) to quantify edible and inedible food weights and detailed food category data on food waste entering the municipal solid waste stream without under-reporting issues or participant biases.
- Household Waste Sorts (individual sampling) to quantify edible and inedible food weights and detailed food category data on food waste entering the solid waste stream from individual households.

There are strengths and weaknesses associated with each method, the significance of which might differ based on the goals of the measurement. No matter what method is used to measure or estimate food waste, it is important to consider how the boundaries of measurement and food waste are defined for the study. Transparently reporting this information allows for easier comparison with other studies. The Food Loss and Waste Accounting and Reporting Standard provides guidance on measurement and sets requirements and provides guidance on how to define system boundaries, perform

²⁴ <https://pacificcoastcollaborative.org/wp-content/uploads/2018/09/PCC-West-Coast-Food-Waste-Reduction-Commitment-FINAL-FINAL-formatted-1.pdf>

measurement, and communicate findings.²⁵ In general, weight-based data is more reliable and is preferred.²⁶

Waste composition or household waste sorts only capture food waste sent to landfill and sometimes capture commercial composting/anaerobic digestion (AD). In contrast, diaries can capture all disposal destinations, including sewer (down the drain), feeding animals, and home or backyard composting. Diary collection therefore provides the potential for a more complete view of the total amount of food waste generated. For example, in the Oregon study, we found that 11.2% of food thrown away in the kitchen diaries was sent down the drain or garbage disposer, making the sewer a significant disposal destination. However, diaries may suffer from under-reporting and participant biases associated with self-reporting. A combination of food waste quantification methods is often used to minimize biases and provide reliable information that can be used to address the root causes of wasted food. For example, to validate data reported in kitchen diaries, studies like the one conducted by NRDC and this one, collected and evaluated the food waste disposed in a household's trash or discarded in curbside composting. This revealed that while household diary users do report food waste sent to other destinations, the amount they report – at least disposed of in garbage and organics/compost collection containers – is significantly lower than the actual amount disposed.

Large, state-based waste composition or smaller, household-level study?

This study was designed in part to be compared to other datasets, to combine qualitative and quantitative information to assess causes of wasted food, and to help assess the practicality of using larger, state-wide waste composition studies that may be more typically conducted by a state to determine a baseline of wasted food, versus conducting high effort, household-level waste sort and diary tracking studies.

To illustrate the differences in measuring wasted food through large waste composition studies versus at the household level through waste sorts or diaries, we have included a side-by-side comparison of the Oregon Wasted Food results to the DEQ's Waste Composition Study. The DEQ Waste Composition Study, last done in 2016, is conducted on an infrequent basis, typically once every five to seven years. Waste is sorted and weighed by collection route in order to estimate the amount and type of over 200 waste material categories discarded to landfill or incinerator for the entire state of Oregon.

²⁵ For a more detailed discussion of methods and associated trade-offs, please refer to the Household chapter and Appendix A of the Commission for Environmental Cooperation's (CEC) Practical Guide on How and Why to Measure Food Loss and Waste (FLW)²⁵ and the Chapter 4 of the National Zero Waste Council's (NZWC) Guide for Measuring Food Waste from Households in Canada. See, http://www.nzwc.ca/focus/food/Documents/LFHW_GuideToMeasuringFoodLossAndWaste.pdf

²⁶ See, NZWC report, cited above, appendices A for measurement methods and D for sample selection methods.

Methodological differences between DEQ's Waste Composition Study and the Oregon Wasted Food Study include:

- The DEQ Waste Composition study assessed residential trash (landfill/incinerator) waste streams by sorting waste at the level of hauler collection route whereas the Oregon Wasted Food Study sorted individual households.
 - Collecting data by collection route is easier in that waste can be sorted in high volume and collected as usual by the hauler.
 - Collecting data at the household level allows for analysis that includes other household specific data (e.g., beliefs and attitudes, demographics, etc.).
- Both studies sorted food into 11 categories. The categories were, however, defined differently. In the DEQ Waste Composition Study, categories were differentiated by being packaged or not, and all food still sealed in packaging was considered edible.
- Packaging was not assessed in the Oregon Wasted Food Study.
- The DEQ Waste Composition Study “mixed” food category is defined as packaged and unpackaged foods that are mainly vegetative by weight but that contain more than a trace of animal products. Examples included pizza and stir-fry with pieces of meat or egg. “Mixed” food is most comparable to the prepared foods and leftovers category in the Oregon Wasted Food Study.
- Weights of unidentifiable foods, snacks, dry food, and liquids in the Oregon Wasted Food Study were excluded from the table below as these food types were in multiple categories in the DEQ Waste Composition Study.
- DEQ's Waste Composition study also provides information about food waste disposed of from other sources, including businesses. Results from residential collection routes are evaluated and reported separately from results from routes that collect garbage using front-loading collection vehicles and large dumpsters. Because smaller multi-family dwellings tend to have their waste collected (like single-family households) in cans, while larger apartment buildings typically use dumpsters (often collected by garbage trucks also collecting from businesses), the DEQ Waste Composition study presents a more complete view of food waste from all sources, but requires further analysis to parse out the full picture of waste just from households.

While the unit of study is different – household versus collection route – the *proportion* of food types in the residential trash (landfill/incinerator) waste stream in the state-wide, DEQ Waste Composition Study was compared to the Oregon Wasted Food Study (see, Table 9). The most notable differences are that inedible food and fruit and vegetable categories are higher in the DEQ Waste Composition results and the mixed food category is higher in the Oregon Wasted Food Study, for both the state-wide and Portland-only samples. Higher levels of inedible food waste in the state-wide trash stream assessed by the DEQ Waste

Composition Study could be attributed to that sample including more areas that do not have access to curbside composting than in the Oregon Wasted Food Study.

Table 9: Comparison of Oregon Wasted Food Study to DEQ Waste Composition Study Results

	DEQ Waste Composition Study (% of food)	Oregon Wasted Food Study WASTE SORT (% of food)	Oregon Wasted Food Study DIARY (% of food)
State of Oregon			
Inedible	41%	25%	23%
Vegetable & Fruit	30%	23%	23%
Bakery	10%	9%	8%
Meat, eggs, dairy	12%	12%	13%
Mixed	5.4%	14%	17%
Portland Only			
Inedible	35%	28%	29%
Vegetable & Fruit	44%	22%	20%
Bakery	8%	6%	10%
Meat, eggs, dairy	12%	8%	14%
Mixed	2%	10%	6%

Entire sample of Oregon Wasted Food Study: Waste sort n = 230 households; Diary n = 182 households. *Data was weighted* on the variables of Urban/Rural, Household Type, and Age Group to reflect proportions found in the state in the American Communities Survey.

Portland Only sub-sample of Oregon Wasted Food Study: Waste sort n = 51 households; Diary n = 44 households. *Data is not weighted.*

In terms of weight, fruits and vegetables represent the largest opportunity for preventing edible waste in Oregon. However, some other categories, specifically meat, eggs, and dairy, are also important to consider because the lifecycle impact of those foods (on a per mass basis) is generally higher (FAO, 2013). Overall, the comparison of the two different household-level methodologies, waste sort and kitchen diary, result in slight differences in weight estimates, with kitchen diaries having slightly lower estimates, as might be expected due to underreporting.²⁷ However, percentage estimates of total food waste generation by food category are relatively similar between methods, indicating the underreporting bias does not seem to asymmetrically impact proportions.

²⁷ Full details on the analysis and results of diary reporting rates can be found in in the *2017 Oregon Wasted Food Study: Residential Sector Waste Sort, Diary, and Survey Study*. See, <https://www.oregon.gov/deq/mm/food/Pages/Wasted-Food-Study.aspx>

The following tables can help states and cities better understand study strengths and weaknesses based on key decision-making factors.

Table 10: Costs, Benefits, and Trade-Offs of Methods of Quantifying Wasted Food²⁸			
Decision Making Factors	Quantification Method		
	<i>Waste Composition (aggregated)</i>	<i>Household Waste Sorts</i>	<i>Diaries</i>
<i>Cost/Resources</i>	<p>MEDIUM Lowest cost on a per sample basis as the main resource requirement is for sorting and data analysis.</p> <p>If waste composition studies are already conducted on a regular basis, they can be adapted to include food waste categories with minimal (5-30% more) cost implications.</p> <p>However, most waste composition studies only address wastes sent to disposal. With more food waste being diverted for composting or digestion, additional sorting of those waste streams may be required, thus increasing costs.</p>	<p>MEDIUM Samples need to be collected by a designated team and cannot be conducted using a collection vehicle on a regular route</p> <p>If informed consent is required, additional resources are needed for participant recruitment</p> <p>Requires a larger number of samples for statistical significance due to smaller sample weights which increases resource needs for collection, sorting, data entry and analysis</p>	<p>HIGH Participant recruitment requires a large amount of resources to ensure representation</p> <p>Each participant requires several points of contact and ongoing support</p> <p>An incentive (\$50 to \$150) is typically offered to each participant for study completion, as well as a kitchen scale</p> <p>Requires the most amount of time for data entry, compilation, and analysis</p>
<i>Understanding Drivers of Wasted Food</i>	<p>LOW Participants do not know that they are participating in a study and thus cannot be asked to complete a survey</p> <p>A general survey can be conducted, but is</p>	<p>MEDIUM A survey may be conducted to obtain data on attitudes and behaviors related to food waste</p>	<p>HIGH Participants can be asked why they wasted food each time data is recorded</p> <p>A pre- and/or post-survey is typically conducted to obtain data on attitudes and</p>

²⁸ Adapted from Table 13, NZWC report (ibid).

Decision Making Factors	Quantification Method		
	<i>Waste Composition (aggregated)</i>	<i>Household Waste Sorts</i>	<i>Diaries</i>
	not linked to waste sample generators		behaviors related to food waste; however, lengthy surveys may result in lower completion rates
<i>Differentiation of Food Categories in Waste</i>	MEDIUM Items may be harder to separate from other materials due to compaction in trucks but are generally still distinguishable	HIGH Samples are typically collected directly from household containers or bags and not compacted, therefore items are more intact and easier to separate	HIGH Food waste is recorded as detailed descriptions by item
<i>Level of Data Objectivity</i>	HIGH Study participants are not aware of their participation	MEDIUM Study participants are typically aware of their participation, but not asked to do anything outside of their usual routines	LOW Participants may change their behavior as they monitor it or complete the diary based on what they consider socially desirable Due to self-reported nature of kitchen diaries, participants may not record all food wasted or mis-report details such as food type With additional resources, kitchen diaries may be conducted in concert with waste composition studies to ground-truth data
<i>Food Waste Destinations Captured</i>	MEDIUM Only includes destinations for municipal solid waste, but the majority of food waste is disposed in that stream Cannot capture food waste that is fed to animals, disposed down the drain, or backyard-composted	MEDIUM Only includes destinations for municipal solid waste, but the majority of food waste is disposed in that stream Cannot capture food waste that is fed to animals, disposed down the drain, or backyard-composted	HIGH Participants are typically instructed to record all food wasted, including amounts fed to animals, disposed down the drain, or backyard-composted Allows for quantification of beverage waste, as the

Decision Making Factors	Quantification Method		
	<i>Waste Composition (aggregated)</i>	<i>Household Waste Sorts</i>	<i>Diaries</i>
			majority is disposed down the drain
<i>Other considerations</i>	Waste composition studies typically address the full municipal waste stream, including commercial sources, thus allowing for an estimate of food waste/wasted food from multiple sectors.	Limited to households	Limited to households

After a study is completed, states and jurisdictions often extrapolate data to get a sense of what is happening across a community or entire state. To extrapolate food waste estimates for a state or municipality, draw from this table, which was adapted from NZWC guidance for household-level food waste measurement.

Table 11: Extrapolating quantities to food waste estimates for larger populations²⁹

Study type	Data Collected	Available Data	Extrapolation Method
<i>Waste Composition Study (bulk or small area sampling)</i>	% of food waste	Tonnage from solid waste management facilities	Multiply % of food waste by tonnage to estimate food waste by jurisdiction
<i>Waste Composition Study (individual sampling)</i>	% of food waste	Tonnage from solid waste management facilities	Multiply % of food waste by household tonnage to estimate household food waste by jurisdiction
	Pounds of food waste per household	Number of households in the jurisdiction	Multiply pounds of food per household by the number of households to estimate residential food waste by jurisdiction
	Pounds of food waste per capita	Total population in the jurisdiction	Multiply pounds of food per capita by the population to estimate food waste by jurisdiction
<i>Kitchen Diary</i>	Pounds of food waste per household adjusted for under/over reporting.	Number of households in the jurisdiction	Multiply pounds of food per household by the number of

²⁹ Adapted from Appendix D, NZWC report

Study type	Data Collected	Available Data	Extrapolation Method
			households to estimate food waste by jurisdiction ³⁰
	Pounds of food per capita adjusted for under/over reporting.	Total population in the jurisdiction	Multiply pounds of food per capita by the population to estimate food waste by jurisdiction
<i>Proxy Data (if unable to do direct data collection)</i>	% of food waste from waste composition study in similar jurisdiction	Tonnage from solid waste management facilities	Multiply % of food waste by tonnage to estimate food waste by jurisdiction
		Weight of food waste/wasted food per household or per capita in similar communities	Multiply weight of food wasted per household or per capita in other community by number of households or population in your community

In the future, the state of Oregon will be able to measure progress in reducing the generation of food waste (per capita) by repeating a state waste composition study (aggregated sampling) that includes landfill, and commercial composting/AD waste streams using detailed food categories based on the quantities and types of food waste identified in the Waste Composition (aggregated) study. Assessing edible and inedible food waste in sorts is recommended as the minimum level of food categorization. This initial level of categorization is necessary in order to assess the amount of edible food in the system and track a reduction over time. Since waste composition studies will only provide reliable data on the amounts and types of wasted food sent to landfills and commercial composting or AD facilities, food diaries could serve as a complimentary method to track loss reasons and disposal destinations not captured in a waste composition study.

Cities and states determine which methods to use based on existing data and resources available. The practical guide developed by the Commission for Environmental Cooperation can further help cities or states develop their own measurement studies of food loss and waste (FLW) with detailed information for each of the seven steps outlined below, including trade-offs between different methods, building cases to support measurement, implementing measurement across all sectors, including household level measurement.

³⁰ The Oregon Waste Food Study, NRDC, and WRAP studies found under-reporting rates in the range of 35% - 47% using food diaries.

✓	Step 1: Determine <i>why</i> you want to reduce food loss and waste. (Module: Why Measure FLW?)
✓	Step 2: Establish your business case for reducing food loss and waste. (Module: The Business Case for FLW Reduction)
✓	Step 3: Prepare for the <i>change</i> of measuring and reducing food loss and waste. (Module: Managing Change)
✓	Step 4: Determine your <i>definition</i> of food loss and waste. (Module: Setting Your Scope)
✓	Step 5: Determine your <i>causes</i> of food loss and waste and identify solutions. (Module: Determining Root Causes)
✓	Step 6: Identify your <i>key performance indicators</i> and <i>impacts</i>. (Module: Selecting Key Performance Indicators and Identifying Impacts)
✓	Step 7: Select and implement a food loss and waste measurement <i>method</i> based on your sector. (Module: Sector-Specific Guidance)

Figure 4: Example of steps to develop a food waste measurement study³¹

Regardless of the method or methods chosen for a city or state study, edible and inedible food categories, such as those used in the Oregon Wasted Food Study and NRDC studies, can be used and replicated over time to inform interventions and measure progress in reducing the generation of wasted food. The cost of a waste composition study can increase by 5-30% when the number of waste sort categories increases from a five-category sort to an eleven-category sort.³² The increase in cost is mostly a result of a multiplier effect on data reporting (e.g., 5 extra rows for a sample of 500 homes) and extra time to clean sorting bins before weighing samples. There are some additional cost considerations depending on whether the sampling is aggregated (truck) or individual (household sorts).

Residential Measurement & Research

Recruiting & Engaging with Residential Participants

To assist municipalities and states that decide to conduct individual level assessments, we detail the protocols and lessons learned from the Oregon Wasted Food Study to provide a model for conducting these studies.

The Oregon Wasted Food Study recruited households – both in single family dwellings and multi-family units – to have their curbside trash and organic waste (compost cart) sorted, complete two surveys and track all food thrown away for seven days. The study was conducted in five geographic locations. Locations were partly based on waste hauler routes, so collection of trash and compost for all households in one location could be done in one day. Recruiters were trained and clearly identified with a badge when going door to door.

³¹ This figure was originally published in Why and How to Measure Food Loss and Waste Practical Guide (CEC 2019) <http://www3.cec.org/islandora/en/item/11814-why-and-how-measure-food-loss-and-waste-practical-guide-en.pdf>. For more detail see the CEC technical guide. <http://www3.cec.org/islandora/en/item/11813-technical-report-quantifying-food-loss-and-waste-and-its-impacts-en.pdf>

³² Based on a phone interview on 10/23/2018 with Belinda Li, who has conducted almost 100 detailed food waste sorts.

They were given a script, other instructions, and supplies, and operated in teams. In our experience, recruiting a sample of approximately 65 households in an urban setting (i.e., relatively short distances between houses) can take pairs of 4-8 recruiters up to 10 evenings and 4-6 weekend days. A sample script, supply list, and protocol for recruiters can be found in the appendix.

Identifying information such as names, addresses, emails, and phone numbers were only collected on a consent form to protect participant privacy. This information was destroyed at the end of the study. Participants were assigned an ID number to identify their data, while protecting participant privacy.

Tips for effective and organized recruiting

Recruiter supplies:

1. Mark clear boundaries on recruiters' maps. If households are recruited outside of the hauling route, participants will be confused as to when to put out trash for collection.
2. Recruiters need to be trained to read maps and have a way of marking the map according to show what households and streets they've covered so the next set of recruiters do not repeat visits.
3. Include a checklist for recruitment kits. Recruiters should compile their own recruitment kits before their shift to familiarize themselves with materials and make sure they have all necessary items.
4. Consent forms and paper surveys should be marked in advance with a participant number in the corner. If forms and surveys are not identified with a number, surveys will come back with no identification.
5. There should be plenty of space on paper recording sheets for capturing data.
6. In the Oregon study, study materials were dropped off when waste was collected. In hindsight, it may be more effective to give participants a packet with all of the materials they will need when they are recruited. Materials to include in study packet:
 - a. Kitchen scale for diary tracking
 - b. Weighing container
 - c. User guide
 - d. One page document with dates for each task and study contact information
 - e. Survey #1 and diary forms for participants who opt for paper versions

Participant interaction:

1. Be thoughtful and thorough when reviewing the steps of the study – participants are being asked to process a lot of information. Expect many questions.
2. Lead with a brief outline of what is being asked of the participant.
3. Help participants fill out the form by asking questions aloud to them.

Communicating with participants

Participant support and reminders about next steps and deadlines for study tasks is key to maximizing the number of participants completing the study. This requires a staffer who is very knowledgeable about the study and who can communicate frequently with participants via email, text, and phone. The study should have a dedicated email account, number for sending texts, and phone number with voicemail. This study, with 299 recruited participants (164 completed all four tasks) had 322 inquiries from participants on top of the routine points of contact detailed below. Communication with participants will be one of the most time intensive aspects of a study, especially if it has multiple tasks like the Oregon study. Be sure to define hours to reach participant support and how much time might elapse before a call, email, or text can be returned. Expect a spike in questions just before waste collection day.

Communications protocol

Participants who opted to complete the diary and surveys **online** were contacted with the following protocol:

1. Email welcome note with links to user guide
2. Email survey 1 (pre-diary) link
3. Email, text and/or phone nudges to finish survey 1
4. Two reminders about waste collection: send one day before and the night before collection. For example, if a participant usually puts out their trash Tuesday mornings, remind them on Sunday that collection will occur Monday evening and Tuesday morning. Ask participants to put out their waste and yard debris Monday by 6pm. Remind them again Monday afternoon to put waste on the curb by 6pm that night.
5. Email or text link to diary
6. Nudges to start diary (if using a two-week time frame for participants to complete seven days of tracking)
 - a. If participants haven't started by day seven, remind them they have seven more days to start and still complete exercise and receive incentive.
 - b. Friendly reminders as needed (check number of entries sent) to keep recording food in the diary and what their end date is.
7. Email survey 2 (post-diary) link
8. Email, text or phone nudges to finish survey 2.

Participants who opted to complete the diary and surveys on **paper** were contacted with the following protocol:

1. Mail packet with user guide, diary forms, and survey 1 if not given directly to participants during recruitment.
2. Remind about waste collection, day before and night before, as detailed in the online protocol, by phone email, or text, depending on participant preference.
3. Remind when there are seven days remaining in their diary period

4. Reminders to complete and return surveys and diaries if we haven't received them, starting 1 week after expected return date.

Retaining participants

Ensuring participation in a diary study can be challenging. The Oregon Wasted Food Study employed four strategies to encourage participants to complete the diary exercise and improve the accuracy of reporting rates. These included: 1) giving participants a two week period in which they could record the food their household threw away; 2) a tiered incentive structure such that if they completed 7 days in a row they earned a full incentive, and if they completed 7 days over the course of the 2 weeks, they received a lower incentive; 3) giving a choice of online or paper tracking; and 4) reminding participants to record their data through email and text.

Table 12: Summary of Diary Data Participation

	Number of Households
Households Recruited	299
Trash Sorted	230
Pre-Diary Survey	216
Post-Diary Survey	184
Seven Days of Diary Tracking	182
Completed All Four Activities (Pre- and Post-Surveys, Waste Sort, Diary)	164
Online Entries	139
Paper Entries	43
Total Number of Entries (Paper and Online)	5,078

One hundred sixty-four households completed all four activities (surveys, sort, and diary), yielding a 55% completion rate. This was comparable to a 53% completion rate for the NRDC study (Hoover, 2017) for a one-week diary and pre- and post-diary survey. It did not include participation in a waste sort. One hundred seventy-one households completed the diary over seven days in a row to receive the full, \$90 incentive. Eleven households completed seven days over a two-week period, receiving the lower, \$60 incentive. This suggests that the tiered approach did serve its intended function to encourage completion over seven days in a row, though it can't be determined if this would hold for lower overall incentive amounts.

Detailed Method Information: Waste Sorts and Diary Tracking

Assessing wasted food typically takes two forms: physical sorts and weighing of waste by a third party and diary tracking by a participant of each instance of throwing out food,

recording weights and loss reasons.³³ Elimelech, et al. (2018) found that conducting physical waste sorts at the household level, before the waste has been collected by a hauler, was more accurate than self-reporting in a diary or waste sorts done post-collection, at the hauler route level. From the perspective of data accuracy and extrapolation to a larger population, waste sorts are superior to kitchen diaries; however, the diary method has other benefits that waste sorts do not, including capturing more disposal destinations, such as drain disposal and backyard composting. Additionally, diary methods allow for more detail to be collected about the reasons why food is wasted, the state of the food at the time of disposal, and where the food is discarded that allow for a more robust understanding of why and how food is wasted in households.

Waste Sorts

The Oregon Wasted Food Study asked participants to place their trash and yard debris bin (if applicable) at their curbside at their regular collection day and time and to dispose of their waste as they ordinarily would. To avoid affecting participant disposal behavior, they were not asked to collect waste in a special bag, to separate out food related waste, or to set aside waste for only one week. Only households in multi-family units were asked to put their waste in an orange bag so that it could be identified more easily and removed from bins where many residents not participating in the study disposed of their waste as well.

Staff made two rounds of waste collection: first, the night before hauler collection and second, early in the morning before haulers arrived. Two to three teams of collectors went out simultaneously, using large trucks with a trailer and working in teams of two staffers each. Collecting trash and compost materials from the curbside holds potential for injuring staff. Staff should be trained to reduce injury from lifting, coming into contact with sharp objects, or from falling bins or equipment. If trash is taken from large bins (for multi-family), staff should be trained about how to properly remove bags without getting into the bin. Staff who collect the materials should also have the proper personal protective equipment, including closed-toed, and preferably steel-toed, shoes.

Other equipment needed for collecting curbside trash and compost include:

1. Large bags
2. Zip tie tags with ID numbers
3. Long gloves
4. Shovel
5. Trash grabber
6. Personal protective equipment, including coveralls, closed toes shoes, long disposable nitrile gloves with puncture-resistant gloves over them (rubberized palms and fingers to protect from sharp objects), face masks, and protective glasses.

Tips for hauling and staffing

³³ In the FLW Standard, weight-based measurement is required, though it can be translated to weight from other terms (e.g. volume). In general, weight-based measurement is more reliable and preferable.

1. Parking a trailer in a central area on the hauling route enabled staff to return to it throughout their route, once their vehicle was full of collected bags.
2. Working in teams of two was easiest, ideally three teams of two, for our collection of 60-70 households, done in one or two, four to five hour, collection periods.
 - a. Person 1 - Driver/Collector. Upon reaching stop, jump out with trash bag and begin collecting trash/compost
 - b. Person 2 - Navigator for the driver. Upon reaching stop, check to see what kind of materials they get (paper/online), write participant ID on bag tag or have ID tags prepped in advance, deliver materials to door, meet Driver/Collector at the curb to finish collection, tag bag, and put in vehicle
3. Tagging bags with ID numbers
 - a. Tag numbers must match numbers on surveys and diary forms. It is helpful to record on the bag tag the number of bags collected. For example, ID# 202 (1/1). If there is more than 1 bag of landfill, it would be ID# 202 (1/2). Bags of organic waste (compost-bound stream) were noted with a C, e.g., ID# 202C (1/1).
 - b. Record number of trash and compost bags picked up on tracking sheet.
4. Route maps
 - a. Route maps should be clearly marked with participant numbers and addresses. Include notes next to the ID number and addresses about special instructions.
 - b. There are many online route generators that create routes optimized for multiple stops. The Oregon Study used <https://www.myrouteonline.com/> but there are many options.

Collected waste was taken to a central sorting area where it could be properly disposed of after sorting. The Oregon study used eleven categories (one inedible and ten edible). These were based on the NRDC's categories to allow for comparison across studies. However, the number of categories can vary based on the level of granularity desired. Sorting staff should be trained on the protocol in advance and understand the definitions of food categories, with examples.

Table 13: Categories Used For Household Waste Sorts

Categories		Definition	Examples
1	Inedible	Items not intended for human consumption (small amounts of edible material associated with the inedible material are permitted to be included)	Egg shells, banana peels, pits/seeds, bones
2	Meat & Fish	Uncooked or cooked meat (with mostly edible components) unmixed with other types of food	Bone-in or boneless chicken piece, salmon fillet
3	Dairy	Solid dairy products unmixed with other food types or in original form	Cheese, yogurt
4	Eggs	Egg products unmixed with other food types or in original form	Fried egg, whole eggs, liquid egg whites
5	Fruits & Vegetables	Solid uncooked or cooked vegetables and fruits (with mostly edible components) unmixed with other types of food	Potatoes, spinach, berries, salad with only vegetables
6	Baked Goods	Baked goods and bread-like products unmixed with other food types or in original form, including pastries	Bread, tortillas, pastries
7	Dry Foods	Cooked or uncooked grains, pastas, legumes, nuts, or cereals unmixed with other food types or in original form	Rice, cereal, pasta
8	Snacks, Condiments, Sauces	Includes confections, processed snacks, condiments, and other miscellaneous items	Condiments, candy, granola bars, sauces, jellies
9	Liquids, Oils, Grease	Items that are liquid, including beverages	Sodas, milk, oil, juice
10	Prepared Food & Leftovers	Items that have many food types mixed together as part of cooking or preparation	Lasagna, sandwiches, burritos, entrees
11	Unidentifiable	Used only if necessary	

Used with permission of and adapted from NRDC (Hoover, 2017)

Sorting staff should undergo a thorough safety training, have an incident plan, and proper protective equipment. PSU's Community Environmental Services staff who worked on this study also routinely complete biohazard and parasite and blood-borne diseases training and are encouraged to have vaccines up to date, especially Hepatitis A.

Equipment and staffing:

1. 4 – 6, 6 foot tables
2. 2 large tubs for sorting, per sorting team plus 1 tub for weighing
3. 11, 5-gallon buckets, per sorting team

4. Laminated category signs to place under 5-gallon buckets. Signs with pictures would be helpful.
5. Calibrated scale, appropriate to volume and weight of materials weighed, preferably to at least the hundred decimal place.
6. Recording sheets (paper or digital) with all categories listed
7. Laminated sheets with definitions and examples of categories
8. Teams of 2 persons for sorting
9. 1 person to record weights
10. Minimum of 5 staff needed (2 sorting teams and 1 recorder)
11. Personal protective equipment (PPE) to include coveralls, closed toed shoes, disposable nitrile gloves with turtle gloves over them (rubberized palms and fingers to protect from sharp objects), face masks, protective glasses. Community Environmental Services sorting staff typically undergo a safety training as well as safe lifting techniques, and pathogen and parasite awareness.

Sorting procedure

1. Tables are set-up with 1 or 2, 6 foot tables per 2 person sorting team, with the 11 5-gallon buckets behind the team, placed on top of the laminated category signs.
2. Taking 1 bag at a time, recorder writes down the total bag weight with ID number and number of bags.
3. Once bag is weighed, move recorded bags to a designated pile for sorters to pull from.
4. When sorters begin a new bag, they let the recorder know which bag ID number they are working on. Recorder will write number down to later confirm when weighing food waste.
5. Food is sorted into pre-determined categories, into 5-gallon buckets. Food is removed from packaging whenever possible.
6. When sorters are ready to weigh they will present the waste to the recorder who will check the participant number and begin recording weight. It's most helpful for a sorter to 'zero' out the scale (or tare it) with weighing tub on it, place the waste into the weighing tub, and call out the category and weight to the recorder.
7. Digital collection sheets can be made in Excel to auto-calculate sum of categories and compare to original weight if data is being entered electronically on site. This allows recorders and sorters to see if there has been an error in weighing or recording at that time. If recording on paper this real-time check isn't possible but errors can be noted when later entered electronically.
8. The Oregon Study was able to sort waste at a rate of 2 pounds/minute/team.

Sorting staff should compare the total weights recorded by category with the original total weights of the bags recorded before sorting. This will allow recorders and sorters to see if there has been an error in weighing or recording at that time. Digital collection sheets made in Excel can be designed to auto-calculate sum of categories and compare to original weight.

Seasonality is an issue to consider when choosing when to do a waste sort. The Oregon study avoided holidays associated with large meals, such as Thanksgiving. In the summer, corn cobs and watermelon rinds are heavy and can affect the relative proportion of edible to inedible waste characterized in a waste sort. Seasonal impacts are usually addressed in aggregated waste composition studies by sampling throughout the year, which was not possible in this study.

Furthermore, compost collection can also be affected, which is important if sorting includes food and yard debris mixed together in an organics (compost-bound) cart. Spring and fall months (or summer, depending on climate and location) can result in large amounts of yard debris. This makes it difficult to collect wastes and can also misrepresent the average amount of total organic waste (yard debris plus food waste). In the Oregon Study, the large volume of yard debris disposed in the fall made it a challenge to collect all compost-bound waste disposed of, and bins and bags that were *exclusively* yard debris were not collected. This meant that food as a percentage of the total material set out in the curbside compost stream was not calculated. This, combined with the seasonal distortion on the total weight of compost set-out, means that a reliable *proportion* of food in the total compost stream cannot be determined if sampling is limited to a single season. However, this is not a significant issue, since this study was not focused on yard waste generation or disposal. Weights of food in the compost stream and the proportion of types of food relative to the total weight of food disposed in curbside compost were recorded and used in analysis.

Diaries

Kitchen diaries are paper or digital forms that are filled out by participants to track the amount of food discarded for a specific period of time. Usually, kitchen diaries also track other information about the discarded food item including a description, weight or other metric, loss reason, and discard destination (see, Table 10 for more detailed information on strengths and weaknesses of the diary method).³⁴

Participants were asked to record the weight and a description of the food their household disposed of in all waste streams for seven days.³⁵ Diaries, as noted earlier, allow for greater depth of understanding of loss reasons and circumstances surrounding waste. Diaries are also known to under-report levels of waste; in this study it was 35% less waste reported compared to the waste sort.

³⁴ Section 3.4 of the CEC Technical Report Quantifying Food Loss and Waste and Its Impacts provides additional discussion of diary strengths and weaknesses and international examples, posted at <http://www3.cec.org/islandora/en/item/11813-technical-report-quantifying-food-loss-and-waste-and-its-impacts-en.pdf>

³⁵ Examples of diary forms used in the Oregon Wasted Food Study can be found in the report *2017 Oregon Wasted Food Study: Residential Sector Waste Sort, Diary, and Survey Study*, posted at <https://www.oregon.gov/deq/mm/food/Pages/Wasted-Food-Study.aspx>

The Oregon study used a tiered incentive and two-week time period to maximize participation. Participants could record food thrown away for any seven days in the two-week period and receive a \$60 gift card. If they recorded food for seven days in a row, they received a \$30 bonus for a total of a \$90 gift card. Seven days in a row is the preferred time period in order to record on all days of the week but previous studies have had difficulty with participants completing the diary in one week. This tiered incentive proved to be an effective strategy, with 95% of participants completing the diary, recording for seven days in a row. All participants were given a kitchen scale to use for the diary exercise, which they kept, whether or not they completed the diary.

Participants were also offered the choice to complete the diary online or on paper. The online version was designed with Qualtrics software and allowed participants to upload pictures if they desired. Part of the intent of offering an online version was that it allowed participants to record their food throughout the day without having to record all details, by taking a photo of the food on the scale and referring to the photo later to complete the diary. The online diary also reduced missing data by forcing responses to items, though participants still made errors in combining many types of food and also not describing the food in sufficient detail. Some participants found the paper records easier to maintain and keep next to the scale where potentially all household members could record the food they threw away.

Underreporting is a common issue related to kitchen diaries and other self-reported measures. In this study, the under-reporting rate for food disposed to landfill in the diary was 35%. The rates for compost alone and compost combined with landfill are much lower, but our experience here suggests that more auditing of compost streams is needed to identify a reliable reporting rate as compost sample sizes are small and more affected by seasonality than the trash stream.

The Oregon Wasted Food Study used a method based on UK WRAP's approach for calculating a reporting rate for the diaries. Total waste sort food weight was subtracted from the total diary sort food weight. This figure was then divided by the waste sort food weight. Or:

$$\frac{(\text{Diary food weight} - \text{Waste sort food weight})}{\text{Waste sort food weight}}$$

The analysis was limited to households that had both diary and waste sort data collected for a given waste stream. In other words, to assess reporting rates of food thrown away in the trash, households had to have completed both the diary and had trash bound waste sorted. Compost-only analysis was limited to households who completed the diary and had curbside compost sorted. The weights used from the diary were only for entries disposed to landfill or to curbside compost.

In a similar study by the Natural Resources Defense Council (NRDC), comparing kitchen

diaries to household-level waste audits showed an average underreporting rate of 47% (NRDC, 2017). The NRDC study underreporting rate was calculated using a slightly different method than the one used by this study. In the NRDC study, the difference in weights reported in the diary and waste sort were divided by the sum of diary and waste sort weights, instead of just by the waste sort weight alone. If the NRDC underreporting rate is recalculated using the same method as this study, the result is an underreporting rate of 36%, comparable to the figures in this study.³⁶

The under-reporting rate of 35% was similar to UK WRAP and NRDC's reporting rates, both of which used paper only diaries. This suggests that the format of the diary did not affect reporting rates. An independent- t-test was performed to determine if there was a difference between the online and paper diary formats for mean household wasted edible food weight. No statistically significant differences were found. It is notable that the online format was much preferred by most Oregon participants, although some participants chose to use the paper diary. While the online diary allows for easier data analysis (and eliminates the potential for data transcription errors), making the diary available in multiple formats may help to ensure a higher completion rate as well as a sample that is more representative of the general population.

Determining Edibility

It is important to clearly define, for both study staff and participants, edible versus inedible parts, including how they will be separated in each of your methods. For instance, separating foods and determining their edibility in kitchen diaries is done by participants, whereas research staff make this determination in waste sort studies. Participants often do not separate all of their food items, nor do they accurately label them, calling some things 'scraps' and inedible that we would consider leftovers. Clear definitions can help minimize this problem. Study staff analyzing kitchen diary data and sorting waste materials also need clear guidance, including examples of what is and is not considered edible.

Edibility is not a fixed concept, differing across cultures and contexts. Thus, when setting a baseline or comparing data to a baseline, it is important to keep consistent definitions of edibility or note any key differences. References for defining edibility and deriving quantitative conversion factors (e.g. to transform a whole apple into edible and inedible parts by weight) include the USDA National Nutrient Database for Standard Reference and UK WRAP's Household Level Data Restated paper (Gillick & Queded, 2018). The FLW Accounting and Reporting Standard Appendix B also has more information and guidance on defining and determining edibility.

Characterizing Food Materials

In both kitchen diaries and waste sorts, specific food items can be characterized and categorized in a variety of ways based on the study goals. Detailing specific food items

³⁶ Unpublished estimation confirmed in a conversation with NRDC.

within each broader food group increases understanding of food waste behaviors and supply chain opportunities to reduce food waste. Based on available resources, both the Oregon Wasted Food Study and the NRDC used the following basic food types:³⁷

- Meat and Fish
- Dairy and Eggs (including milk)
- Fruit and Vegetables
- Baked Goods
- Dry foods (grains, pasta, cereals)
- Snacks, condiments, and other
- Liquids/oils/grease
- Cooked/prepared items/leftovers
- Unidentifiable
- Inedible

If resource constraints are an issue, categories can be combined. Here is an example of a simplified list of food categories. Sort edible food into 5 simplified food categories, below, and 1 inedible category to reduce waste composition study costs and associated data analysis by anywhere from 5-30%.

- Fruit and Vegetables
- Animal products (including dairy and eggs)
- Leftovers/prepared foods
- Bread/Baked goods
- Other (can include liquids if sewer is included as a destination)
- Inedible

Increasing the granularity of data by sorting and weighing specific foods within each broader food group can add to our collective understanding of food waste behaviors and supply chain opportunities to reduce food waste.

Cities and counties without access to any waste data can use proxy data for a similar geographical area and population size to try to assess the baseline amount of wasted food. However, it will not be possible to measure progress over time without data collection. It is not currently possible to develop proxy metrics for how certain actions translate to reductions in wasted food, given the current lack of data evaluating solutions and high rates of variability of outcomes.

³⁷ Ten edible food categories were used in the Oregon Wasted Food Study, separating eggs from dairy. NRDC combined eggs with dairy for nine edible food categories.

By tracking multiple disposal destinations to assess the total generation of wasted food, progress can be assessed over time, as illustrated in this example table from the CEC Practical Guide:

Table 2. Tracking Reduction in FLW by Measuring FLW Sent to Various Destinations over Time (tonnes/year)

	2016	2017	2018
Total Production	100,000 tonnes	100,000 tonnes	100,000 tonnes
Anaerobic Digestion	3,000 tonnes	4,000 tonnes	4,000 tonnes
Landfill	8,000 tonnes	6,000 tonnes	5,500 tonnes
Sewer/water treatment	4,000 tonnes	3,500 tonnes	3,500 tonnes
Total FLW	15,000 tonnes	13,500 tonnes	13,000 tonnes
Tonnes FLW per unit of production (percent)	15%	13.5%	13%
Reduction in FLW (percent relative to 2016)	0%	-10%	-13%

The most helpful option for states to assess and measure food loss and waste is to develop as granular baseline data sets as possible. Starting with waste composition data (either from an aggregated study or sorts from a large number of independent households) for food focused categories provides a solid starting point, which can be complemented with other methods to determine loss reasons and root causes. Amounts, types of food waste, and loss reasons are the three critical elements to developing actionable data sets that inform state level actions to reduce food loss and waste, and will allow for the tracking of outcomes over time. In the state of Oregon, the generation of waste is defined as the total amount of material disposed to landfill, incinerator and recovery pathways (such as compost and anaerobic digestion), however, disposal destinations like sewer and feeding to animals can be significant and growing, which is why a diary method can help to supplement traditional data on waste collection.

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Appendix

Technical Tables

Table 14: Comparison of Oregon Wasted Food Study to DEQ Waste Composition Study Results, Unweighted Results

	DEQ Waste Composition Study Pounds (% of food)	Oregon Wasted Food Study WASTE SORT Pounds (% of food)	Oregon Wasted Food Study DIARY Pounds (% of food)
State of Oregon			
Inedible	3468.72 (41%)	347.57 (27%)	151.98 (25%)
Vegetable & Fruit	2518.59 (30%)	296.03 (23%)	149.51 (24%)
Bakery	831.51 (10%)	119.05 (9%)	43.34 (7%)
Meat, eggs, dairy	1001.92 (12%)	149.45 (12%)	62.79 (10%)
Mixed	450.50 (5.4%)	186.16 (14%)	113.96 (19%)
Total food	8271.25	1298.44	616.44
Portland Only			
Inedible	266.1 (35%)	24.98 (28%)	7.06 (29%)
Vegetable & Fruit	333.9 (44%)	19.38 (22%)	4.8 (20%)
Bakery	60.6 (8%)	5.34 (6%)	2.31 (10%)
Meat, eggs, dairy	91.6 (12%)	7.57 (8%)	3.42 (14%)
Mixed	11.6 (2%)	8.88 (10%)	1.43 (6%)
Total food	763.8	89.83	24.39

Oregon Wasted Food Study: Entire sample Waste sort n = 230 households; Diary n = 182 households
 Portland only sub-sample: Waste sort n = 51 households; Diary n = 44 households
 DEQ Waste Composition Study: Weights collected at the level of residential hauling routes.

Additional Results

Additional analyses of survey items using the phase II data (state-wide phone survey) and the phase III data (pre-diary survey only) are detailed here.

The data collected in phase II (state-wide phone survey) and phase III (pre-diary survey only) were combined to allow for an analysis of demographic groups that were too small for analysis in each survey independently. Data was weighted on three variables: household type, urban/rural classification, and age group of respondents. The recruitment and sampling methods for the phase II and III surveys were very different. Phase II recruited households

randomly using a sample of phone numbers. Phase III recruited households on specific waste hauling routes in five sites. This approach yielded findings in all areas studied in the surveys (e.g., procurement, planning, etc.), reported below. We would like to note that combining the data of two samples recruited in such different ways and whose data was collected differently does introduce a potential for error due to selection bias. Testing for differences between the two samples, we found that they did differ significantly by age, gender, and education level. The samples also did not differ in terms of household type or income. Since the three variables that differed were individual level, not the household level, these differences between a statewide random sample and a non-random, site constrained sample are not surprising. The two household level demographic variables were not significantly different between the two samples which is a positive finding as the study was done at the household level. Results of the surveys individually can be found in detail in the previously published reports on phases II and III.

Procurement

A chi-square analysis was conducted and found a statistically significant relationship between the age group of the respondent and how much they agreed or disagreed with the statement “I find grocery shopping to be a hassle.” Respondents in the 65 or older group were more likely to disagree that grocery shopping is a hassle. ($X^2= 24.445, p<.01$).

Table 15: Grocery Shopping Is a Hassle across Age Groups

Age Group**	Grocery Shopping Is a Hassle				
	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree
18-34 years	29.4%	16.8%	7.1%	15.7%	31.0%
35-64 years	31.5%	6.9%	13.3%	19.4%	28.9%
65 years or older	52.2%	19.0%	9.7%	14.2%	4.9%

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant
Q15_G: I find grocery shopping to be a hassle.

A chi-square test was conducted to test for a relationship between how much the respondent reported spending on food eaten at home and how often they said they “buy more than what I need in case there are unexpected guests.” A statistically significant relationship was found with respondents that spend more on food also more often saying they buy more than they need in case of unexpected guests. ($X^2= 26.467, p<.01$).

Table 16: Buying More in Case of Unexpected Guests across Amounts of Money Spent on Food

Money Spent on Food Eaten at Home**	Buy More in Case of Unexpected Guests				
	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree
\$100 or less	64.6%	9.7%	8.0%	8.0%	9.7%
\$101 to \$200	52.2%	15.7%	9.1%	9.9%	13.1%
\$201 or more	42.7%	11.7%	8.7%	20.4%	16.5%

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant
Q15_I: I buy more than what I need in case there are unexpected guests.

A chi-square test was conducted and found a statistically significant relationship between the money spent on food eaten at home and how much respondents agreed with the statement “I buy more than I need because I like my fridge to be full.” Respondents that reported spending more than \$101 a month were more likely to agree or somewhat agree ($X^2= 17.920, p<.05$).

Table 17: Buying More to Keep Fridge Full across Amounts of Money Spent on Food

Money Spent on Food Eaten at Home*	Buy More to Keep Fridge Full				
	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree
\$100 or less	78.8%	6.3%	4.5%	3.8%	6.6%
\$101 to \$200	67.6%	13.8%	3.3%	8.4%	6.9%
\$201 or more	68.0%	14.6%	2.9%	7.8%	6.8%

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant
Q15_J: I buy more than I need because I like my fridge to be full.

A chi-square test was done and found a statistically significant relationship between respondent age group and how much they agreed that “date labels are a key source of information when they purchase dairy and meat.” The 18-34 year age group was less likely to agree as compared to the other older age groups ($X^2= 18.762, p<.05$).

Table 18: Date Label Are Key Source of Information for Buying Dairy and Meat across Age Groups

Age Group*	Date Labels Are Key Source of Information When Purchasing Dairy and Meat				
	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree
18-34 years	9.3%	4.6%	9.8%	12.9%	63.4%
35-64 years	7.3%	2.9%	5.3%	14.3%	70.2%
65 years or older	10.4%	3.0%	2.2%	6.0%	78.4%

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant
Q15K_Reversed: Date labels are a key source of information when I purchase dairy and meat.

Planning

A chi-square test was conducted to determine if a statistically significant relationship existed between the age group of the respondent and how often they check to see what they already have before going shopping. The Never and Rarely options were combined to ensure the minimum cell count was achieved to properly run a chi-square test. Respondents in the 35-64 year and 65 years and older age groups were more likely to report Often or Always checking as compared to respondents in the 18-34 year age group ($X^2= 22.400, p<.01$).

Table 19: Checking for Food on Hand across Age Groups

Age Group**	Frequency of Checking for Food on Hand before Shopping			
	Never or Rarely	Sometimes	Often	Always
18-34 Years	9.0%	18.5%	30.5%	42.0%
35-64 Years	3.8%	11.3%	39.4%	45.0%
65 Years or Older	4.5%	15.8%	24.1%	55.6%

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant
Q2: Before shopping for food, how often does your household check to see what you already have?

A chi-square test was conducted to explore the relationship between respondent age group and how often they estimated how much of each item they needed before shopping for food. A statistically significant relationship was found with respondents in the 18-34 year age group being less likely to estimate how much of each item they need to buy before shopping for food as compared to older age groups ($X^2= 25.029, p<.05$).

Table 20: Frequency of Estimating Amount of Each Item You Need To Buy Before Shopping Across Age Groups

Age Group*	Frequency of Estimating How Much to Buy before Shopping			
	Never or Rarely	Sometimes	Often	Always
18-34 Years	11.0%	21.0%	38.5%	29.5%
35-64 Years	6.4%	14.2%	34.5%	44.9%
65 Years or Older	9.8%	15.2%	22.7%	52.3%

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant
 Q3: Before shopping for food, how often does your household estimate how much of each item you need to buy?

A chi-square test was conducted to explore the relationship between household type and frequency of estimating how much of each item they need to buy before shopping for food. The Never and Rarely options for this item were combined to ensure the minimum cell count was achieved for running a chi-square test. A statistically significant relationship was found with Single Adult Households being more likely to report that they Always estimate how much of each item they need to buy before shopping for food as compared to other household types ($X^2= 24.014, p<.05$).

Table 21: Estimating Amount of Food to Buy before Shopping Across Household Types

Household Type*	Frequency of Estimating How Much to Buy before Shopping			
	Never or Rarely	Sometimes	Often	Always
1 Adult	6.4	16.6	21.9	55.1
2+ Adults without Children under 18	9.6	15.8	36.2	34.9
1+ Adults with Children under 18	8.2	17.4	27.3	39.5

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant
 Q3: Before shopping for food, how often does your household estimate how much of each item you need to buy?

A chi-square test was conducted to explore the relationship between age group and the how many main meals respondents planned ahead of time. A statistically significant relationship was found with the 18-34 year age group reporting that they plan meals ahead of time less often than the 35-64 year and 65 year or older age groups ($X^2= 26.875, p<.05$).

Table 22: Planning Meals Ahead of Time Across Age Groups

Age Group*	Proportion of Main Meals Planned Ahead of Time on a Weekly Basis			
	None of Them	A Few of Them	Most of Them	Almost All of Them
18-34 Years	16.6	38.7	33.7	11.1
35-64 Years	5.2	36.3	36.9	21.5
65 Years or Older	7.6	37.1	37.9	17.4

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant
 Q6: On a weekly basis, how many of your main meals do you plan ahead of time?

Leftovers

A chi-square test revealed that households that have two or more adults without children were more likely to say they Always eat leftovers as another meal without alteration or other food added ($X^2=15.741, p<.05$) as compared to households that only have one adult or have children under 18.

Table 23: Leftovers Eaten as Another Meal without Alteration Across Household Type

Household Type*	Frequency Leftovers Are Eaten as Another Meal without Alteration			
	Never or Rarely	Sometimes	Often	Always
1 Adult	12.3	20.9	53.5	13.4
2+ Adults without Children under 18	5.8	25.4	46.4	22.3
1+ Adults with Children under 18	12.2	20.9	51.0	15.8

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant
 Q8_B: Sometimes households have leftovers. How often are leftovers eaten as another meal, without alteration or other food added?

A chi-square test was conducted to determine if a statistically significant relationship existed between respondent age group and eating leftovers with other food added. Respondents in the 18-34 year age group were significantly more likely to say they Never or Rarely did this as compared to respondents in the 35 to 64 year or 65 years or older age groups ($X^2= 31.639$, $p<.001$).

Table 24: Leftovers Eaten as Another Meal without Alteration across Age Groups

Age Group**	Frequency Leftovers Are Eaten as Another Meal without Alteration				
	Never	Rarely	Sometimes	Often	Always
18-34 Years	12.1%	20.7%	39.4%	26.8%	1.0%
35-64 Years	5.8%	11.6%	39.8%	38.1%	4.7%
65 Years or Older	5.3%	10.5%	42.9%	33.1%	8.3%

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant
 Q8_B: Sometimes households have leftovers. How often are leftovers eaten as another meal, without alteration or other food added?

A chi-square test was conducted to determine the relationship between respondent age group and how often leftovers are composted or put in curbside composting. A statistically significant relationship was found, with respondents in the 18-34 year and 35-64 year age groups being significantly more likely to report Often or Always than those in the oldest age group ($X^2=17.937$, $p<.05$).

Table 25: Leftovers Composted or Put in Curbside Composting across Age Groups

Age Group*	Frequency that Leftovers Are Composted or Put in Curbside Composting				
	Never	Rarely	Sometimes	Often	Always
18-34 Years	37.3%	27.6%	14.6%	12.4%	8.1%
35-64 Years	41.3%	19.6%	21.4%	8.3%	9.5%
65 Years or Older	44.5%	30.3%	9.2%	8.4%	7.6%

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant
 Q8_C: (How often are leftovers) Composted or put in curbside composting?

A chi-square test was conducted to determine the relationship between respondent age group and how often leftovers are put down the drain or garbage disposal. A statistically significant relationship was found with respondents in the 18-34 year significantly more likely to report Often or Always than those in the older age groups ($X^2=17.937, p<.05$).

Table 26: Leftovers Put Down the Drain or Garbage Disposal across Age Groups

Age Group*	Frequency that Leftovers Are Put Down the Drain or Garbage Disposal				
	Never	Rarely	Sometimes	Often	Always
18-34 Years	21.2%	31.3%	26.8%	14.6%	6.1%
35-64 Years	38.3%	31.6%	19.7%	5.8%	4.6%
65 Years or Older	31.1%	35.6%	19.7%	8.3%	5.3%

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant
Q8_D: (How often are leftovers) Put down the drain or garbage disposal?

A chi-square analysis was conducted to determine if a relationship existed between respondents putting leftovers down the drain and the household type. A statistically significant difference was found with single adult households reporting that they are less likely to put leftovers down the drain ($X^2=23.393, p<.005$).

Table 27: Leftovers Put Down the Drain or Garbage Disposal across Household Types

Household Type*	Frequency that Leftovers Are Put Down the Drain or Garbage Disposal				
	Never	Rarely	Sometimes	Often	Always
1 Adult	35.6%	36.7%	19.1%	3.2%	5.3%
2+ Adults without Children under 18	32.2%	33.6%	21.6%	9.6%	3.1%
1+ Adults with Children under 18	27.7%	26.2%	25.1%	13.3%	7.7%

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant
Q8_D: (How often are leftovers) Put down the drain or garbage disposal?

An additional chi-square test was run to determine if the presence of children in a household was related to how often respondents reported putting leftovers down the drain. This also resulted in a statistically significant difference with adult only households reporting that they less frequently put leftovers down the drain ($X^2=16.022, p<.005$).

A chi-square analysis was conducted to determine the relationship between the money spent on food each week and how often they put leftovers down the drain or garbage disposal. A statistically significant relationship was found with households that spent \$100 or less were less likely to put leftovers down the drain or garbage disposal ($X^2=32.619, p<.001$).

Table 28: Leftovers Put Down the Drain or Garbage Disposal across Money Spent on Food Eaten at Home

Money Spent on Food Eaten at Home***	Frequency that Leftovers Are Put Down the Drain or Garbage Disposal				
	Never	Rarely	Sometimes	Often	Always
\$100 or Less	37.6%	33.8%	19.5%	4.2%	4.9%
\$101 to \$200	25.2%	32.8%	25.5%	13.5%	3.3%
\$201 or More	34.0%	26.2%	19.4%	9.7%	10.7%

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant
 Q8_D: (How often are leftovers) Put down the drain or garbage disposal?

A chi-square test was used to determine if a statistically significant relationship existed between household income and how often leftovers were put down the drain or garbage disposal. To conduct this test, it was necessary to combine the Often and Always categories to achieve the required minimum responses per cell to run a valid chi-square test. The test found that a statistically significant relationship exists, with the highest income group being most likely to report Sometimes putting leftovers down the drain and generally reporting to do this behavior more often than other income groups ($X^2=24.684, p<.001$).

Table 29: Leftovers Put Down the Drain or Garbage Disposal across Household Income Levels

Household Income***	Frequency that Leftovers Are Put Down the Drain or Garbage Disposal			
	Never	Rarely	Sometimes	Often or Always
Less than \$25,000	38.7%	28.8%	18.0%	14.4%
\$25,000 to less than \$50,000	31.5%	28.9%	22.1%	17.4%
\$50,000 to less than \$75,000	34.1%	36.2%	18.1%	11.6%
\$75,000 to less than \$100,000	42.7%	28.1%	16.9%	12.4%
\$100,000 or more	21.65	34.5%	32.4%	11.5%

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant
 Q8_D: (How often are leftovers) Put down the drain or garbage disposal?

A chi-square test was conducted to determine the relationship between respondent age group and how often leftovers were fed to pets. To conduct this test, it was necessary to combine the Often and Always categories to achieve the required minimum responses per cell to run a valid chi-square test. A statistically significant relationship was found with younger respondents in the 18-34 year age group reporting that this happens more often than the other age groups and the 65 year or older age group reporting that this happens the least often. ($X^2=21.673, p<.001$)

Table 30: Leftovers Fed to Pets or Animals across Age Groups

Age Group***	Frequency that Leftovers Are Fed to Pets			
	Never	Rarely	Sometimes	Often or Always
18-34 Years	54.7%	17.9%	17.9%	9.5%
35-64 Years	65.8%	10.2%	12.9%	11.1%
65 Years or Older	70.0%	8.3%	14.2%	7.5%

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant
 Q8_E: (How often are leftovers) Fed to animals?

A chi-square test was conducted to see if a relationship existed between household types and feeding leftovers to animals. To conduct this test, it was necessary to combine the Often and Always categories to achieve the required minimum responses per cell to run a valid chi-square test. A statistically significant relationship was found with single adult households being less likely than other household types to feed leftovers to pets. ($X^2=24.684, p<.001$).

Table 31: Leftovers Fed to Pets or Animals across Household Types

Household Type***	Frequency that Leftovers Are Fed to Pets			
	Never	Rarely	Sometimes	Often or Always
1 Adult	77.6	5.7	11.5	5.2
2+ Adults without Children under 18	60.1	12.6	15.0	12.2
1+ Adults with Children under 18	55.2	17.7	16.7	10.4

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant
 Q8_E: (How often are leftovers) Fed to animals?

An additional chi-square test was run to determine if the presence of children in a household was related to how often respondents reported putting leftovers fed to pets. This also resulted in a statistically significant difference with adult only households reporting that they less frequently feeding leftovers to pets ($X^2=11.177, p<.05$).

A chi-square test was conducted to see if a relationship existed between the amount of money spent on food eaten at home and feeding leftovers to animals. To conduct this test, it was necessary to combine the Often and Always categories to achieve the required minimum responses per cell to run a valid chi-square test. Respondents that reported spending \$201 or

More on food per week were more likely to report that they Often or Always feed leftovers to animals ($X^2=23.697, p<.01$).

Table 32: Leftovers Fed to Pets or Animals across Money Spent on Food Eaten at Home

Money Spent on Food Eaten at Home Per Week**	Frequency that Leftovers Are Fed to Pets			
	Never	Rarely	Sometimes	Often or Always
\$100 or Less	68.3%	11.1%	11.8%	8.9%
\$101 to \$200	65.9%	11.2%	15.0%	7.9%
\$201 or More	43.6%	18.8%	18.8%	18.8%

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant
Q8_E: (How often are leftovers) Fed to animals?

A chi-square test was conducted and found a statistically significant relationship between the reported income of the household and how often that household fed leftovers to pets. Respondents that reported household income of less than \$25,000, \$50,000 to less than \$75,000 and \$100,000 or more were more likely to report never or rarely feeding leftovers to pets as compared to households that reported income of \$25,000 to less than \$50,000 or \$75,000 to less than \$100,000. ($X^2=26.03, p<.05$)

Table 33: Leftovers Fed to Pets or Animals across Household Income Levels

Household Income*	Frequency that Leftovers Are Fed to Pets			
	Never	Rarely	Sometimes	Often or Always
Less than \$25,000	69.5%	12.4%	10.5%	7.6%
\$25,000 to less than \$50,000	59.3%	11.4%	16.4%	12.9%
\$50,000 to less than \$75,000	76.2%	5.4%	9.2%	9.2%
\$75,000 to less than \$100,000	55.1%	11.2%	22.5%	11.2%
\$100,000 or more	60.1%	18.9%	11.2%	9.8%

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant
Q8_E: (How often are leftovers) Fed to animals?

A chi-square test was conducted to see if a relationship existed between the respondent age group and throwing leftovers in the garbage. A statistically significant relationship exists with respondents in the 18-34 year age group being more likely to report Often or Always throwing leftovers in the garbage as compared to the other older age groups ($X^2=41.192$, $p<.001$).

Table 34: Leftovers Thrown in the Garbage across Age Groups

Age Group***	Frequency that Leftovers Are Thrown in the Garbage				
	Never	Rarely	Sometimes	Often	Always
18-34 Years	24.1%	33.2%	18.1%	17.6%	7.0%
35-64 Years	43.9%	27.9%	18.6%	5.8%	3.8%
65 Years or Older	46.6%	27.1%	15.0%	9.8%	1.5%

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant
 Q8_F: (How often are leftovers) Thrown in the garbage?

A chi-square test was conducted to see if a relationship existed between the household type and throwing leftovers in the garbage. A statistically significant relationship such that households that had one or more adults with children under 18 years were more likely to say they Often or Always threw leftovers in the garbage ($X^2=33.34$, $p<.001$).

Table 35: Leftovers Thrown in the Garbage across Household Types

Household Type***	Frequency that Leftovers Are Thrown in the Garbage				
	Never	Rarely	Sometimes	Often	Always
1 Adult	44.1%	34.0%	14.4%	4.8%	2.7%
2+ Adults without Children < 18	41.9%	27.1%	18.6%	8.2%	4.1%
1+ Adults with Children < 18	27.7%	28.2%	20.0%	17.9%	6.2%

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant
 Q8_F: (How often are leftovers) Thrown in the garbage?

An additional chi-square test was run to determine if the presence of children in a household was related to how often respondents reported throwing leftovers in the garbage. This also resulted in a statistically significant difference with adult only households reporting that they never or rarely put leftovers in the garbage ($X^2=28.306$, $p<.001$).

A chi square test was conducted and found that there is a relationship between the amount a respondent reported spending on food eaten at home and how often they prioritize eating leftovers, with people who spend \$100 or less being more likely to do so. To conduct this test, it was necessary to combine the Never and Rarely categories to achieve the required minimum responses per cell to run a valid chi-square test ($X^2=20.433, p<.01$).

Table 36: Prioritizing Eating Leftovers across Amount of Money Spent on Food Eaten at Home

Money Spent on Food Eaten at Home Per Week**	Frequency of Prioritizing Eating Leftovers			
	Never or Rarely	Sometimes	Often	Always
\$100 or Less	5.9%	20.1%	35.4%	38.5%
\$101 to \$200	11.3%	18.6%	46.7%	23.4%
\$201 or More	9.6%	17.3%	44.2%	28.8%

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant
 Q12_A: Generally, how often do you or other household members take the following actions? Prioritize eating leftovers

A chi-square test was done to see if a relationship existed between how much the respondent household spent on food and how often household members freeze leftovers. A statistically significant relationship exists with respondents that spend \$100 or less being more likely to report always freezing leftovers ($X^2= 26.720, p<.05$).

Table 37: Freezing Leftovers across Amount of Money Spent on Food Eaten at Home

Money Spent on Food Eaten at Home*	Frequency of Freezing Leftovers				
	Never	Rarely	Sometimes	Often	Always
\$100 or Less	18.5%	14.7%	26.6%	20.6%	19.6%
\$101 to \$200	26.4%	23.4%	15.4%	24.4%	10.6%
\$201 or More	23.1%	20.2%	20.2%	24.0%	12.5%

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant

Disposal

A chi-square test was done to determine if a relationship existed between how easy or difficult it would be to reduce waste in respondents' households and the age group of the respondent. A statistically significant relationship was found with the youngest age group (18-34 years) being much more likely to report it being very easy to reduce food waste as compared to the older age groups ($X^2=19, p<.001$).

Table 38: Ease of Reducing the Amount of Food that Goes to Waste across Age Groups

Ease of Reducing the Amount of Food That Goes to Waste

Age***	Very Difficult	Somewhat Difficult	Neither Difficult nor Easy	Somewhat Easy	Very Easy
18-34 Years	3.1%	23.2%	15.5%	39.7%	18.6%
35-64 Years	9.2%	25.7%	15.4%	38.2%	11.5%
65 Years or Older	17.5%	30.0%	18.3%	16.7%	17.5%

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant

A chi-square test revealed that there is a statistically significant relationship between a respondent's gender and how easy or difficult they thought it would be for them to reduce the amount of waste in their household. Respondents who identified as male generally said it would be easier to reduce waste than respondents who identified as female ($X^2 = 15.292, p < 0.01$).

Table 39: Ease of Reducing the Amount of Food that Goes to Waste by Respondent Gender

Ease of Reducing the Amount of Food That Goes to Waste

Gender**	Very Difficult	Somewhat Difficult	Neither Difficult nor Easy	Somewhat Easy	Very Easy
Male	11.5%	21.7%	11.5%	41.7%	13.6%
Female	7.1%	28.3%	18.0%	31.0%	15.6%

* $p<.05$ ** $p<.01$ *** $p<.001$ no notation: difference across groups was not statistically significant

Q14: How easy or difficult do you think it would be for you personally to reduce the amount of food that goes to waste in your household?

A chi square test was conducted and found a statistically significant relationship between household income and how easy or difficult respondents thought it would be for them to reduce the amount of waste in their household. Respondents that reported income of less than \$25,000 were more likely to report reducing household waste as Very Difficult as compared to other income groups. Respondents reporting \$100,000 or more were more

likely to say it would be Somewhat Easy to reduce food waste than other income groups. Respondents reporting \$75,000 to less than \$100,000 were more likely to report that reducing food waste would be Very Easy compared to the other income groups ($X^2 = 30.384, p < 0.05$).

Table 40: Ease of Reducing the Amount of Food that Goes to Waste Across Household Income Levels

Ease of Reducing the Amount of Food That Goes to Waste

Household Income*	Very Difficult	Somewhat Difficult	Neither Difficult nor Easy	Somewhat Easy	Very Easy
Less than \$25,000	14.7%	19.6%	16.7%	32.4%	16.7%
\$25,000 to less than \$50,000	8.5%	27.7%	10.6%	36.9%	16.3%
\$50,000 to less than \$75,000	8.9%	28.1%	12.6%	34.1%	16.3%
\$75,000 to less than \$100,000	2.3%	20.5%	18.2%	37.5%	21.6%
\$100,000 or more	5.6%	27.3%	21.7%	38.5%	7.0%

* $p < .05$ ** $p < .01$ *** $p < .001$ no notation: difference across groups was not statistically significant
 Q14: How easy or difficult do you think it would be for you personally to reduce the amount of food that goes to waste in your household?

A chi-square test revealed that respondents that identified as male were more likely to agree with the statement “I feel less guilty about throwing out food that has been in the refrigerator for a long time, compared to food that has been in the refrigerator for a short time” than respondents that identified as female ($X^2 = 18.266, p < 0.01$).

Table 41: Feel Less Guilty about Throwing Out Food Left in the Fridge a Long Time by Respondent Gender

Feel Less Guilty about Throwing Out Food Left in the Fridge a Long Time

Gender**	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree
Male	12.2%	6.3%	14.7%	13.9%	52.9%
Female	17.7%	6.4%	14.6%	23.6%	37.7%

* $p < .05$ ** $p < .01$ *** $p < .001$ no notation: difference across groups was not statistically significant
 Q15A_Reversed: I feel less guilty about throwing out food that has been in the refrigerator for a long time

Food Use, Preparation, and Management

A chi-square test revealed that different age groups differed in a statistically significant way with how strongly they agreed or disagreed with the statement “work and social life can make managing food at home difficult, leading to food going uneaten.” Respondents in the

18-34 year age group more strongly agreeing with the statement than the other two age groups, with the 65 years or older age group more often disagreeing ($X^2 = 84.881, p < .001$).

Table 42: Managing Work and Social Life Make Managing Food Difficult Across Age Groups

Work and Social Life Make Managing Food Difficult

Age Group***	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree
18-34 years	7.7%	12.3%	7.7%	30.3%	42.1%
35-64 years	31.3%	11.9%	7.5%	17.1%	32.2%
65 years or older	49.6%	10.5	10.5%	9.8%	19.5%

* $p < .05$ ** $p < .01$ *** $p < .001$ no notation: difference across groups was not statistically significant
 Q15_F: Work and social life can make managing food at home difficult, leading to food going uneaten.

A chi-square test showed that households who reported going to farmers markets were more likely to Often or Always use vegetable peels and stalks in cooking ($X^2 = 11.442, p < .05$).

Table 43: Frequency of Using Vegetable Peels and Stalks in Cooking for Households Shopping at Farmers Markets

Frequency of Using Vegetable Peels and Stalks in Cooking

Farmers Market*	Never	Rarely	Sometime	Often	Always
No	41.2%	20.6%	22.3%	10.3%	5.6%
Yes	33.5%	18.1%	22.2%	17.8%	8.4%

* $p < .05$ ** $p < .01$ *** $p < .001$ no notation: difference across groups was not statistically significant

A chi-square test showed that people who reported having a backyard garden were more likely to Often or Always use vegetable peels and stalks in cooking ($X^2 = 35.577, p < .001$).

Table 44: Frequency of Using Vegetable Peels and Stalks in Cooking for Households with a Backyard Garden

Frequency of Using Vegetable Peels and Stalks in Cooking

Backyard Garden***	Never	Rarely	Sometime	Often	Always
No	44.8%	19.9%	21.0%	8.3%	6.1%
Yes	27.8%	18.4%	23.6%	21.7%	8.4%

* $p < .05$ ** $p < .01$ *** $p < .001$ no notation: difference across groups was not statistically significant

A chi-square test showed a statistically significant relationship between people reporting going to farmers markets and how often they used bones in cooking. Households that shop at farmers markets reported using bones in cooking more Often ($X^2 = 11.637, p < .05$).

Table 45: Frequency of Using Bones in Cooking for Households Shopping at Farmers Markets

Farmers Market*	Frequency of Using Bones in Cooking				
	Never	Rarely	Sometime	Often	Always
No	45.7%	20.7%	18.7%	8.0%	7.0%
Yes	39.1%	19.6%	17.1%	16.6%	7.6%

* $p < .05$ ** $p < .01$ *** $p < .001$ no notation: difference across groups was not statistically significant

A chi-square test was conducted and a statistically significant relationship was found between respondents that had backyard gardens and how often they reported managing food in the refrigerator by storing items that need to be eaten the soonest in a designated area with those that had a garden reporting not doing this as often as those that did not have a garden. ($X^2 = 14.922, p < .01$).

Table 46: Frequency of Managing Food in the Refrigerator for Households with a Backyard Garden

Backyard Garden**	Manage food in the refrigerator				
	Never	Rarely	Sometime	Often	Always
No	36.2%	9.9%	13.2%	21.6%	19.2%
Yes	37.1%	13.2%	21.6%	14.5%	14.2%

* $p < .05$ ** $p < .01$ *** $p < .001$ no notation: difference across groups was not statistically significant

Sample materials

Recruiting Guide

Food Study³⁸ - Recruiting Guide

Thank you for recruiting participants for the Food Study! Below you'll find everything you need to successfully, and safely, talk to residents about participating in this important study.

- Supply list
- Clip board
- Map of recruiting area
- Laminated info sheet
- Digital tablet or paper record sheets
- Door Hangers
- Consent forms (2 copies per participating household)
- Instructions (for digital participants)
- Instructions (for paper participants)
- Survey #1 (paper version, for participants who opt for paper over online)
- Contact information cards
- Orange liners (bags) w/ instructions (for multi-family only)

Safety considerations

You are to recruit only in pairs, knocking on doors within shouting distance of each other (i.e., across the street from one another).

If there is a “No Soliciting” sign on a house, skip the house and go to the next one.

If there is an unrestrained dog or anything else that makes you feel your safety could be compromised, skip the house and go to the next one.

GOING DOOR TO DOOR

Knock or ring doorbell and wait for someone to answer.

No-one answers:

- Leave a door hanger
- Enter data into spreadsheet on tablet

Someone answers:

- If it is a child clearly under the age of 18, ask if there is an adult you can speak with.

³⁸ We do not use the term ‘food waste’ to minimize bias in the study.

“Hello. I want to let you know I am not selling anything. I am part of a research study team at X. We are looking for households in your neighborhood to participate in a study on food use and disposal. You can earn up to \$X and receive a digital kitchen scale. Would you like to hear more about the study?”

If person declines: “Thanks for your time. Could I leave this card with more information in case you change your mind?”

If they are unsure or interested: Present them with the simple laminated info-sheet. “This is a study being conducted to better understand how X use and dispose of food. There are four steps to participating in this study:

1. Taking a 20-30 minute survey.
2. Having our staff collect your trash (and compost if you have curbside composting) on your regular pick-up day, as you would ordinarily put it out. We will sort this off-site and dispose of it properly. We only record information about the weight and type of food that is in the trash and compost. We will not record any other information about the trash.
3. Filling out a diary for seven days, recording all food your household throws out.
4. Taking a 10-15 minute follow-up survey.

You can do the surveys and diary online, or on paper, if you prefer.

Once you complete the first survey and have your trash collected, you’ll receive a digital kitchen scale that you can keep. After you complete the food diary and second survey you will receive a \$X gift card. If you complete the food diary for seven days in a row, you receive a \$X bonus for a total of \$X on a gift card.”

If they are interested but hesitant to commit:

If you’d like, you’re welcome to review the study details on the website on this card (give them door hanger. You can also offer them a printed copy of participant guide). I’d also be happy to email you more information about the study for you to review. (If someone says they’d like you to email them more info, please enter their email address in spreadsheet.)

If person is still unclear about requirements: If you choose to participate, we will send you a survey that would take about 20-30 minutes to complete.

After that, we'll schedule a time to come and take away your trash and compost to be sorted, weighed and recorded. We will sort this off-site and dispose of it properly. We are only recording information about the weight and type of food that is in the trash and compost and will not be recording any other information about the trash.

Next, you complete the food diary for seven days. You record all of the food that is thrown out in your home. If possible, record the food your throw away when you are outside of the home for you or whoever is the main participant. Any person in the household can participate, but only one person in the household can receive the \$X-X incentive.

After the diary is completed, we will send a follow-up, 10-15 minutes survey.

If person decides to participate, review consent form with them:

“This form describes the study and what it means to participate in it. This research is being conducted by X. This explains the process in more detail. If you want to participate, you will need to sign this consent form and indicate the best ways to contact you during the study period. Any information we collect throughout the study will be confidential and your identity would be kept private. There is also contact information if you have any questions about this study.”

REVIEW CONSENT FORM WITH PARTICIPANT THOROUGHLY.

Show participants where to sign and fill out contact information.

Sign on the line for staff signature.

Complete two copies of the consent form, one for our records and one for them to keep.
Make sure the consent form has a participant number in the corner.

Distribute appropriate supplies:

If participant selects online option, provide online instructions

If participant selects paper option, provide paper instructions, Survey #1, and self-addressed stamped envelope. Make sure the paper survey and consent form have the same participant number in the corner.

FOR MULTIFAMILY UNITS

For multifamily buildings with a lobby or buzzer system, **DO NOT** go door to door. If there is a person in the reception area, ask if you can leave some door hangers for residents to pick-up, or if there is a board you can post them on.

You can recruit standing outside of the building and asking people as they enter or leave if they might be interested in being in a study.

If you recruit a multi-family household, provide them with 3 orange trash bags with instructions, in addition to the other materials provided to all participants.

Potential questions participants may ask

Q: This is interesting... is it about food waste?

A: Understanding how and why food is thrown out is one part of this study. We're hoping to better understand many aspects of how households manage food, what they do with it and where it ends up. (We do not use the term 'food waste' to minimize bias in the study.)

Q: I don't compost so I don't think this applies to me.

A: You don't need to be someone who composts to be eligible for this study.

Q: How can I be sure my information is kept confidential? Are you going to sell my information?

A: NO. We take many steps to keep your information confidential. All participants are identified only by a participant ID number, separated from any contact information you provide us. All data files are kept on password protected computers. Your contact information will be destroyed at the end of the study. We will never sell your information.

Q: Is this a government project? Will the government know what goes on in my home?

A: The Oregon Department of Environmental Quality has funded Portland State University's Community Environmental Services to conduct this study. We will de-identify and anonymize all data and there will be no references to individual participants in any reports or publications. The DEQ will receive a spreadsheet of the data we collect, again with only participant ID numbers and no identifying information included.

Q: I'm willing to do the surveys but I don't want to do the rest. Can I still participate? Do I get \$X and the scale?

A: I'm sorry, only households willing to complete all parts of the study - the 2 surveys, the collection of trash and compost, and the seven day diary - can participate. We need all of this information to answer our research questions.

Q: I'm not sure I understand - if I do the diary in two weeks, do I get \$X?

A: Participants who complete a survey before the diary, put their garbage and compost (if applicable) out for collection, fill out the food tracking diary for seven days within two weeks, and complete a second survey will receive \$X and can keep the kitchen scale we provide. If you are able to do the diary for seven days in a row, you receive \$X more for a total of \$X on a gift card.

FINISHED? BEFORE YOU MOVE TO NEXT HOUSE...

Enter the address you just visited

If it is a multifamily unit, put an asterisk after the address (e.g., 123*)

Enter the outcome of the visit in the spreadsheet on the tablet

1: Door hanger
2: Recruited
3: Refused
4: Do Not Return
5: Other

*Please mark the sections on your recruiting map where you have knocked on doors with a highlighter or pen. When you return to the office, please update the laminated master copy to reflect the areas you have recruited in as well, using a sharpie.

Diary Script

Q146 Welcome to the Oregon food diary! If you have any questions, please check out the USER GUIDE.

Q161 Did you dispose of any food today?

- Yes (1)
- No (2)

Q145 What is the date?

Date entry

If answered “No” in Q161

Q143 Comments:

Text entry _____

End of survey

If answered “Yes” in Q161,

Q147 Where was the food disposed of?

- At home (1)
- Outside of the home (2)

Q148 Was the food from breakfast, lunch, dinner, or not part of a meal?

- Breakfast (1)
- Lunch (2)
- Dinner (3)
- Not part of a meal (4)

Q149 Would you like to add a photo?

Choose file button, browse to choose photo file

Q150 Please provide a detailed description of the food.

Text entry _____

Q151 How much did it weigh?

(0 to any whole integer)

- pounds (lb) _____
- ounces (oz) _____

If answered “Outside of the home” in Q147

Q152 Where did it come from?

- Restaurant or Cafeteria (1)
- Grocery store or market (2)
- Brought from home (3)
- Other (4) _____

If answered "Other" in Q152,
Type text explaining where it came from, text entry

Q153 Was it?

- Unprepared food (1)
- Cooked or prepared food (2)
- Inedible parts (3)
- Liquids (coffee, milk, etc.) (6)
- Other (5) _____

If answered "Other" in Q153,
Type text answering the nature of the food, if answer is not listed in the response list from Q153,
text entry

Q154 Reason? (select the primary one)

- Past date on label (1)
- Moldy or spoiled (2)
- Didn't like or tired of eating (3)
- Worry that it might cause illness (4)
- Too little to save (6)
- Not good as leftovers (7)
- Unable to store or save (10)
- Other (9) _____

If answered "Other" in Q154,
Type text explaining primary reason for disposing of food, if answer is not included in the response
list for Q154, text entry

Q155 What happened?

- Bought too much (1)
- Made too much (2)
- Lost track of in the fridge or cupboard (3)
- Too busy (4)
- Didn't know what to do with or how to use (6)
- Other (5) _____

If answered "Other" in Q155,

Type text explaining what happened, if answer is not included in the response list from Q155, text entry

Q156 Why was too much bought?

- It was on sale or discounted (1)
- The package was too large (2)
- Don't know (3)
- Other (4) _____

If answered "Other" in Q156,

Type text answering why too much was bought, if answer is not included in the response list from Q156, text entry

Q157 Why was too much made?

- Made a larger batch to eat throughout the week (1)
- Thought Others would eat it (2)
- Made too much on accident (3)
- Don't know (5)
- Other (4) _____

If answered "Other" in Q157,

Type text answering why too much was made, if answer is not included in the response list from Q157, text entry

Q158 Where did it go?

- Trash (1)
- Compost picked up at curb (2)
- Home or other compost (3)
- Down the drain (4)
- Fed to pets/animals (5)
- Other (6) _____

If answered "Other" in Q158,

Type text answering where and how the food was disposed of, if answer is not included in the response list from Q158

Q133 Comments:

Text entry _____

Q159 Do you have another entry to make?

- Yes (1)
- No (2)

If No, end of survey.

If Yes, return to beginning of survey

If Yes and 10th entry made,

This will be the final item you can enter, but if you still have more entries to make you can click on your diary link again after clicking the next button below.

Pre-Diary Survey

Thank you for taking time to participate in this important project. This is the initial survey and the first step in the Oregon Food Study. The purpose of the survey is to better understand how Oregonians purchase, use and dispose of food. The results will be used to develop programs to better manage food and leftovers. The survey takes about 20-30 minutes and is completely confidential. You may skip any item you don't want to answer, or stop the survey at any time.

First, a few questions about your household's shopping habits. Throughout the survey, when we say "household" we mean anyone you consider to be part of your household. Consider anyone you usually buy or cook food with or for. If you live alone or don't have anyone you buy or cook food with or for, consider yourself the "household".

[response option codes for each item are shown in parentheses]

Q1 Below is a list of possible places where your household may purchase or get food to eat at home. Please select all that apply.

- Superstores, like Costco (1)
- Grocery stores (2)
- Corner stores or mini-marts (3)
- Farmers market (4)
- Food pantries (5)
- Your backyard garden or local garden (6)
- CSA (Community-supported agriculture) (7)
- Online meal delivery for example, GrubHub, Blue Apron, or restaurants (8)
- Online grocery delivery for example, Amazon or Safeway (9)
- Other (Please specify) (66)

Display This Question: If Below is a list of possible places where your household may purchase or get food to eat at home... = Grocery stores

Q1A On average, how often does your household purchase or get food from a grocery store? Please consider your purchasing habits over the past year.

- 3 or more times per week (1)
- 1 to 2 times per week (2)
- Less than once per week (3)

Display This Question: If Below is a list of possible places where your household may purchase or get food to eat at home... = Farmers market

Q1B On average, how often does your household purchase or get food from a farmers market? Please consider your purchasing habits over the past year.

- 3 or more times per week (1)
- 1 to 2 times per week (2)

- Less than once per week (3)

Q2 Before shopping for food, how often does your household check to see what you already have?

- Never (1)
- Rarely (2)
- Sometimes (3)
- Often (4)
- Always (5)

Q2A Would you like to do that more?

- No (0)
- Yes (1)

Q3 Before shopping for food, how often does your household estimate how much of each item you need to buy?

- Never (1)
- Rarely (2)
- Sometimes (3)
- Often (4)
- Always (5)

Q3A Would you like to do that more?

- No (0)
- Yes (1)

Q4 When shopping for food, how often does your household do the following...

	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)
Buy more of a product than you were planning to, because it is on sale? (Q4_A)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Buy something unplanned, because it looks good at the time? (Q4_B)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Buy food in larger quantities than desired, due to the way food is packaged? (Q4_C)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q15_1 How strongly do you agree or disagree with the following statements?

	Agree (1)	Somewhat Agree (2)	Neither Agree nor Disagree (3)	Somewhat Disagree (4)	Disagree (5)
I buy more than what I need in case there are unexpected guests. (Q15_I)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I buy more than I need because I like my fridge to be full. (Q15_J)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I find grocery shopping to be a hassle. (Q15_G)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Date labels are a key source of information I use when purchasing dairy and meat. (Q15_K)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When shopping at the grocery store, I only purchase fruits and vegetables with no blemishes. (N15_A)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q5 On which days of the week does your household usually shop for food? Please select all that apply.

- Monday (1)
- Tuesday (2)
- Wednesday (3)
- Thursday (4)
- Friday (5)
- Saturday (6)
- Sunday (7)

Q6 On a weekly basis, how many of your main meals do you plan ahead of time? Main meals would be breakfast, lunch, or dinner.

- Almost all of them (1)
- Most of them (2)
- A few of them (3)
- None of them (4)

Q6A Would you like to plan ahead more often?

- No (0)
- Yes (1)

Q15_2 How strongly do you agree or disagree with the following statements?

	Agree (1)	Somewhat Agree (2)	Neither Agree nor Disagree (3)	Somewhat Disagree (4)	Disagree (5)
The person in my household who most often prepares meals is able to create meals based on what is on-hand. (If there is not one particular person that applies to, please consider yourself for this question.) (Q15_D)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My household eats similar meals each week. (Q15_C)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I wish I ate more healthily, for example eating more servings of fresh fruits and vegetables. (Q15_E)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Work and social life can make managing food at home difficult, leading to food going uneaten. (Q15_F)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I always eat the food that I have stored in the freezer. (Q15_H)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is important to finish all food that is on our plates for a meal. (N15_B)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I worry about whether I will have enough food in an average week. (N15_C)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q7 As part of your household's garbage and recycling service, do you have a separate container for food and yard waste?

- No (1)
- Yes (2)

Q8 Sometimes households have leftovers. How often are leftovers...

	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)
...eaten as another meal, without alteration or other food added? (Q8_A)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...used as part of another meal, with other food added? (Q8_B)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...composted or put in curbside composting? (Q8_C)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...thrown in the garbage? (Q8_F)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...fed to animals? (Q8_E)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...put down the drain or garbage disposal? (Q8_D)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q9 Considering the food your household throws away or composts in the average week, how much of that do you think could be avoided?

- None (1)
- A Little (2)
- About half (3)
- A Lot (4)
- All (5)
- Not Applicable / Don't Compost or Throw Away Food (7)

SCREEN Do you live in a vegan or vegetarian household?

- Vegan household (1)
- Vegetarian household (2)
- Neither (3)

Q10 Food is often marked with a “use by,” “sell by,” or “best by” date. What do you generally do with the following foods after that date has passed?

	Don't pay attention to dates (1)	Throw it away or compost it (2)	Smell or look at it to determine if it's still good (3)	Not Applicable, everything is eaten or frozen before the package date (4)	None of the above (7)	Don't buy or eat this type of food (8)
Fresh meat or fish (Q10_A)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Eggs or dairy <i>Dairy would include milk, cheese, yogurt, etc. (Q10_B)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fresh fruits or vegetables <i>This would include dates on packaged fruits and vegetables. (Q10_C)</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Canned Foods (Q10_D)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Condiments, for example, mayonnaise, mustard, or salad dressing (Q10_E)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

N1 How strongly do you agree or disagree with the following statements?

	Agree (1)	Somewhat Agree (2)	Neither Agree nor Disagree (3)	Somewhat Disagree (4)	Disagree (5)
I use the time food has been left out of the fridge to determine whether food is safe to eat? (N1_A)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I use the time food has been stored in the fridge to determine whether food is safe to eat? (N1_B)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q11 How often do you clean out your fridge?

- Every week (1)
- Every other week (2)
- Every month (3)
- Every 3 months or more (4)
- Never (5)

N2 In general, what proportion of your household leftovers are eaten?

(1)	
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Q12 Generally, how often do you or other household members take the following actions:

	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)
Prioritize eating leftovers? (Q12_A)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Freeze leftovers if you think you will not be able to eat them in time? (Q12_B)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Remove the bad part and eat the rest, when fruits or vegetables are bruised? (Q12_C)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use vegetable peels and stalks in cooking (for example, soups)? (Q12_D)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use bones for cooking (in soups, for example)? (Q12_E)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Manage food in the refrigerator, by storing items that need to be eaten the soonest in a designated area? (Q12_F)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q13 Thinking of the average American, do you think the amount of food you throw out or compost is:

- A Lot More (1)
- A Little Bit More (2)
- The Same (3)
- A Little Bit Less (4)

- A Lot Less (5)
- Don't Know (8)

Q14 How easy or difficult do you think it would be for you personally to reduce the amount of food that goes to waste in your household?

- Very difficult (1)
- Somewhat difficult (2)
- Neither difficult nor easy (3)
- Somewhat easy (4)
- Very easy (5)
- Not applicable (7)

Q15_3 How strongly do you agree or disagree with the following statements?

	Agree (1)	Somewhat Agree (2)	Neither Agree nor Disagree (3)	Somewhat Disagree (4)	Disagree (5)
I feel less guilty about throwing out food that has been in the refrigerator for a long time, compared to food that has been in the refrigerator for a short time. (Q15_A)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel less guilty about throwing out food that is composted. (N15_D)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel less guilty about storing leftovers rather than throwing food away, even if they are thrown away later. (N15_E)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q15_4 How strongly do you agree or disagree with the following statements?

	Agree (1)	Somewhat Agree (2)	Neither Agree nor Disagree (3)	Somewhat Disagree (4)	Disagree (5)
Given the amount of food that is thrown away in this country, the actions of my household will not make a meaningful difference in the amount of food being wasted. (N15_F)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe my household should reduce the amount of food we throw away. (Q15_B)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The quantity of food that goes uneaten in my home costs my household very little money. (N15_G)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reducing how much food my household throws out would save resources used to grow and produce the food we eat. (N15_H)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

D1A Approximately how much money does your household spend on food and beverages EATEN AT HOME each week?

- \$100 or less (1)
- \$101 to \$200 (2)
- \$201 to \$300 (3)
- More than \$300 (4)
- Don't Know (8)

D1B Approximately how much money does your household spend on food and beverages EATEN AWAY FROM HOME each week?

- \$100 or less (1)
- \$101 to \$200 (2)
- \$201 to \$300 (3)
- More than \$300 (4)
- Don't Know (8)

D3 How many people live in your household, including yourself?

D4 Other than yourself, how many people live in your household in each of the following age groups?

	None (1)	1 (2)	2 (3)	3 (4)	4 (5)	5 (6)	6 (7)	7 or More (8)
0 to 5 years old (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6 to 12 years old (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13 to 17 years old (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18 to 64 years old (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
65 years of age or older (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

D5 In what year were you born?

D6 To verify, what is your gender?

- Male (0)
- Female (1)
- Other (2)
- Prefer not to answer (3)

D8 Which of the following best describes your race or ethnicity? Please select all that apply.

- American Indian or Alaska Native (1)
- Asian (2)
- Black or African American (3)

- Hispanic or Latino (4)
- Native Hawaiian or Pacific Islander (5)
- White (6)
- Some other race or ethnicity (Please specify) (7)

D9 What is the highest level of education you have completed?

- Elementary or some high school (no diploma or GED) (1)
- High school diploma or GED (2)
- Some college, but no degree (3)
- Associate's degree (2-year degree, AA, AS, etc.) (4)
- Bachelor's degree (4-year degree, BA, BS, etc.) (5)
- Master's degree or higher (6)

D10 What was your approximate annual household income in 2016?

- Less than \$10,000 (0)
- \$10,000 to less than \$25,000 (1)
- \$25,000 to less than \$50,000 (2)
- \$50,000 to less than \$75,000 (3)
- \$75,000 to less than \$100,000 (4)
- \$100,000 to less than \$150,000 (5)
- \$150,000 to less than \$200,000 (6)
- \$200,000 or more (7)

Q37 Thank you again for taking time to participate in this important project! When you are ready, you can click "Submit" and your responses will be recorded.

Post-Diary Survey

Thank you for taking time to participate in this important project. This is the follow-up survey described in your user guide, and is the final step in the Oregon Food Study. As a reminder, your participation in this project is voluntary and you may stop at any time. You may also skip any questions you do not wish to answer.

The following set of questions are about your experience in this study.

[response option codes for each item are shown in parentheses]

P1 What (if anything) would have made it easier to complete the kitchen diary or participate in this study in general?

P2 What did you learn (if anything) from participating in this study?

P8 How often is your garbage (landfill-bound trash, not separated recyclables) picked up?

- More than once a week (1)
- Once a week (2)
- Every two weeks (3)
- Once a month (4)
- Other (5)

P9 How many hours do you work in paid employment each week?

- More than 40 (1)
- 30-40 (2)
- 20-30 (3)
- 10-20 (4)
- less than 10 (5)
- Do not work in paid employment (6)

Q9 Considering the food your household throws away or composts in the average week, how much of that do you think could be avoided?

- None (1)
- A Little (2)
- About half (3)
- A Lot (4)
- All (5)
- Not Applicable / Don't Compost or Throw Away Food (7)

Q13 Thinking of the average American, do you think the amount of food you throw out or compost is:

- A Lot More (1)
- A Little Bit More (2)
- The Same (3)
- A Little Bit Less (4)
- A Lot Less (5)
- Don't Know (8)

Q14 How easy or difficult do you think it would be for you personally to reduce the amount of food that goes to waste in your household?

- Very difficult (1)
- Somewhat difficult (2)
- Neither difficult nor easy (3)
- Somewhat easy (4)
- Very easy (5)
- Not applicable (7)

P3-4 How strongly do you agree or disagree with the following statements?

	Agree (1)	Somewhat Agree (2)	Neither Agree nor Disagree (3)	Somewhat Disagree (4)	Disagree (5)
Measuring the food that was discarded in our household reduced how much food we throw away. (P3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
After measuring the food that was discarded in our household, I now believe that our household throws out or composts more food than I previously thought. (P4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q15_B How strongly do you agree or disagree that your household should reduce the amount of food you throw away?

- Agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)

- Disagree (5)

P5 How strongly do you agree or disagree that being in this study increased how often you talked with *members of your household* about the issue of food being wasted (other than talking about using the diary)?

- Agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Disagree (5)
- Not applicable, I live alone (6)

P6 How strongly do you agree or disagree that being in this study increased how often you talked with *someone outside of your household* about the issue of food being wasted (other than talking about using the diary)?

- Agree (1)
- Somewhat agree (2)
- Neither agree nor disagree (3)
- Somewhat disagree (4)
- Disagree (5)

Q2 Before shopping for food, how often does your household check to see what you already have?

- Never (1)
- Rarely (2)
- Sometimes (3)
- Often (4)
- Always (5)

Q2A Would you like to do that more?

- No (0)
- Yes (1)

Q3 Before shopping for food, how often does your household estimate how much of each item you need to buy?

- Never (1)
- Rarely (2)
- Sometimes (3)
- Often (4)
- Always (5)

Q3A Would you like to do that more?

- No (0)
- Yes (1)

Q6 On a weekly basis, how many of your main meals do you plan ahead of time?

- Almost all of them (1)
- Most of them (2)
- A few of them (3)
- None of them (4)

Q6A Would you like to plan ahead more often?

- No (0)
- Yes (1)

N2 In general, what proportion of your household leftovers are eaten?

(1)	
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Q12 Generally, how often do you or other household members take the following actions:

	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)
Prioritize eating leftovers? (Q12_A)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Freeze leftovers if you think you will not be able to eat them in time? (Q12_B)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Remove the bad part and eat the rest, when fruits or vegetables are bruised? (Q12_C)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use vegetable peels and stalks in cooking (for example, soups)? (Q12_D)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Use bones for cooking (in soups, for example)? (Q12_E)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Manage food in the refrigerator, by storing items that need to be eaten the soonest in a designated area? (Q12_F)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

P7 Imagine you could make all the decisions for the state of Oregon about how to waste less food... What do you think Oregon can do to help residents waste less food?

END Thank you again for taking time to participate in this important project! When you are ready, you can click "Submit" and your responses will be recorded.

Participant Support Materials

User guide

The **online version** of the user guide can be found at:
<https://sites.google.com/pdx.edu/fooddiaryguide/home>

The **paper version** of the user guide follows:

Oregon Food Study User Guide

Welcome to the Oregon Food Study! We appreciate your participation in this important project. Below you will find information on what's involved in the study, instructions on how to complete the Food Diary, and answers to other frequently asked questions. If at any point you decide you would rather complete the surveys or diary online, please contact us and we will be glad to email you links so you can participate online.

You can find all of this information and more online at
<https://sites.google.com/pdx.edu/fooddiaryguide/home>

If you have questions, please contact our support staff at ORfoodstudy@gmail.com or (503) 420-7340

SURVEYS

The first step is to complete Survey #1. Survey #1 should take approximately 20-30 minutes and asks questions about your households food-related behaviors, attitudes, and beliefs. Survey #2 is a shorter, follow-up survey done at the end of the study. We will mail you each survey. Please take the surveys as soon as possible after you receive them. Survey #1 needs to be completed before you begin your food diary. If you encounter any difficulties when trying to take the surveys, please contact us!

HAVING YOUR GARBAGE AND CURBSIDE COMPOST COLLECTED

Project staff will come by to pick up your household's discarded trash and curbside compost, if you have curbside compost service. We ask that you simply put your garbage and compost out as you normally do. You do not have to do anything differently for this step. We will contact you to remind you to put out your trash and compost (where applicable) the day before your collection.

*For participants who live in an apartment or other multifamily housing, we have given you orange bags. Please use the bags for **all of your usual waste** and put it in the bin or dumpster as your normally would. You do not need to change any of your normal disposal habits, other than using the provided bags, before putting your trash in the bin or dumpster. We will send you a reminder the day before we collect, asking you to put out your orange bagged waste.*

USING THE FOOD DIARY

You will weigh and record all food and drink you dispose of in your household for one week using the Food Diary. The diary can be done online or on paper, depending on your preference. You will have 2 weeks to complete the diary. If you complete the surveys, have your garbage collected, and complete seven days of the diary, you will receive a \$60 Amazon gift card. If you do the surveys and garbage collection AND can complete the diary in just one week, recording your food for **seven days in a row**, you receive a \$30 bonus. If you are able, please also record any food you personally discard outside of the home as well.

How to use the food diary

1. Please record all of the food and drink discarded (thrown away, composted, poured down the drain, or fed to pets) in your household, including things you wouldn't normally eat (chicken bones, vegetable scraps, etc.), as well as any food/drink you personally discard outside of the home.
2. You should use a new page each day, and make an entry each time you discard food. You can use more than one page per day if you need to but **don't forget to fill in the date on the top of each page.**
3. The top portion is for food discarded in your household (by everyone) and the bottom section is for food you (only you) discard outside of the home. There is a comments section in the middle for any unusual circumstances or important notes. Please note if the food being discarded is part of a fridge or pantry "clean out."
4. Mark the box that applies for each section with a check or an X. If you choose other and want to write in the option, you can use the numbered lines on the bottom of the page. Just put the line number in the box instead of a check or an X.
5. If you and your household did not discard any food that day, please mark the box at the top of the page and indicate why in the comments section. You can use the numbered lines at the bottom if you need more space.
6. At the end of your diary period, please put all completed pages in the envelope and mail it back to us.

Weighing your food

1. For all food and drink discarded at home, you will be asked to record the weight, using the provided scale (which is yours to keep). Please record ALL the food and drink that is discarded by all the people in your household, no matter what it is, why it is being discarded, or how small it is. For food and drink discarded outside of the home, you only need to record your own you don't need to record the weight.
2. Be sure the scale is set to ounces by pressing the UNIT button until "lb:oz" appears.
3. Set the scale to zero with the empty container on it, by pressing the Power/TARE button.
4. Record the weight in the weight box in the diary.

5. See the detailed instructions on using the scale in the following pages.

Diary Questions

Included with this guide are 10 pages of blank diary pages. Please use them each day for seven days. The questions below are for reference only and your entries should be marked on the diary tables provided.

1. **Meal:** Was the food from breakfast, lunch, or dinner? Choose the meal that the food was a part of or select “not a meal” if the food wasn’t part of a regular meal.
 - Breakfast
 - Lunch
 - Dinner
 - Not part of a meal
2. **Item:** Use this space to give a detailed description of the food or drink [including inedible parts]. Examples: Apple core, leftover chicken breast, or pizza with cheese, tomato sauce, pepperoni, and olives.
3. **Weight:** Using the provided scale and tubs, please weigh the item(s) and record to the nearest tenth of an ounce [0.1 ounces]. *This is for food discarded at home by everyone.*
4. **Where’s it from?** *This is only for food discarded outside of the home, only by you.*
 - Restaurant or cafeteria
 - Grocery store or market
 - Brought from home
 - Other _____ (*remember to use the lines below and write the line number in this box*)
5. **Condition:** Select one that best describes the item(s)
 - Unprepared food - (i.e. bread slices, an orange, block of cheese, canned beans)
 - Prepared, cooked, or leftovers - (i.e. macaroni salad, a sandwich, leftover pasta)
 - Inedible parts - (Use this option for items you would not normally eat, such as egg shells, avocado peels, or
 - Liquids - (any liquid you would normally consume as a beverage)
 - Other _____ (please write in any other conditions the item(s) were in.
6. **Reason:** Select the reason that best describes why you are getting rid of the item(s) rather than eating it.
 - Past date on the label
 - Moldy or spoiled
 - Don’t like or tired of eating
 - Worry that it might cause illness
 - Improperly cooked
 - Too little to save
 - Not good as leftovers
 - Unable to save or store (This option will be available for food discarded outside of the home, for situation when you are simply unable to save leftover food.)

- Other _____
7. **Did you?** Please choose the option that best explains why the food was not eaten.
- Bought too much
 - Made too much
 - Lost track of in the fridge or cupboard
 - Too busy
 - Didn't know what to do with it or how to use
 - None of these apply
8. **Where did it go?** What was the final destination for the item?
- Trash
 - Compost picked up at curb
 - Home or other compost
 - Down the drain
 - Fed to pets or animals
 - Other _____

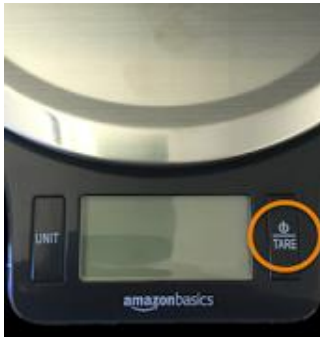
What Food To Include

Please include ALL food and drink you get rid of. This includes things you would normally eat or drink, such as:

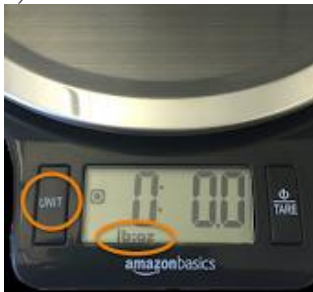
- Fruit and vegetables
 - Meat or fish
 - Dairy and eggs
 - Bread, pasta, rice, boxed cereal
 - Prepared meals (like Lasagna, soup, salads, pizza, burrito, etc.)
 - Milk, soft drinks, coffee, tea, juice, beer, wine, and alcohol
 - Leftovers, frozen foods, and that little bit you just couldn't finish
 - Condiments, sauces, dressing, and oils
- This also includes items that you would not normally eat, but are still part of your food, such as:
- Egg shells
 - Coffee grounds (you can include the filter) and tea bags
 - Bones, skin, and other parts from meat or fish
 - Fruit and vegetable cores, husks, peels, pits, pods, rinds, roots, stems, skins, seeds, and stalks
 - Cheese rinds
 - When using the diary, only select "inedible parts" for food or drink that you or your household considers to be inedible.

Using the Scale

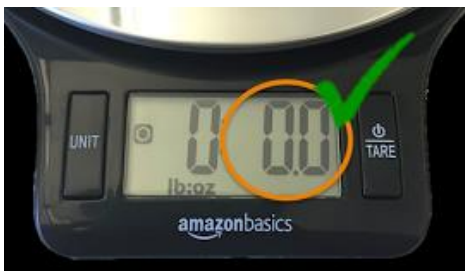
1) After inserting the batteries, turn the scale on by pressing the POWER/TARE button.



2) Be sure the scale is set to ounces by pressing the UNIT button until "lb:oz" appears.



3) Before weighing items, set scale to zero by pressing the POWER/TARE button.



4) If you are using a container, place the empty container on the scale and then press the POWER/TARE button.



5) Once you add your items to the scale, there will be two numbers on the screen. The first is pounds and the second is ounces (for example a weight of 3 lb and 9.3 oz would be displayed as 3:9.3). Please record the displayed pounds and ounces in the diary.



Support & Contact

You may contact the project support staff by email or phone. We will respond as quickly as possible. Email us at ORFoodStudy@gmail.com or call us at (503) 420-7340.

FAQ

The Food Diary

Q: What if I forgot to complete the diary for one of the days?

A: Don't worry, you have 14 days to complete 7 days of the diary, and you can still receive a \$60 gift card. If you can complete the diary for seven days in a row you get a \$30 bonus for a total of \$90 gift card.

Q: Am I supposed to record food/drink discarded outside of the house?

A: Yes, but only the food you personally discard, and you will not be asked to weigh it.

Q: We didn't discard anything in our house for a day and I did not discard anything outside of the home either. What do I record?

A: The first question in the diary asks if you discarded any food today. If you didn't discard any food or drink for a whole day, then select "no" and that is all you have to do that day. You can also explain if there was an unusual cause for this in the comments section.

Q: Should I record food/drink discarded outside of the household for every family member?

A: No. Only the primary participant should record the food/drink they discard outside of the household.

Q: How should I note if the amount of food/drink discarded is different than usual because of a special event (e.g. party, barbeque, cleaned out refrigerator)?

A: Write a note in the comments section that indicates there was a special event or clean-out.

Kitchen Scale

Q: What if I can't get my scale to work?

A: First, ensure that your batteries are properly installed and that you have read the page on how to use the kitchen scale. If the scale still doesn't work, please contact participant support.

Surveys

Q: What if I didn't receive my survey in the mail? Or I forgot to complete the survey before starting the diary?

A: If you didn't receive your Survey #1, contact us immediately. Survey #2 will be sent to you after we receive your completed diary.

If you didn't yet complete the Survey #1, please complete it as soon as possible, send it back to us in the enclosed SASE and contact us to let us know.

Waste collection

Q: What if I forgot to place my trash and/or compost out on the curb?

A: If this occurs, please contact us as soon as possible.

Additional Diary Instructions

These notes were distributed with each scale.

Oregon Food Study: Kitchen Diary Important Notes

Thank you for completing the Survey #1, either online or on paper. Now, it is time to start the kitchen diary. We will contact you with the two week period you can use to record your food. You will find full instructions for the kitchen diary in the User Guide. This reference sheet will help you with some important details and questions you may have.

Please weigh and record all of the food (including inedible food parts, e.g. banana peels, eggshells, and coffee grounds) **and beverages you discard in your household for one week** using the online diary link or the kitchen diary pages provided you, if you requested paper copies.

Additionally, we do not ask that you *weigh* any food/drink discarded outside of your home, but we do ask that you *record it*, either in the online diary or in the second section on each paper kitchen diary page.

You can help us by filling out the kitchen diary as completely and accurately as possible. To help everyone in your household remember to record all of the food and drink that gets thrown away during the week, you may want to select one person to take the lead in your household. **It is very important that you record ALL of the food and drink that is thrown away:**

- By all the people in your household
- No matter what it is or why it is being discarded (even food that you would not normally eat such as fruit pits, bones, or vegetable peels)
- No matter where you discarded it (in your trash, curbside compost, put down the drain, fed to pets or animals, or composted in your backyard)
- No matter the amount being discarded (nothing is too small to measure)
- Do not include food purchased for the main intention of feeding animals.
- Don't change how you usually prepare or discard food/drinks. If you would normally do a refrigerator or cupboard clean out during the week, do that.
- If anything unusual occurs in your weekly food-related activities (like you throw a party or eat out more than usual), please note that in the comments section.
- Any food discarded in your household trash or compost should be recorded as food disposed of in the household even if it was not prepared at home (for example: you should record leftovers from restaurants that are later discarded at home).
- If you did not discard any food/drink at home or outside of the home on a given day, please check the box that notes this.

- It is best to record discarded food/drink as it happens; however, you or other household members may want to set discarded food aside until you can record it in the kitchen diary. You can also take photos of it and refer to it later. Online diary users have the option of uploading these photos.

For those using the paper diary:

- If you run out of room to record information, there are extra pages (10).
- Describe any food/drink discarded in detail and fill out the required boxes in each row of the kitchen diary. If there are many ingredients, please provide as much detail as possible (for example: one pan of homemade lasagna including two zucchini, ground beef, tomato sauce, and cheese).
- When checking the box that best describes the state of the food/drink when discarded, please see the definitions below. If none of them apply, please write the state of the food/drink in the “Other” box.
 - Unprepared (meaning it was not cooked or prepared – for example: a whole onion, bread slices, an orange, a block of cheese, canned beans)
 - Prepared, Cooked or Leftovers (meaning food was cooked or in the final state before eating – for example: salads, lasagna, sandwiches)
 - Inedible Parts (meaning these are items you would not normally eat – for example, egg shells, pits, peels, or coffee grounds)
 - Liquids – any liquid you would normally consume as a beverage
 - Other (for any other conditions the items were in)

For those using the online diary:

- Describe any food/drink discarded in detail and fill out each question the online form guides you to enter. If there are many ingredients, please provide as much detail as possible (for example: one pan of homemade lasagna including two zucchini, ground beef, tomato sauce, and cheese). There is a question where you will be asked to provide as much detail as possible.
- You may re-use your link to make as many entries as needed; be sure to note the correct date for the entry.

A special note on weighing food in packaging

Page 6-7 of the User Guide shows you how to use the scale to weigh your food that you dispose of. It may be easier to place the discarded food/drink in a separate container to weigh it, either the one we provided you or one of your choosing. If you use a container, tare it while empty, prior to weighing the food. You do not need to indicate that you used a container in this way for weighing.

If your food or drink is in packaging that is not easy to remove before weighing it, then you do not need to remove the food/drink from the packaging and follow the guidelines below:

- If the discarded food was in glass, metal, or hard plastic when weighed, estimate the size of the packaging (dimensions or volume) and note the type of packing in the comments.
- Do not record lightweight packaging such as plastic wrap or paper packaging in the door diary, as these materials are much lighter than the weight of the food/drink