FOOD WASTE AND THE VOICE OF THE SMALL PRODUCER

by

HANNAH BUCKINGHAM

A THESIS

Presented to the Department of Environmental Studies
and the Robert D. Clark Honors College
in partial fulfillment of the requirements for the degree of
Bachelor of Science

August 2020

An Abstract of the Thesis of

Hannah Buckingham for the degree of Bachelor of Science
in the Department of Environmental Studies to be taken August 2020

Title: Food Waste and the Voice of the Small Producer

Approved: *Galen Martin*
Primary Thesis Advisor

In the literature of food waste, the voice of the small producer is frequently missing. This study aims to contribute to the growing field of food waste literature, and address the gap in small producer research, by exploring the experiences and perspectives of small producers regarding food waste.

To accomplish this, the present study conducted recorded interviews with small producers. These interviews concentrated on three scales of inquiry: personal, on-farm, and bigger picture. Once completed, these interviews were transcribed and analyzed for common themes between participants.

This study found the voices of small producers to be valuable contributors in the field of food waste research. Result indicate that small producers view food waste as a primarily ethical, but multifaceted, issue. Overproduction, lack of available processors, and time are the primary factors driving waste for small producers. Donations, feeding livestock, and composting are the methods most commonly used to manage waste. Small producers are motivated to manage and reduce food waste primarily by their ethics, but also by the pragmatic and economic savings available. In their own homes, small producers most frequently manage waste through composting or feeding to

livestock. Small producers believe that disconnection, lack of education, and convenience-seeking habits are the drivers of consumer waste. Government subsidies and industrialization are the characteristics of our food system contribute to this undervaluing of food. This is why food waste is high among consumers, and these are the factors contributing to high consumer food waste in the US as a whole. Small producers believe people might be motivated to waste less food if they are reconnected with the nonindustrial food system, prices a raised, better understand the impacts of food waste.

As food prices rise, global food security declines, and environmental degradation accelerates, the importance of understanding and effectively reducing food waste grows. The results of this study show that small producers offer unique and valuable perspective on food waste that prioritize community growth, consumer exposure to non-industrialized food systems, and belief in food waste as an ethical issue.

Acknowledgements

Thank you to Dr. Galen Martin for introducing me to the engaging subject of food waste and for his patience in helping to guide and coach my frequently overwhelmed self through this challenging and exciting project. Thank you to Professor Harper Keeler for helping connect me with many groovy folks and inspiring my interest in food. Thank you to Professor David Frank for constantly encouraging and supporting me throughout my college career as well as this project. Thank you all for your flexibility and investment in this project and myself. It was a privilege to have such a knowledgeable and dedicated committee – this would not have been possible without your generosity.

Thank you to the small producers who shared their time, experiences, and stories with me during an especially unique period in history. Thank you for bringing me into the work you all passionately do and for sharing your successes, struggles, and ambitions for better food systems.

Finally, thank you to my family, friends, and advisors who fielded questions and requests for advice at all hours over the past year. You supported me through every step of this. I would like to extend special thanks to Sophie Murray and Clarke Block for their unwavering encouragement, to my brother for his many edits, and to my mom and dad for always pushing me to excel.

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Introduction

Research on food waste has increased in recent years, and the myriad detrimental effects of our waste are gaining attention in both public and academic spheres (James and Evans 1997). While a multitude of studies have tried to quantify and understand our waste, a gap in the literature exists. The voice of the small producer is largely absent in US and European research. Given that food waste is an economic, pragmatic, and ethical issue, with wide-reaching implications, this study aims to add to the growing field of knowledge and narrow the literature gap by exploring how the issue of food waste is present for small, primary producers in the United States food supply chain. Food wase varies largely when comparing European and North American countries against other, less developed regions of the world. This research is therefore limited because it focuses on developed country's food system and does not consider small producers or food waste in less developed countries. Producers are the beginning of our food supply chain. The preferred approach to the food waste problem is to reduce food surpluses; therefore, the best option requires reducing food production at the source (EPA Food Recovery Hierarchy 2019). If surpluses are reduced there is less food that can become waste. Diminishing our excess surplus and waste also has the potential to decrease global food insecurity, economic inefficiencies, and curb some climate and environmental degradation (Horrigan, Lawrence and Walker 2002; Munesue, Masui and Fushima 2015). Some surplus is necessary to protect against uncertain futures, through it is important to note that current surpluses are superfluous (Stuart, Waste). Ultimately, food is a perishable product and there will always be some waste.

Small producers hold a unique position in food production. Their deeper understanding of what goes into the production process creates familiarity with the value of food. This understanding affords them a more nuanced appreciation of food and thus food waste. This study is based on the concept that their opinions and practices, as a result of their familiarity with food's value, are uniquely valuable for understanding food waste in our society. This study also assumes their practices in preventing and managing food waste will be more rigorous because of this background. Their voices are valuable, and their understanding can offer insight which may otherwise be missing from this field of literature.

This study defines the small producer by subjective criteria. Those who participated were their own business entities, not owned by a larger group or part of a whole. Their products were not contracted out to one buyer but instead either used for their own purposes or sold directly to a multitude of customers. Their production operations were not large monocultures or concentrated animal feeding operations (CAFO's) spanning hundreds of acres. The owners worked on-site and were intimately involved in their businesses, familiar with operations, and were producers or processors as well as business owners. This study sought to contact those whose businesses were interconnected with their communities, operations small enough to have a personal presence in lieu of a corporate presence. Producers who, as a result of the community presence, could be reached through social networks of community members and referrals.

Research Questions

Understanding waste and its drivers is necessary for effective prevention and management. Bearing this in mind, this study seeks to answer the four following research questions: What are the opinions, thoughts, and perspectives held by small producers regarding food waste on their farms and beyond their farms? What do small producers believe are the origins and causes of food waste on their farms, and further down the supply chain? What, if anything, are small producers doing to prevent food waste, and what are their motivations for preventing food waste? How do the 'voices' and opinions of the producer and processor vary from the voices predominantly present in current food waste literature? My research of farms in Oregon and Texas will contribute to the overall field by describing the opinions and methods of small producers that have otherwise been left out of the food waste research. Within this line of investigation this study also seeks to determine whether small producers view food waste as an economic, ethical, or practical issue.

Research Design

Project Description

This study investigates how small producers view and approach food waste, drivers of waste on their farms and ranches, and the waste reduction strategies they endorse. The literature gap this study seeks to amend is the lack of small producer voices in food waste research. To ensure clear focus on this population, small producers were defined subjectively by size, marketing behavior, management structure, customer base, and community presence.

This study assumes small producers are knowledgeable regarding food waste and have valuable opinions which merit inclusion in the food waste discussion. The value of small producer voices is derived from their unique backgrounds in food production. Familiarity with the necessary investments in food production allows for a deeper understanding of the value of food. Being located at the beginning of the food supply chain also allows small producers a unique opportunity to reduce waste. Because many small producers sell directly to consumers, they also have experience with how consumers contribute to waste. Small producers are also consumers themselves, and this dual role in the supply chain yields a more nuanced understanding and awareness of their own consumer waste habits, thus they likely have less wasteful in-home practices as a result.

To best bring the voice of the small producer into food waste literature, this study involved four interviews with five different producers. One interview consisted of a husband and wife who wished to interview together. These interviews followed a conversational, semi-structured format based around a general script, which allowed for

unplanned discussions of participants' communities, experiences, and tangential topics they felt related to waste and waste management. These conversations are the center of this research, so interviews were recorded and later transcribed to allow use of direct quotes and foster accuracy in the presentation of their voices.

The general script used to guide and create consistency across interviews was developed through a series of drafts. Each draft received input from the primary advisor and was adapted until it was satisfactory. The final draft included an introduction which provided details about the primary investigator's background, the reasoning for the study, and three sections of questions: Personal, Farm, and Bigger Issue.

Before any interviews were conducted, all participants provided informed consent. All participants were also given a copy of the interview questions before giving consent in order to ensure their understanding of participation requirements. Documents were delivered digitally via email due to COVID-19, and all interviews were conducted over the phone. Interviews frequently lasted longer than the anticipated 20 to 30-minute timeframe due to life experiences and anecdotes that participants shared beyond their initial answers. As a result, interviews lasted 60 minutes on average but ran 45 minutes at their shortest and 90 at their longest. To protect the privacy of participants, interview recordings were saved with anonymous identification codes (T1-T3.2 and O1). All interview recordings were saved on the primary investigator's personal, password-protected computer as well as a USB drive, which served as a backup, kept in a locked location. Visiting the farms and ranches of participants, and interviewing in person, was the original design of this study. However, due to COVID-19, the study was adapted to foster social distancing and respect shelter-in-place orders, so in-person interviews and

visits were foregone. This study was approved by the University of Oregon Institutional Review Board.

Participant Recruitment

At its outset, this study was set to focus on small producers near Eugene, Oregon. However, due to relocation of the primary investigator to Austin, Texas, COVID-19 complications, and the Spring/Summer timing of the interview process, participant recruitment shifted. Difficulty coordinating with Eugene area farms led to the recruitment of participants in Texas.

Initial recruitment was based on recommendations from faculty advisors. Farms were then contacted via email or phone. A limited number of responses were received, and the time frame of the study prevented participation by those who did respond. One small producer in Oregon, found through a referral, was able to participate. To expand participation, participants were sought through word of mouth and referrals within Texas. Small producers in Texas were contacted via phone and email as well. During interviews participants would often mention other producers with whom they interacted. These connections at times led to further referrals and other interviews.

Literature Review

How Much We Waste & Where it is Wasted

Levels of food waste in the United States have increased over time. In 1974 approximately 900 kcal per person per day was wasted in the US whereas in 2003 Americans wasted roughly 1400 kcal per person per day, which totals close to 150 trillion kcal per year. In 1974, 900 kcal per person per day amounted to about 30 percent of the available US food supply. Today, 1400 kcal per person per day amounts to almost 40 percent of our food supply (Hall *et al.* 2009). Forty percent of our food supply translates to more than 20 pounds of food per person per month wasted (Gunders 2012). If this amount of waste is measured according to its dollar value, the United States wastes $165.6 billion worth of food per year (Buzby and Hyman 2012). Food wasted in the United States makes up an estimated 10 percent of the average amount spent on food per consumer, which is over 1 percent of the average consumer's disposable income (Buzby and Hyman, 2012). This makes up $43 billion of the American economy, and this consumer food waste is 12-14 percent of all municipal solid waste in landfills. The Environmental Protection Agency (EPA) estimates the disposal of this consumer waste costs $1 billion (Melikoglu, Lin, and Webb 2013).

The United States is not alone in their waste of surplus food. Most estimate that approximately 30 percent of all food produced globally is wasted, though some have put this number at 70 percent (Stuart 2009, 9). If we assume 30 percent is wasted, this amounts to 2.9 trillion pounds per year (Royte 2016). In the UK, the estimated total mass of food waste, from farms to homes, is approximately 18-20 million tonnes. Because this number is an initial assessment by the Waste and Resources Action

Programme (WRAP) it is unlikely to be entirely accurate, but a million tonnes more or less is still a large quantity of wasted food (Stuart 2009, 184). WRAP also estimates that one third of all food sold in the United Kingdom is wasted, and half of the food wasted is still edible. Japan wastes 19 million tonnes of food annually. This is 40% of their food production (Melikoglu, Lin, and Webb 2013).

Food Surplus and Food Waste

Food waste and food surplus are two distinct terms. Food surplus is food produced beyond our nutritional needs. Food waste is a product of food surplus. Food surplus acts as a safeguard against uncertain futures; however, the current scale of food surplus is no longer beneficial to global food security (Papargyropoulou *et al.* 2014). Instead, modern levels of surplus have crossed from beneficial into excessive and are now threatening global food security and serve as an environmental liability (Papargyropoulou *et al.* 2014; Stuart 2009, xix).

The Food and Agriculture Organization (FAO) estimates minimum energy requirements of western Europeans and Americans are between 1,900 and 2,000 kcal per person per day (Stuart 2009). To ensure food security, agronomists recommend nations should supply around 130% of nutritional requirements (Smil 2004). A supply of 2,600 to 2,700 kcal per person per day is sufficient for affluent countries so long as all sectors of the population have adequate access and entitlement to food, but inadequate access is a prevalent problem in many countries (Smil 2004; Lundqvist, Fraiture, and Molden 2008; Stuart 2009). Currently, 3,500 to 3,900 kcal per person per day is available in Europe and the US. This is up to 200% of what the average person

physically needs. If the grains fed to livestock are included, the US food supply is over 400% of our country's energy requirements (Stuart 2009, 175).

As with food waste, the United States is not alone in their excess food surplus. The FAO's data from 2003 show the UK, Ireland, France, Belgium, Italy and Canada supply 170 and 190 percent of nutritional requirements. The Netherlands, Iceland, Finland and New Zealand supply 160 to 170 percent; Sweden and Australia are between 150 and 160 percent; Japan is below 150 percent. Countries with less wealth also have excess surpluses of food. Less well-developed retail and distribution systems likely cause a great deal of waste in these countries, leading to their need for excess surplus (Stuart 2009, 192).

Food Waste in the Supply Chain

There is waste along the entire food supply chain. In the harvesting, transporting, and storing of food, developing countries can lose between 10 and 40 percent of their harvest (Stuart 2009, 150). At this stage, the greatest losses are of fresh produce. The food that goes to waste is either never harvested or lost between harvest and sale (Gunders 2012). Losses on farms can happen during preharvest because of severe weather, such as droughts, floods, or pest infestations. Freezes in Florida that damage citrus crops and hurricanes are examples of these events. James and Evans state each year an average of 7 percent of planted acreage in the US is not harvested (1997). This number can vary widely, to upwards of 50 percent, depending on crop and operation. Six-year averages show acreage left unharvest is approximately 2 percent for potatoes, 8 percent for sweet corn, and 15 percent for wheat. Vegetable and fruit row crops average 97,000 acres unharvested, or about 6 percent. Feeding America estimates

more than 6 billion pounds of fresh produce go unharvested or unsold each year (Gunders 2012).

Post-harvest and packing phases of the supply chain contribute considerable quantities of waste, which are often due to culling of produce that do not meet quality or appearance criteria. Quantities wasted vary by product and situation. On one cucumber farm, fewer than half of the harvest leaves the farm. Of those cucumbers, 75 percent are edible. A large tomato-packing business reported that at certain times they discard up to 22,000 pounds of tomatoes every 40 minutes (Gunders 2012). According to the Food and Agriculture Organization, 2 percent of grain harvests, 3 percent of fruits and vegetables, and 2 percent of meat products are wasted in this phase (see Figure 2).

Processing facilities generate losses of around 16 percent of raw materials, which amounts to 23 percent of total food losses produced by manufacturing, distribution, retail operations, and households. A study by the European Commission estimates that 39 percent of total food loss, excluding loss at the farm level, is generated in the manufacturing stage (Gunders 2012).

In-store food losses in the United States were an estimated 43 billion pounds in 2008, which is 10 percent of the total food supply at the retail level (Buzby *et al.* 2011). However, retailers have influence on the supply chain both before and after themselves (Gunders 2012). Exertion of this influence makes retailers responsible, in part, for larger portions of total food losses (Stuart 2009). USDA estimates put supermarket losses around $15 billion annually in unsold produce alone. In 2006, annual supermarket losses averaged 11.4 percent for fresh fruit and 9.7 percent for vegetables (Gunders 2012).

Households and food service operations lost 126 billion pounds of food in 2008. This is 19 percent of the total United States retail food supply (Buzby *et al.* 2011). Of food purchased at restaurants, roughly 4 to 10 percent is lost before reaching the consumer (Leanpath 2008). This does not include food wasted by the consumer. Diners, on average, waste 17 percent of their plate and 55 percent of leftovers are not taken home. American families waste approximately 25 percent of the food they buy annually, and the cost estimate of this waste for the average family of four is from $1,365 to $2,275 (Gunders 2012). By commodity, the ratio of food consumed to food wasted shows more waste in the produce, grain, and seafood categories (see Figure 1). These variations are present in the supply chain as well, which is shown by Figure 2.

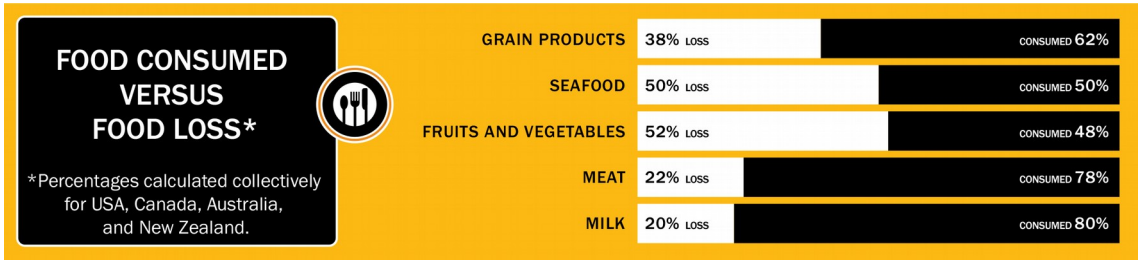

Figure 1: Food Consumed Versus Food Lost (FAO 2011)

A comparison of the percent of food consumed next to the percent of food lost by category of food commodity.

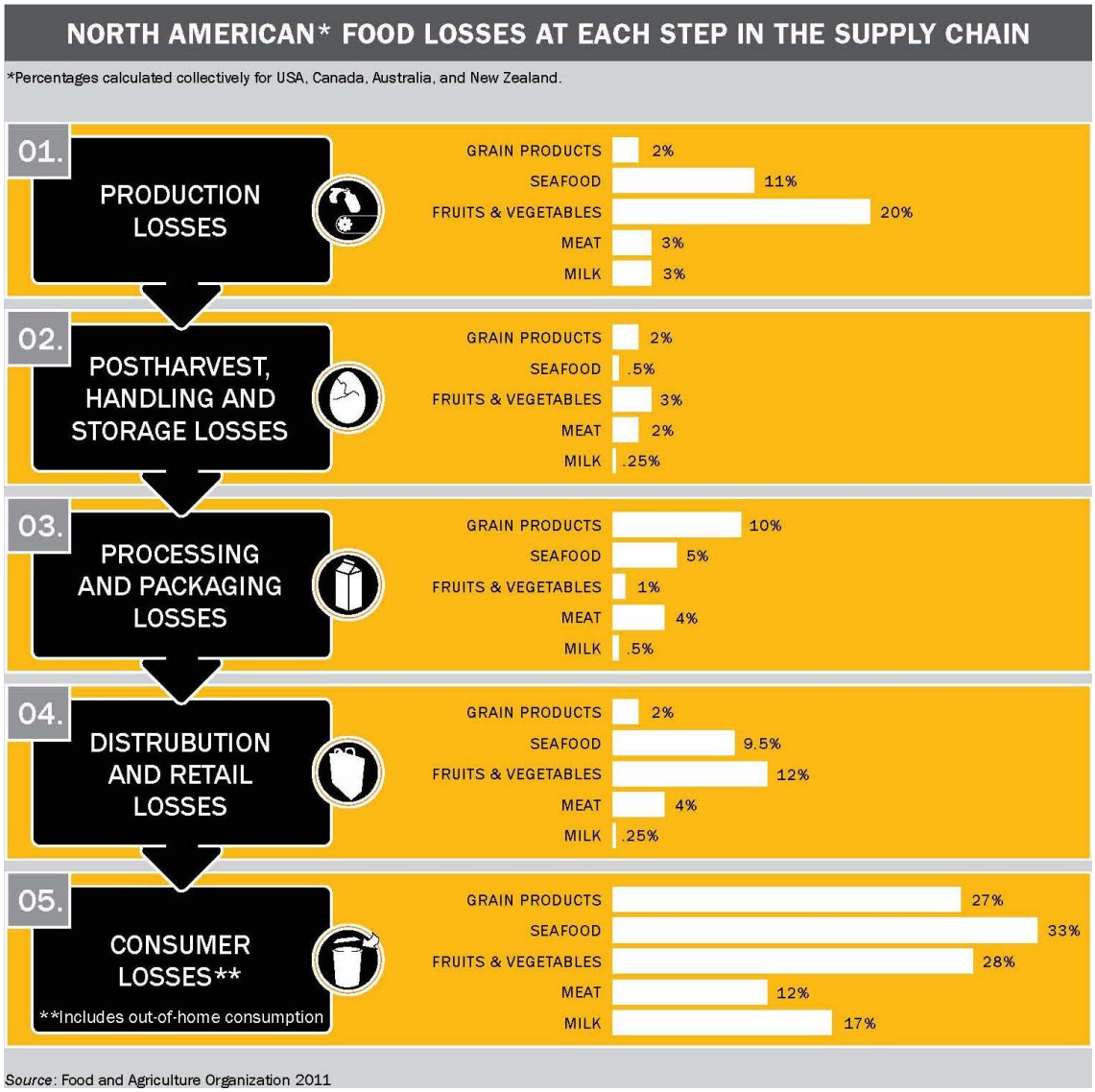

Figure 2: North American Food Losses at Each Step in the Supply Chain (FAO 2011)

A commodity-focused supply chain showing what percentage of each commodity is lost at each stage.

Drivers of Waste

The Origins and Importance of Surplus

Evidence of food waste is present throughout human history. Waste is a product of food surplus and surplus has been key to human success for over 10,000 years;

surplus protects against poor crops and disasters or other weather patterns that negatively affect food supply (Stuart 2009, 169). Archeological records indicate some early populations wasted prodigal amounts of food, much like society today. When ancient humans first reached the Americas, approximately 75% of the large animal species were wiped out in just over a millennium. Climate change is a debated contributor, but bones from hunted animals indicate that only portions of the carcasses were butchered. This implies that much of the carcasses were left to rot and therefore were wasted. Many practices today are having similar impacts on our wild fish populations and other food sources (Stuart 2009, 170).

Surplus, despite our history of waste, has allowed human populations to expand quickly. This expansion, though often at the cost of species extinction and destruction of large ecosystems, created the conditions under which human settlement and agriculture developed. Population growth and constant overreaching of our food supply likely forced us into technological and social development (Boserup 2014). Agriculture allowed consistent production of surpluses (so long as soils remained fertile), which fueled human reproduction and allowed groups practicing agriculture to conquer those who did not. Stuart, in *Waste,* argues that sustaining population growth, division of labor, and military prowess were the first rationales for the production of food surpluses (2009). Beyond these principles, storage of surpluses further guarded populations against times of scarcity. If we are constantly overproducing, then in times of scarcity we can avoid inconvenience or shortage by wasting a little less (Stuart 2009, 174). It is also important to note that food waste is not something we can completely avoid. There

is always going to be some amount of waste. Because of this food waste is often categorized as avoidable and unavoidable.

Avoidable food waste includes foods or parts of foods that are considered edible by the majority of people. Unavoidable food waste is food that is not, and has never been, edible under normal circumstances. Apple cores, meat bones, and orange peels fall into this category. This is a subjective categorization, and can vary with culture, religious beliefs, social norms, and personal preferences (Papargyropoulou *et al.* 2014). However, this does not mean the levels of food waste in Western nations is reasonable (Horrigan, Lawrence, and Walker 2002; Papargyropoulou *et al.* 2014). The vast majority of our food waste is perfectly edible, and therefore avoidable (Stuart 2009, 71).

It is also important to note that food is a perishable product. The limited lifespan of food products creates an inherent amount of waste, and because food will not remain edible forever there will always be a time factor that drives food waste.

Supermarkets

Supermarkets are efficient at pushing waste up and down the food chain, and because much of the data on their waste is self-reported, it is likely the numbers are greatly underestimated (Stuart 2009, 26). The food waste they contribute to, therefore, is both within their position in the supply chain and in the stages before and after. Within their stores, supermarkets cause food waste by ordering more than they can sell. Supermarkets believe shoppers like to see full shelves. Full shelves communicate infinite abundance, an illusion central to the expectation of choice in today's consumer culture (Stuart 2009, 27). Supermarkets choose to waste food when they do this because they believe the losses incurred will be offset by attraction of customers, even though

others suggest consumers like to see empty shelves because it suggests the food they purchase is fresh because it has not been sitting for too long (Stuart 2009. 27). Retailer profit margins have also determined that overstocking can still be profitable. By setting prices higher, retailers can make overstocking more profitable than the sales foregone by understocking. The cheap price of food disposal further enables these wasteful practices (Stuart 2009, 28).

Cosmetic standards also contribute to waste. If packaging is damaged, products will be tossed, even if the damage consists of minor tears or marks on the outer packaging, which do not affect the food. When one item in a larger pack is blemished or imperfect then the whole pack is often disposed of (Stuart 2009, 28). Excessively stringent quality controls also lead to the discard of good food on cosmetic, and sometimes taste, standards (James and Evans 1997). When supermarkets refuse to donate or redistribute their rejected, but perfectly edible, food this further contributes to waste (Stuart 2009, 36).

Supermarkets also push vast amounts of waste onto their suppliers. One company in the UK requires their sandwich manufacturer to discard four slices of bread from every loaf because they do not want the crust or crust-adjacent pieces used in the sandwiches. This is 17 percent of every loaf, or 13,000 slices of bread from a single factory every day (Stuart 2009, 45). Supermarkets hold a position of power in their relationships with manufacturers because there are many suppliers and few buyers. Thus, manufacturers are dependent on their few supermarket buyers for survival, whereas supermarkets can easily switch to another supplier. This allows supermarkets to negotiate extremely advantageous business deals. For example, when a supermarket

fails to predict demand, they can push overproduced goods back on their supplier. This allows them to force their waste onto their supplier (Stuart 2009, 47-48). Oftentimes, supermarkets will simply avoid making any contract at all, which allows them to suspend, reduce, or cancel orders at the last minute (Gunders 2012; Stuart 2009). Through this pushing of waste, supermarkets force some farms to lose up to a third of their harvest every year (Stuart 2009, 102).

Downstream offloading of surplus often happens through deals and sales. BOGO, or "Buy One Get One" deals allow supermarkets to offload surplus. This can be a deal for customers, but only if they need what they are buying. If customers do not eat the extra food because they do not need it, then this is simply more waste (Stuart 2009, 69). This also applies to value packs of produce and other oversized supermarket offerings.

Economic Factors

Beyond the opportunity cost of producing food, there are other economic factors contributing the waste. In the production phase, bumper crops that reduce commodity prices may discourage farmers from bringing full harvests to market if, after accounting for the costs of labor and transport, it is determined that prices will be too low to cover their costs (James and Evans 1997; Gunders 2012). Consumer demand for, and supermarket regulations regarding, cosmetically unblemished produce of consistent size and shape can also motivate farmers to harvest selectively, leaving undesirable but perfectly edible food in the field (Stuart 2009; James and Evans 1997). It is also difficult for farmers to grow the exact amount that will match demand. Food safety

scares can decrease demand, which also discourages harvesting the entire crop (Gunders 2012).

Consumer Behavior

In the UK, about two thirds of consumer food waste is due to food spoilage and the other third is due to cooking or serving too much. Food spoilage stems from improper or suboptimal storage, partially used ingredients, and misjudged food needs (Gunders 2012). Expiration dates, and confusion interpreting them, accounts for an estimated 20 percent of consumer food waste (Stuart 2009, 65; FDA: How to Cut Food Waste 2019). The dates they set are consistently days earlier than when the food will spoil, if handled properly. In the US, there are no federal laws requiring date labelling on food, with the exception of some baby foods. However, because over twenty states have their own legal requirements, the variety of labeling methods causes consumer confusion. (Stuart 2009). This confusion often leads consumers to discard food prematurely.

Lack of awareness and concern is at the core of consumer food waste. Consumer food behaviors indicate that they do not place a high value on avoiding waste (Gunders 2012). While this is partially due to supermarkets pushing food onto consumers, the sheer quantity wasted implies that the blame cannot entirely be placed on supermarkets (Stuart 2009, 70). Consumers are so unaware of how much they waste that, in studies comparing self-reported numbers with actual waste totals, they regularly underestimate their food waste (Schmidt 2016: Secondi, Principato and Laureti 2015).

Another cause of waste is something food psychologists refer to as ‘Good Mother Syndrome’. Providing enough choice and surplus is preferred over the shame of

failing to offer enough food. Many cultures view a surplus of food as a symbol of status, wealth, or good hospitality (Stuart 2009, 75).

Impacts of Food Waste

Energy, Resources & Environmental Impacts

The caloric or monetary value of wasted food is merely one aspect of the waste issue; these values do not fully communicate the impacts to our environment. The opportunity cost of wasted food is comprised of the resources used to produce it, as well as what those resources could have been used for otherwise (Stuart 2009, 86). For example, land is an important resource. Almost 53 percent of the US landmass is used for agricultural purposes (Hellerstein, Vilorio and Ribaudo 2019). Converting ecosystems into usable agricultural land is one of the most dramatic changes we can make to our landscapes (Stuart 2009, 95). When food is wasted in one part of the world it puts pressure on production elsewhere. If demand is high enough, the rising value of agricultural land will incentivize sacrifice of ecosystems into agricultural land. This can lead to increased deforestation which, in places like Brazil, can account for up to 75 percent of a country's emissions. Globally, such deforestation is responsible for approximately 20 percent of greenhouse gas emissions (Stuart 2009, 93). Food supply scarcity, which is exacerbated by waste, also encourages overexploitation of land. When soil becomes infertile, customers can move their business elsewhere. Meanwhile the farmers are left on overextended land without the same ability. (Stuart 2009, 86).

Food production also requires inputs like water, fertilizers, and fossil fuels. When food is wasted, resources invested throughout the production process are also wasted because the intended use of the food, consumption by people, is not

accomplished. Approximately 70 percent of the freshwater supply is used by agriculture (Postel, Daily and Ehrlich 1996). Of our total freshwater usage, one quarter is accounted for by wasted food. However, this number is still an incomplete total because it excludes water usage further down the supply chain (Stuart 2009, 90). The average farm uses approximately 300 million barrels of oil per year. This was about 4% of the total US oil consumption in 2003. So much energy goes into food that if one calorie is saved, an estimated sevenfold reduction in the energy is achieved (Stuart 2009, 91). Fertilizers used in agriculture also contribute to water pollution when they runoff and cause eutrophication. Drastic reductions of food waste through decreased production, and therefore reductions in fertilizer use, could significantly improve water quality (Grizzetti *et al.* 2013). Another resource consumed in the production of some foods is food itself. Cattle require 7 kg of grain to produce 1 kg of beef. As livestock diets become more grain-based and less grass-based, the energy and resource inputs to rear them are becoming more intensive (Horrigan, Lawrence and Walker 2002). We are growing food in order to grow more food, which is inefficient and, when wasted, means those products have a far higher price.

Food waste undergoing anaerobic decomposition in landfills also produces methane, a greenhouse gas 25 times more potent than carbon dioxide (Hall *et al.* 2009). Thus, food waste not only contributes to resource depletion but also climate change, since landfills are responsible for approximately 8% of all anthropogenic methane emissions (Melikoglu, Lin and Webb 2013). Landfills contribute to more than carbon dioxide and methane emissions. Problems like leachate contaminating soil and groundwater are also related to landfills. If we do not landfill the waste but instead

incinerate it, a properly equipped facility can generate electricity. However, this still produces carbon dioxide along with trace amounts of toxic pollutants. It is predicted that food waste will only increase for the foreseeable future, which means the environmental issues associated with food waste will also likely increase (Melikoglu, Lin and Webb 2013).

Climate Change

When food is wasted, all of the carbon generated along the supply chain is thus emitted into the atmosphere without any positive benefits to offset that environmental cost. In the UK, it is estimated that 20% of all greenhouse emissions are related to this problem, which adds up to at least 15 million tonnes of carbon dioxide each year (Hall *et al.* 2009). Preventing waste has the potential to reduce emissions by 456 million tonnes of greenhouse gasses by 2050 in the UK alone. Globally, the carbon footprint of wasted food is approximately 3.3 Gt of CO_2 equivalents. This does not include impacts like emissions caused by disruption of carbon sinks or ecosystem shifts resulting from temperature increase. (Munesue, Masui and Fushima 2015). To provide some perspective on disruption of carbon sinks: If temperature increases cause the Amazon to dry out and become semi-arid grassland, then 55 billion tonnes of carbon dioxide could be released into the atmosphere (Stuart 2009, 94). Certain sectors are more wasteful. For example, livestock contribute an estimated 18 percent of all emissions (Stuart 2009, 93).

In some regions, climate change is shown to have adverse impacts on agricultural productivity. Climatic extremes, early or late frosts, increases in fire, insects, or disease are some examples of negative impacts that affect yields. Increasing

temperatures can also decrease crop yields in warm regions. While temperate regions can benefit slightly by small temperature increases, above a 3ºC increase yields dipped below current yields. Climate change is also predicted to contribute to rising food prices, which would greatly impact food security in developing countries that are already food insecure (Easterling and Apps 2005). Storms and other climate impacts also cause economic losses that affect both farmers and consumers. Communities that are agriculturally dependent are especially vulnerable to the economic side of climate change impacts on agriculture (Walthall *et al*. 2013).

Food Insecurity

Global hunger and its impacts are a serious problem. A recent report from the United Nations World Food Program determined that 870 million people, which is more than the populations of the US, Canada, and the EU in total, do not have enough to eat (UN World Food Program 2019). In the US alone, 14.3 million households, or 11.1 percent of the population, was food insecure in 2018 (Household Food Security 2018). Though the number of undernourished people has been decreasing since the early 1990's, progress is slowing, and food prices are rising (Munesue, Masui and Fushima 2015; Braun *et al.* 2008). Given that the global demand for food is also projected to increase 60 to 110 percent between 2005 and 2050, it is increasingly important that we use our food supply efficiently and allow less to go to waste (Hic *et al.* 2016). With our current food supply, the amount wasted is directly contributing to food insecurity because the amount of global food waste is more than enough to feed the entirety of the world's hungry population (Melikoglu, Lin and Webb 2013). A study by Munesue, Masui and Fushima in 2015 found that reducing food losses and waste can effectively

reduce hunger and allow us to make better use of natural resources. However, just reducing waste must be complemented by policy and safety net programs in order to enhance access.

Economic Impacts

Wasted food also has economic impacts. For consumers, the waste of supermarkets is often added to the price of the product. Environmental costs, however, are not generally paid for by anyone, at least not directly in dollars (Stuart 2009, 47). Rising food prices are a threat to global food security and, while they may benefit some farmers' incomes, this assumes that higher international prices will be reflected by prices in rural areas, and that farmers will be able to respond to any opportunities that arise. For poor consumers, increased food prices may especially lead to reduced income available for other purposes, or reduced food consumption, or both (Levy and Wiggins 2008). Food waste also costs consumers money since wasted food is food they paid for but did not consume.

Waste Prevention and Management

Waste Prevention and Waste Management

The terms 'waste prevention' and 'waste management' are distinct. Waste prevention is defined by activities that avoid waste generation, like reducing food surplus. Waste management is the process of handling waste once it has been generated through activities like composting and feeding it to livestock. Generally, waste prevention is more challenging to achieve (Papargyropoulou *et al.* 2014). The EPA's Food Recovery Hierarchy presents a visual interpretation of the best waste prevention

and management options in order (see Figure 3). Waste prevention is preferred over waste management, thus “Source Reduction” is atop the inverted pyramid (EPA Hierarchy 2019). Reducing undesirable surpluses prevents overproduction and oversupply at all stages of the supply chain. Source reduction aims to limit production to only the necessary amount of food required by global nutrition and food security needs. In retail and consumption, source reduction applies to supplying only what is required, offering correct portion sizes, and addressing unsustainable consumption patterns (Papargyropoulou *et al.* 2014). Reducing waste at the source saves food and labor dollars, allows for the largest positive environmental impact, and conserves raw materials. Carbon emissions from production and decomposition are avoided as well (Leanpath 2008). While it may seem counterintuitive, reducing food surpluses in wealthy nations and cutting post-harvest losses in developing countries could decrease global food demand by 19.6 percent (Stuart 2009, 192).

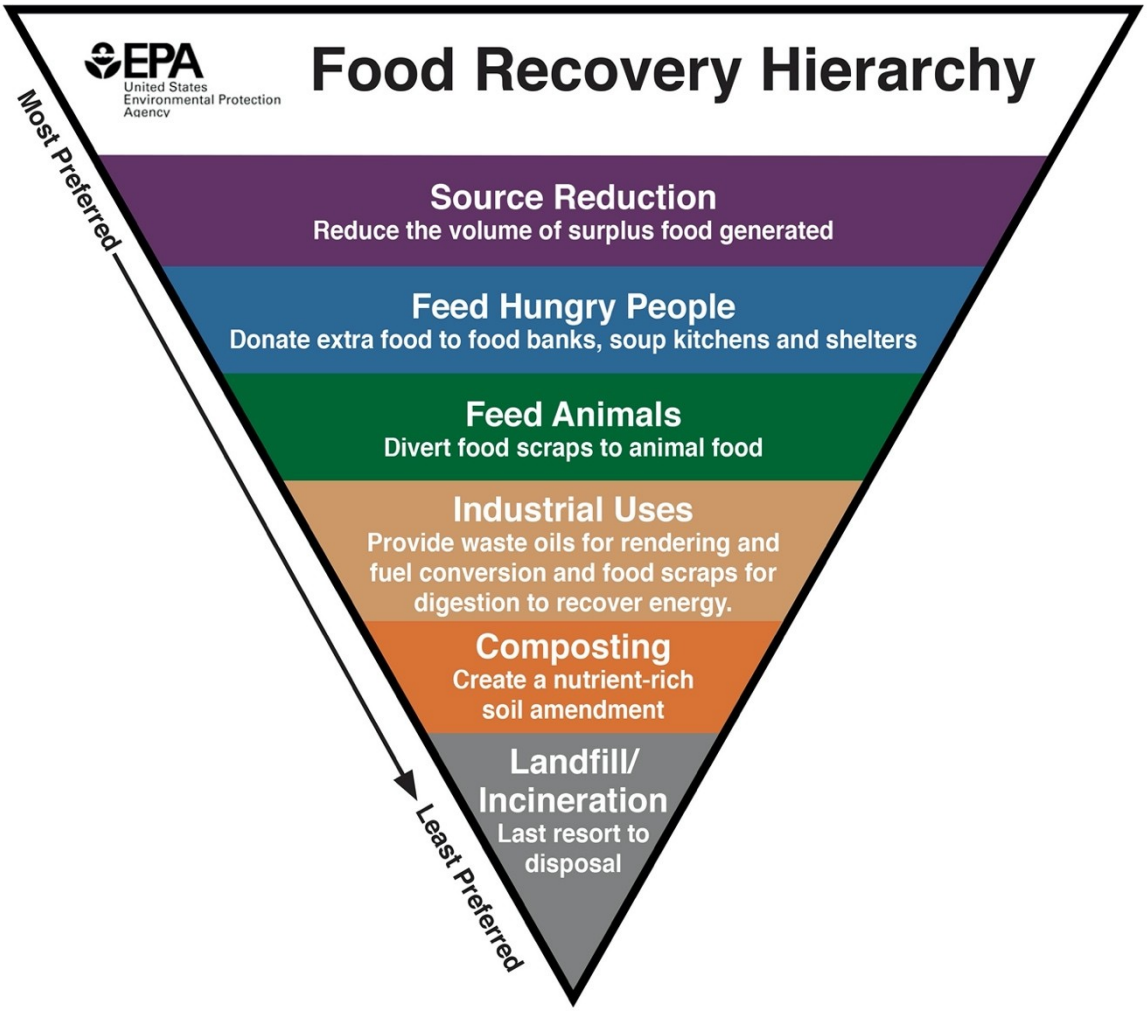

Figure 3: The EPA's Food Recovery Hierarchy (EPA 2019)

The instructional, inverted pyramid of the United States EPA which outlines most and least preferred options for avoiding and managing food waste.

Food Recovery: Feed Hungry People

If surplus does arise, the next most sustainable option is to ensure that whatever can be fed to people is. Food can be recovered if it is donated or collected by a food recovery organization, like Food Rescue US or Food for Lane County, and then redistributed to the poor and hungry. Food can also be recovered by gleaning fields

following harvest, and some glean by going through the trash of supermarkets (Stuart 2009).

Currently, approximately 10 percent of available, edible food is recovered annually. Significant room for improvement is possible, but many barriers exist. Liability concerns, distribution, storage logistics, and limited funds are examples of issues hindering the recovery of food. Often there is plenty of food being offered, but redistribution organizations lack the funds to make use of it all (Stuart 2009, 221). Many businesses also site transportation as the main barrier to donating food. Food recovery organizations are often responsible for collection and transportation of donations, and businesses need collections to be consistent and reliable in order to participate. Unfortunately, food recovery organizations are frequently staffed by volunteers and they lack the resources necessary to provide this consistency. In addition, donated food does not always meet the needs of food recovery programs (Gunders 2012).

Laws like the Bill Emerson Good Samaritan Food Donation Act protect donors from liability so long as the donor has not acted with negligence or intentional misconduct (EPA Reduce Wasted Food 2019). However, awareness of and trust in this law remains low. Companies fear negative publicity if donated food causes illnesses (Gunders 2012). Other laws allow large companies to deduct the cost of donated food against their taxes and provide tax breaks on shipments of food if they transport donated food on return journeys (Stuart 2009, 227). These incentives help with food recovery, but much still goes to waste.

Food Recycling: Animal Feed, Industrial & Compost

Food can be recycled into animal feed, compost, or industrially processed products. The least wasteful recycling option is to feed waste to animals (Stuart 2009, 238). This is the least capital investment intensive of these options while also offering the greatest environmental benefit. If conventional pig feed were replaced with swill from food waste, an estimated 236 kg of carbon would be saved. If this food were used to generate electricity through anaerobic digestion it would produce a carbon savings of only 110 kg (Stuart 2009, 239). Livestock fed on food by-products could also reduce the need to use environmentally damaging cereal crops as feed, and animal manure could be used to generate heat and electricity as well as fertilizer. Food scraps could also economically benefit farmers by decreasing the amount they spend on conventional feed (Stuart 2009, 250).

Anaerobic digestion has the potential to salvage energy from food waste, but at a less efficient rate than feeding to pigs and other livestock. One tonne of food waste processed via anaerobic digestion has an economic value of $46.74 whereas one tonne of food waste converted into pork has a retail value of approximately $415 (Stuart 2009, 240). The benefits of anaerobic digestion are that some energy and emissions are recouped when that food is converted into energy, which is better than the food going to landfill and producing further emissions as it decomposes, but the saved energy and emissions amount to a miniscule portion of total emissions from production (less than 0.75 percent, in the case of tomatoes) (Stuart 2009, 241). Anaerobic digestion, in the eyes of Tristram Stuart, is too often viewed with a technophilic faith unjustified by its –

comparatively – meager returns. However, it is currently the best option for kinds of food waste that cannot be fed to livestock (Stuart 2009, 240).

The next preferred option is composting. Through composting, wasted food can be used to remediate soils, reduce the use of chemical fertilizers, and enhance soil water retention (EPA Composting 2020). While compost is better than landfill, it is the last option before landfill because it recovers little of the inputs involved in producing food.

The Study of Food Waste

In the literature of food waste, the voice of small producers is rarely present. It is challenging to find research focused on small farms or work that includes the voice of small producers. In their analysis of food waste research, O'Sullivan and Bowman found a lower percentage of studies focused on the upper portions of the supply chain (2018). Roughly 49 percent of food waste research covers consumption stages of the supply chain whereas only 18-30 percent include the stages between production and distribution (Xue *et al.* 2017). As a result, studies of how much consumers waste, and how to influence consumers to produce less waste, are relatively easy to find and often quite specific (e.g. Richter 2017; Schmidt 2016; Graham-Rowe, Jessop, and Sparks 2015; Secondi, Principato, Laureti 2015). In contrast, only four sources containing the voice of the producer were found in my research. One contained the voice of the small producer.

The three sources containing the voice of the producer, but not the small producer, were produced by Tristram Stuart, WRAP, and Feedback. In 2017, WRAP conducted a "relatively novel" study of preliminary losses of strawberry and lettuce crops in England (Sheane, McCosker and Lilywhite 2017, 1). Their research included

how much was wasted as well as the growers' opinions on driving factors of waste. Tristram Stuart's *Waste* also included accounts from large producers regarding waste, drivers of waste, and how grocery stores impact their waste (2009). O'Sullivan and Bowman, with the organization Feedback, conducted a similar investigation into supermarket roles in UK crop waste in 2018. Their research, along with measuring waste, included quotes from large producers, thus preserving and including their voices. O'Sullivan and Bowman's findings corroborate Stuart's findings: Supermarkets drive waste upstream, on farms, through cosmetic specifications, normalization of overproduction and waste, failure to market seasonal produce, cancelled or altered orders, and the concentration of power among supermarkets (O'Sullivan and Bowman 2018; Stuart 2009).

Campbell and Munden-Dixon conducted a study of California growers which included some producers operating on less than 10 acres. Though more information was not provided, these potentially qualify as small producers by this study's subjective standard. Campbell and Munden-Dixon's study included quotes from interviews with producers, though whether a producer was large or small was not specified. Key findings from this study were: Difficulty estimating on-farm losses, key factors driving on-farm losses are beyond farmers' control, food unharvested is often tilled back into the soil or fed to animals, and gleaning and donations usually depend on nonprofit connections (Campbell and Munden-Dixon 2018). Farmers also cautioned against economically impossible waste-reduction efforts but were open to doing more with food banks. Their recommendations pointed toward focusing on the processing sector and

their interest in the creation of secondary markets for imperfect produce or by-products (Campbell and Munden-Dixon 2018).

Research into all food waste, not just on-farm, is further complicated by issues of measurement, disclosure, and scale. Inconsistencies between studies make this topic's literature varied and often convoluted. One of the most comprehensive food waste reports in the United States was issued by the USDA in 1997 and included retailers and consumers. The report explicitly cited the need for more data at that time (Gunders 2012). Lack of data is still an issue but increasing public concern and political attention has provoked an increase in the literature on food waste (Xue *et al.* 2017). In the existing research, food waste is often analyzed in different ways, making it difficult to construct a corroborated, clear account of the food waste issue. For example, one study may use a caloric evaluation of the entire food supply, while another considers only consumer-level waste in pounds. Some studies combine losses to cooking, such as fat or water that burn off, with discards like orange peels. This makes it difficult to determine how much food is actually being wasted. The studies do agree that, in developed countries, the majority of waste occurs at the consumer and food service levels and in developing nations most food loss occurs between harvest and market (Gunders 2012). These conclusions should be viewed with some reservation, however, because many omit farm, post-harvest, and processing. Lack of clarity defining food waste further contributes to differing methodologies (Gunders 2012). For example, the FAO defines food loss as "the decrease in quantity or quality of food" and food waste as part of food loss that "has been left to spoil or expire as a result of negligence by the actor (predominantly, but not exclusively, the final consumer)" (Xue *et al.* 2017, 6620).

Differentiation between food loss and food waste and avoidable and unavoidable waste is inconsistent across the literature as well (Xue *et al.* 2017). Figure 4 offers an overview from Xue *et al*. on the varied methods of quantifying food waste and displays the complexity of research methods and how each involves varying pros and cons (2017).

	method	symbol	time	cost	accuracy	objectivity	reliability	example of case countries and regions	food supply chain	reference
direct measurement or approximation based on first-hand data	weighing	W	●●●	●●●	●●●	●●●	●●●	Portugal	P6b	Ferreira et al.[148]
								Italy	P6b	Falasconi et al.[157]
	garbage collection	G	●●●	●●●	●●●	●●●	●●●	Austria	P6a	Lebersorger etal.[150]
								Sweden	P6a	Bernstad et al.[71]
	surveys	S	●●	●●	●●	●●	●●	Sweden	P5	Gustavsson et al.[65]
								U.K.	P1, P2, P3, P5	Mena et al.[114]
	diaries	D	●●●	●●	●●	●●	●●	U.K.	P6a	Langley et al.[108]
								Sweden	P6a	Sonesson et al.[63]
	records	R	●	●	●●	●●	●●	Sweden	P5	Eriksson et al.[73]
								Sweden	P5	Scholz et al.[158]
	observation	O	●	●	●	●	●	U.K.	P6b	Sonnino et al.[110]
								Italy	P6b	Saccares et al.[159]
indirect measurement or calculation derived from secondary data	modeling	M	●●	●	●	●●	●	United States	P6	Hall et al.[15]
								EU-27	P1, P2, P3, P4, P5, P6	Khan et al.[135]
	food balance	F	●	●	●●	●●●	●●	United States	P6	Buzby et al.[23]
								global	P1, P2, P3, P4, P5, P6	Gustavsson et al.[9]
	use of proxy data	P	●	●	●●	●●●	●●	Austria	P5	Lebersorger et al.[56]
								Singapore	P6a	Grandhi et al.[160]
	use of literature data	L	●	●	●●	●●●	●	global	P1, P2, P3, P4, P5, P6	Lipinski et al.[90]
								Denmark	P1, P3, P4, P6	Halloran et al.[161]

[a]Note: ●●●, high; ●●, medium; ●, low. Cost includes both economic cost and labor cost of conducting the research. P1: agricultural production and harvesting; P2: postharvest handling and storage; P3: manufacturing; P4: distribution; P5: retailing; and P6: consumption (including P6a: household and P6b: out of home).

Figure 4: Description of Advantages, and Examples of Different Methods Used for FLW Quantification (Xue *et al.* 2017)

Results

Small Producer Perspectives

Waste is an issue that consistently concerned the small producers participating in this study. None of the participants regarded food waste apathetically, but instead all expressed strong, negative opinions against the wasteful tendencies of our society, such as:

> *I think that it's disgusting how much fresh produce is thrown away. It's appalling how wasteful we are as a society.*

When asked if they thought food waste was an economic, pragmatic, or ethical issue, participants often felt more than one label was necessary. All of the participants felt waste was an ethical issue, and most producers said food waste was "an ethical problem first."

Though all five participants described waste as an ethical issue, the moral philosophies behind their opinions varied. Many mentioned the environmental side of the issue and felt that because food waste impacts our environment this contributed to its qualification as an ethical issue: "Environmental problems are ethical problems." When discussing the environmental side of food waste ethics, one producer felt strongly about the importance of respecting where you live:

> *Are your ethics that it's OK to trash where you live? If so, then just waste away. Because that's what I think we're doing. Animals know better than to **** where they sleep. We don't. We just muck it up until we say: 'Oh it smells really bad; I think I'll move.' It's your ethics. It's the ethics of you leave a place better than you found it.*

For this small producer, food waste also went against social standards of behavior:

> *It's not ethical to leave your waste for somebody else to clean up later. It's not polite. It's bad manners.*

Two small producers included religious beliefs when discussing the ethics of food waste. These participants felt wasting food went against the moral philosophies of their belief systems:

> *I would say that it's an ethical problem. It's a religious problem. We should do stuff in consideration of the seventh generation. We shouldn't trash the beautiful thing that's been given to us. How ungrateful is that?*

> *But is it ethical to waste, no I don't think so. I think that's part of being a member of society and doing the right thing. It's the same reason we don't rape, steal, cheat, lie, murder, etc. Go back to the ten commandments. It's all about doing the right thing. Wasting food is an ethical issue.*

Two other producers believe wasting food is ethically wrong because doing so disrespects life itself:

> *Because of our values we love and respect our animals because of the relationship we have with them and what they do for us and it's a living being also. It gives us life so that we can have nourishment, so I mean ethically it's just disgusting and sad if people waste. It's disrespectful to life itself. You had to kill something to eat that. An animal is an animal, we love and respect our animals, but we know what their position is in life. But we want to give them a good life and show respect towards them and part of that is using it all. It's the same way with a plant too. You show disrespect to whatever it is or however it's made if you don't recycle.*

Four small producers discussed economics as a factor as well, but the economic side was often addressed as a secondary, influencing factor:

> *I think more than anything it's an ethical problem first. It's also influenced by the economic issue.*

This does not mean the cost savings of reducing waste were considered unimportant by small producers. Instead, the economic issue of reducing waste was seen as a part of the overall effort to reduce waste, a positive effect worth pursuing alongside the value of reducing waste:

> *We are very conscientious of our waste in every aspect of our operation because we put so much energy, time and resources into it. It is cost effective to identify where there's waste that we could recycle or reuse, but it's not just the economics and that it saves us money. It's also our values. Because we know what it takes, we don't want to waste any of it.*

Three participants also felt that there is a pragmatic side to the issue, and that the costs of wasting food are important: "It's pragmatic and the cost matters."
Small producers ultimately defined food waste as an ethical issue, but many also discussed how it qualified within other categories as well. Their ethics influenced how they approached the economic and pragmatic aspects of food waste.

Why Consumers Waste

Small producers cited disconnection with the food supply chain and lack of understanding as the two main reasons for consumer food waste. They stated that, if consumers understood the investment it takes to produce, they would be less willing to waste because they would better understand what that waste means:

> *The biggest thing is if they understood what it takes to grow and produce the good and safe food that we all take for granted.*

They pointed to the way our supply chain distances consumers from the intensive process of producing food, and how that fosters undervaluing of food was a result:

> *Many people are so disconnected from production that they intrinsically waste because they're so disconnected from all of the inputs. But here we are very conscientious of our waste because we know what it takes, we don't want to waste any of it.*

> *Because it's cheap. Because they're disconnected from the food supply chain. The products that they get are relatively cheap, so they don't value them.*

> *If you were living on a farm and producing all those products, you would know how much work it was to milk a cow and then you certainly wouldn't put half a glass of milk down the sink. You would only pour half a glass of milk to start with. You inherently would know better because you had to milk that cow. That doesn't exist anymore.*

> *People do not understand the effort it takes to feed them. I think it's the lack of appreciation of the effort required. I call it the Walmart effect. It's the mindset of wanting everything for cheap no matter what the impacts. We've created a society of cheapskates and we're all part of it. I mean, who wants to go pay more for anything? That's just the mindset. I think that flows over into food purchases too.*

Because our food system strives to provide plentiful, cheap food it further disguises how costly production is and amplifies the illusion of food as a cheap commodity:

> *The only reason food is cheap is because of the federal government. They subsidize it for the benefit of huge corporations. People like to have cheap foods, but when they buy that cheap food, they don't fully value it.*

Small producers universally agreed that people waste food because they undervalue it, and that undervaluing is only possible because of disconnection.

During the interviews, convenience was another commonly mentioned explanation for high levels of waste. One small producer noted that many people cook

for themselves only twice a week and eat out frequently. When they noticed declining community supported agriculture (CSA) subscriptions, and polled customers to determine the cause, this participant found that consumers felt the CSA boxes had more food than they needed because much of it often went to waste. When asked how much they cooked for themselves, they found that their customers were eating out more frequently than they ate in and as a result much of the CSA food spoiled. People cancelled their CSA subscriptions because they felt guilty about wasting food, and they wasted so much food because they preferred the convenience of eating out:

> *We realized that fewer and fewer people signed up for CSA's. And we started talking to people and hearing that it was too much food and they just couldn't use it all and they felt bad about throwing it away. So, we start asking people how many times a week do you cook for yourselves? And the answer was people don't cook for themselves very much. As we found out from this pandemic, people spend over half of their food budget eating out.*

> *Convenience kills. I think that plays a big part in food waste. We don't want to cut up the stuff, and we want somebody else to have that waste. We just want to have it all prepared, so we don't even have to do the dishes. We want somebody else to deal with that.*

Small producers believe eating out is also correlated with higher levels of waste because of the large portions served in restaurants:

> *Over the last 30 years the size of the plate has grown and the amount of food on the plate has grown and the amount of money you sell it for has too. There's this expectation that if you give them what they should be eating you're cheating them.*

This desire for convenience also translates into shopping habits:

> *I think people get carts full of Costco supplies that they don't need because it's convenient and it saves money because the big container was cheaper than the proper portion size.*

And consumer preferences for larger-than-necessary quantities of food lead them to larger surpluses and more waste as a result, since they are often purchasing more than they need:

> *I notice when I go to other people's homes and if I happen to be in their refrigerator for some reason, I notice the amazing amount of food they have in the fridge. Some of it spoils because they buy too much of it. If you look in my refrigerator there isn't hardly anything in there.*

Convenience-seeking habits in shopping and how consumers get their meals, by eating out rather than cooking for themselves, is something small producers believe drives consumer food waste. Valuing convenience over reducing waste can be tied back to disconnection from the food supply chain and lack of understanding food's value. When people do not see waste-reducing habits as a priority it is because they do not see the value of the food they are wasting and do not feel they are doing significant harm through their waste.

One small producer also stated that lack of responsibility is a contributor:

> *The social responsibility is not there. And I think that translates into, "Why should I care about wasting food, why should I care about creating trash?" It's just all about that instant gratification, all about me.*

This argument links concepts of instant gratification and food waste. Instant gratification comes with convenience, and by seeking convenient solutions to food consumers are valuing their gratification over the food they waste in the process. This small producer viewed such thinking as self-centered and stated that this was part of the

ethics of food waste. Their belief was that we should live with the seventh generation in mind:

> *We should do stuff in consideration of the seventh generation. We shouldn't trash the beautiful thing that's been given to us. How ungrateful is that?*

To live in a way that would be harmful to the seventh generation is unethical and, since wasting food is harming the environment and already increasing food insecurity, it is therefore unethical to waste food. The lack of responsibility people take concerning their waste enables them to waste.

Another small producer expressed concerns regarding cosmetic standards. The preferences consumers have cause food to be wasted because it is left unpurchased:

> *Consumers don't want imperfect produce. They want the prettiest one. You'll do it and you won't even know that you're doing, and so the ugly piece of fruit gets thrown away.*

This farmer discussed how they also catch themselves selecting for cosmetically appealing produce to reinforce the pervasiveness of these preferences. They also presented it as an issue that, because of consumer behavior, causes waste above their position in the supply chain.

On-Farm Waste

On small farms and ranches the most common forms of waste are inedible byproducts, animal excrement, and unharvested products resulting from excess production. One small producer both grows grapes and produces wine from their crop. They commonly had byproducts of wine productions as waste:

> *And we get a lot of red grape skins once fermentation is over, then we'll press off the red grapes and get the juice.*

From their grapevines they also had leftover grape canes: “We have all the grape canes that we cutoff every year.” Two other small produces who grew both produce and livestock said they frequently could not sell, and sometimes could not harvest, all of their products:

> *The only thing that really causes food waste is when people don’t buy the food. One year there was a guy here that grew all kinds of food, but he was growing more food than we could sell. We were dumping tractor bucket loads of tomatoes to the chickens. It didn’t go to waste, but it would’ve been nicer if some people had eaten it.*

> *We have five acres of fruit and vegetables, which is a lot to pick. There was no way I could get all that stuff picked when it came ripe. We wasted at least half of it. I let my employees come out on Saturday and pick their own stuff, which they did, but you just can't get anybody to come pick fruit and vegetables unless you want to hire illegal immigrants.*

> *I had so many pigs I didn't know what to do with them. I thought I could take them to sale just like you do with a cow or a horse but there is only one sale lot for pigs here. All the corn’s up north so almost none of it's here. So, there's no real market for grown pigs here in Texas.*

Two other small producer mentioned animal excrement as food byproducts. This another form of unavoidable waste, much like pressed off grape skins of grapevine canes.

Though the rough numbers given by these small producers indicate large quantities of waste can occur on their farms, their opinions were that they produce little waste because:

> *The food waste we have goes to the animals which creates compost which feeds the plants. So, we have very little waste.*

Challenges Driving Waste

The small producers that took part in this research experience the majority of their waste because of the inherent time-sensitivity of food. Though they overproduce, they also do not have functional methods of preserving this food for sale at a later date. The food's lifespan is limited to the time before it spoils in its unprocessed form:

> *We could grow a lot more food if we had a way to preserve it. Overtime there have been fewer and fewer small and mid-size processors, and all that was left were big processors. The bigger the processor the bigger the intake they want. They don't want to mess with you unless you're growing 20 tons or something. So that leaves all the mid to small size farmers out, with no place to take their product.*

One of the small producers experiencing waste because of this also struggled with labor. They could not find legal labor to help with harvesting their crop and this limited resource caused waste as a result. Another reason cited was the challenge of direct marketing:

> *One of the other problems for mid-size farmers is that you can't direct market everything. You can't sell everything fresh.*

Another small producer noted that time limitations also affected their ability to compost:

> *I wanted to compost here, and we still do a little bit of composting here with grape skins. But we produce so much and we're such a small facility that we're in the middle of the night trying to drum skins and it's really challenging to manage that process.*

This byproduct of wine production, grape skins, is not an avoidable form of waste. However, time and labor limitations also inhibited this small producer's ability to manage the waste.

Unreasonable or out of date regulation was the other waste management challenge small producers faced. Water from wine production is classified as hazardous waste. The regulation responsible for this is out of date, but the organization enforcing it does not have the resources or time to concern themselves with updating it:

> *We use it to water the ground, but we can't actually directly water something that is going to go into somebody's mouth. It's an antiquated law. They call it hazardous waste even though it's grape skins and water.*

Waste Reduction & Management Strategies

On-Farm

The small producers interviewed for this project indicated that reducing overall waste, including food waste, is an important value for them. One Texas producer, who grows grapes and also uses them to produce wine, said:

> *We're trying to get close to zero waste production facilities. We take all of our wastewater and treat is to get the [carbon] load down… and then we use that as irrigation water.*

This small producer also donates their grapes to a small rancher nearby who uses them for livestock feed:

> *[The grape skins are] waste but what we do with it is we have a really good rancher across the street who farms hay and cows and we have dump trailers and we will take all of that waste and put it in dump trailers for him.*

The unavoidable plant mass waste, grape canes, are burned, turned into wreaths or decorations, or given to a meat smoker who uses them to create grape cane smoked pork belly:

> *Most of them we burn, but we've been making wreaths and selling them. We just made a covering for our bathroom doors with the canes woven in and out. And then the market across the street makes smoked meat and so we give him grape cane to smoke pork belly with.*

On two other small farms if the food cannot be fed to livestock it is composted:

> *Any of our food gets fed to the cows and if it can't go to the cows it goes to compost. If we have any kind of fruit that the horses will eat, we'll give that to them. When we come across waste from other farmers or ranchers if it's healthy to feed the cows or horses we will.*

Gleaning is another method used by one small producer, who allows employees to glean what would otherwise go to waste:

> *I let my employees come out on Saturday and pick their own stuff.*

And, if they have too much harvested produce or pork, they will take it to their office or give it away at group events, like Rotary meetings:

> *I rented a refrigerated truck and took it to the office, and I gave each of my employees a ham and pork chops and bacon and gave them little care package sacks. I did the same thing with my fruit and vegetables. I put it all in the break room. I did the same thing at the Rotary. Because I had too much.*

The most common method of waste management was composting. All of the participants mentioned composting their waste. Feeding to livestock was the second most common, with two of the three farms with livestock indicating that they feed waste to their animals.

Two of the four farms also helped divert waste from the landfill by taking donations. One small producer, who produces beef, takes the grape skins of another participant in this study. The grape and wine producer struggled to compost all of their skins, so this diversion of waste keeps the skins from potentially going to landfill, saves the grape producer time, and also benefits the rancher who uses them as feed. The rancher, along with taking grape skins, also collects spent grain and molasses from nearby brewing companies and uses these as feed as well:

> *When we come across waste from other farmers or ranchers, if it's healthy to feed the cows or horses we do that. Sometimes we are able to source spent brewery grains from the distillers. And molasses is really good for cows and a lot of people actually go and buy molasses, but we get ours recycled from the rum distillery. That's their waste product and it's a win-win.*

In the past, this ranch collected bread from a local bakery and unsold produce from their grocery store; however, an unknown circumstance caused these businesses to stop donating, and the small producer is no longer able to divert waste this way. The other small producer taking donations also collects spent grain:

> *We get spent grain from beer making and that translates to approximately a ton of wheat that isn't going into the landfill. That gets recycled as livestock feed for chickens, goats and sheep. And what we don't feed to them goes into the compost pile.*

All of the small producers also indicated efforts to reduce in-home waste. All five composted, three managed it through feeding to livestock, and one had access to curbside organic waste pickup. One small producer also explained how they prevent waste by cooking in conscientious quantities, freezing food, and keeping their fridge

only as full as they need. One used to have chickens but found them incompatible with their lifestyle and switched over to compost.

Waste Management Benefits for Small Producers

Waste management on these farms has more positive impacts than the environmental benefits of diverting food waste from the landfill (e.g. Stuart 2009; Postel, Daily and Ehrlich 1996). Financial savings from donated waste that becomes livestock feed, creation of unique and marketable qualities, community-building, and conservation of time and resources are other positive impacts of this waste diversion that small producers noted during their interviews.

When breweries donate spent grain, the two small producers taking these grains save money on feed:

> *I always knew feeding spent grain was a good source of feed. It's inexpensive, and you can get it for free sometimes. I heard there was going to be a new brewery here so before they were even open, I was banging on our doors saying I want your spent grain! I was the first one in line, so I got it.*

And, even though they are small producers, the cumulative impacts of their waste diversion can amount to large quantities:

> *And I've been doing it for eight years now. So, you figure a ton of weight for eight years. It's a lot of spent grain.*

The breweries also benefit when they donate:

> *They're able to haul it off and not have to pay for the waste fees and then we get to use it 'cause it's a benefit to our animals.*

This creates a relationship in which both parties' businesses are enriched through the diversion of waste. Costs are decreased on both sides of the exchange. This is also true for the donations of molasses and grape skins received by one of these small producers.

When the small producer growing grapes donates to their neighbor, the rancher, both parties once again experience cost savings. On top of the economic benefits, these exchanges appear to have some compounding effects. Grape skins are not a commonly available source of livestock feed, and their use created a unique, marketable quality for the rancher receiving them:

> *He's able to market those cows are a little bit differently. He goes to all the local restaurants and markets grape skin fed Wagyu beef.*

In addition, the relationship between these small producers creates opportunities for them to help each other grow:

> *And it's kind of crazy, when we mentioned them on our virtual tasting it caused a huge increase in sales for them. A lot of people reached out asking to buy direct. So those guys help us we help them and it's all a big win-win.*

Because of these donations both the rancher and grape grower found that grapes make exceptional feed because they have a high nutrient value:

> *We had it tested a long time ago and the amount of protein is really exceptional. It's a really good protein source for his cows and he's like it saves me money so.*

Multiple small producers expressed the sentiment that their communities were important parts of their food systems, and that the donations they give and receive help them strengthen those community ties:

> *When we recycle the Brewers grains from our neighbors, we're developing more community ties and we're keeping the money here local and so it's awesome. It's fun. It gives us more tight community ties. We're collaborating and working together and interacting more instead of being in our own bubbles. We're part of this business community that's going on and that's really nice and you feel good about each other's success.*

One small producer specifically expressed their faith in their community as a support system that could support them in times of need, and how this support would also likely help them keep their waste levels down:

> *If we got hurt or sick and we needed a temporary convenience, a way of taking care of our animals, I think the thing that would really save us is the relationships component of it. Because of our community ties I think people would rally around us and they would help us continue with our operations so that we wouldn't be forced to go buy a bunch of inputs in the short term. We wouldn't have to go out and buy all those inputs and therefore have all that waste.*

Motivations

Small farmers described a variety of motivations when discussing why they seek to prevent and manage food waste. Personal beliefs were the most common motivating factor, with all small producers mentioning personal convictions, or ethics, as part of their reasoning. Small producers also noted the convenience or economic benefits of reducing food waste, especially regarding donations. Those donating food waste saved the price of disposal and had the convenience of not having to dispose of the food themselves. Small producers receiving donations gained the economic benefit of saving financial resources as well. However, economic and pragmatic benefits were mentioned briefly, whereas ethical motivations were frequently elaborated upon. One small producer discussed in detail how, while taking donations do save the cost of feed, it takes time as well. They do not pay the price of the feed, but they do pay in their time:

> *It's not so much about saving money because it requires time and your effort. It's just wanting to reuse things. Sometimes it's not cost effective, but I look at it as that we're using that product again. It's the same thing with all the little bottles that we reuse in our house if we get it from the store or the restaurant, we wash it and we reuse it.*

> *There's a trade-off. There's an actual value you could place on reusing things and trying to divert things that could be wasted. The tradeoff is your time. All the little things that we try to reuse, and that we take time to clean and reuse, picking up the waste product from other farmers and ranchers, it takes a lot of our time. If we just went to the store and bought it and handed over the money it would be fast and easy and convenient. So that's the trade-off: We're saving money, yes, but we're spending more time. We put more value on feeling like our time is well spent then we do having the convenience to spend the money. Even if we were super wealthy and we could just go buy truckloads of feed and tubs of molasses we probably wouldn't because we just put a lot of value in how we spend our time. We know that these resources may not last forever.*

This choice, to value time spent acting in accordance with their values over their money, is an important piece of why these small producers are motivated to prevent waste.

Another motivating factor for one small producer was the influence of personal beliefs held by others in their family, which they have now adopted as their own:

> *My grandfather was an inventor and started one of the first plastics recycling centers in the country, and he was a big influence in my life and a really great businessman. And I'm thankful that it gave me an appreciation for that when I was young because he was like, why wouldn't you recycle? Why wouldn't you prevent waste? You've got to be thoughtful, and I think it was just his way.*

Waste Management Recommendations

Consumer-Level

Our food system perpetuates undervaluing of food through disconnection, and when food is undervalued it is wasted. The small producers that participated in this study overwhelmingly shared this opinion. To help prevent waste, all participants suggested strengthening the relationship between consumers and their food. Educating

consumers on the impacts of food production and building relationships with producers, so they would better value their food and waste less, were the universal recommendations.

Experiential agriculture, where producers are able to connect with food production, is one way consumers can both understand food production and build relationships with producers. Visiting farms, buying direct, and connecting with producers are all forms of experiential agriculture. Through experiential agriculture consumers can grow their understanding of inputs and understand that food, and how we buy food, has the power to change our environment, food systems, and our health:

> *The biggest part of it is that people are disconnected from their food source. You just start to see changes in mentality even with people that shop at the farmers market. When people buy directly from us or visit the ranch, just that simple act of them getting exposed to how and where their food is produced starts to make an impact in their view and understanding of what they eat and what they use and their footprint. Once they have a connection [it makes a difference].*

One small producer uses wine tastings on their farm as a form of experiential agriculture:

> *Intention is something we can share and that experiential agriculture, when we can share and have people out to the winery, that's where you can feel the heartbeat. We want people to feel something, to feel differently and to think about food differently. I want people to think about the decisions they make and how they affect people.*

> *When we make people aware of how their purchases impact the world and how they can have an impact and make a difference you see this "Aha" moment, which is really cool. And then for our business it has transformed us and transformed our culture. It transforms our value system.*

> *I like to put a face on the grower, and say: When you drink this wine, this is the guy's wife and him in the vineyard and these are his kids this is his story. We should know it because it's meaningful. And you feel something, you feel more connected to this bottle as a result.*

Consumers that do not or cannot visit producers could be educated or connected through marketing that focuses on experiential agriculture:

> *If you got to see a picture of the Apple Orchard and the farmers and their kids, you would say: That's so cool. I want to know his story. And you would want to know why he wants to grow the best apples and why you should buy this apple to put in your pie.*

Other producers recommended education through schooling:

> *Teach people how to cook. Home economics needs to go back into the curriculum. That needs to be a class that's taught in high school. It needs to be more than just learning how to cook and sew a pretty dress. Now it needs to be composting and gardening and recycling and how to do all that stuff.*

And one did not specify how consumers should be educated, but emphasized that consumers need to understand the social responsibility that comes with how they purchase their food:

> *Just being educated on what happens to [wasted food], knowing the ripples of their actions. We've got to have people know that buying food means: Hey, we're going to support these companies. That's got to be a higher priority on somebody's list. Right now, people are like: I can go to McDonald's and get cheaper food. Which is crazy 'cause it's probably Australian or Chilean beef, not even from Texas. We've got more cows in Texas and most of [them] get shipped up to The Midwest to get processed. Looking at how we've industrialized the food chain, it's bigger, faster, cheaper and ultimately, it's creating a bigger strain on the earth.*

Portion size education and cooking realistic meals at home were other recommendations:

> *The only way you're going to fix the restaurant food waste problem is to educate the public. They need to know that they don't need to expect so much on the plate and they need to be satisfied with reasonably-sized portions.*

> *[People need] better measurements of the food they're preparing, so you cook the right number of portions. Be honest about what you really want to eat, so that nothing is cooked that's not going to be eaten. Everybody [should] communicate about what they will or won't eat, so you don't have to throw away servings over politeness.*

Consumers might waste less food if they had access to composting through curbside pickups or worm boxes. If diverting their waste from the landfill is more convenient, then small producers believe consumer food waste might be reduced:

Government & Market Action

Educating consumers, through various means and on various food waste topics, was recommended by every small producer. Another solution presented by all five small producers was raising prices. However, this suggestion was often acknowledged as more complex and potentially problematic:

> *You could argue that raising the prices of food would motivate them, but that in itself is a communist idea, trying to force people to do something by doing something that a free enterprise system doesn't naturally do. The price of food is based on the cost of production and market. It's the ying and yang of trying to fix this problem versus taking away peoples' freedom. So, you got to be careful of that one.*

> *Higher prices, if possible, would be nice because the producers definitely need to make more. Most of us live at or below the poverty level. So, that would be nice, but if that couldn't happen because too many consumers couldn't afford higher prices maybe you could make up for it by having portion control.*

Three small producers suggested that, in lieu of artificially raising prices, government subsidies should be removed. This would allow small producers to compete more effectively with industrial farming operations on price, and it would increase food prices to their natural levels, which might force consumers to realize the true price of food:

> *The only reason food is cheap is because of the federal government. They subsidize it for the benefit of huge corporations. People like to have cheap foods, but when they buy that cheap food, they don't fully value it.*

> *I would love to see the government eliminated from production because I think subsidizing is how the United States started to make cheap food. The government made it to where if you want to stay in business you have to go to [them] in order to stay in business because you have to stay on all the programs in order to keep producing all this cheap food. I hate all of that. All I want to do is just get a fair price. And that's the case with all producers. All they want is a fair shake. They don't want to have to go to the government. They want to be sustainable like every other business in the world. Now you have to buy and do everything at high volume in order to stay in business.*

Relaxing regulations on donated food waste would also increase how much waste producers can divert. Four small producers partake in waste diversion, and their efforts save significant amounts of waste from the landfill. Their efforts are hindered when businesses refuse to donate for fear of liability or because of outdated or overly strict regulations:

> *If [governments] could be more lax about [donations] that would be nice. For example, our local grocery store used to be able to let their cold produce go out the door. Anything they couldn't sell we used to be able to go pick up by boxes for free and we'd feed that to our cows or chickens, and they were happy to help us out. And a couple years ago something must have happened, and the laws got strict and now they take all that produce and they put it in locked dumpsters.*
>
> *Of course, we need to be considerate of food safety and maybe you could say you have three days to reroute it for animal consumption or human consumption, but then at least it wouldn't go to waste. You shouldn't tie the hands of people that want to recycle. Maybe just pass one big law that says any food waste taken from your establishing you're not liable for. Just make it so that nobody can sue over that. The liability is definitely an issue.*

Participants indicated interest in services for food waste management, but many also expressed concerns over the economic feasibility or reasonability of such services. For those living far from urban centers, the cost of services to manage their waste would not be reasonable, given the distance vehicles would have to travel:

> *You know if the carbon footprint of curbside food waste pickup was actually better then, yeah. I think there could be more resources, but I live out in the boonies where the amount of waste it would take to drive out and collect something maybe it's worth it, but I would support it if it was.*

Other small producers already had access to organic waste pickup in their county, which they felt should be available to everyone as a solution for waste management:

> *Just put your food waste in your yard waste bin. When you're preparing a meal, there's going to be things you don't eat, and that's unavoidable. But they should be able to just put it in their bins.*

All participants viewed food waste as a complex issue, and none of the participants felt one solution would be enough to address consumer food waste. Most suggested a combination of solutions, such as price raises with consumer education:

> *I think it's everything. Having relationships with food production, relationships with their community, higher prices to put the pinch on people to value it more which restricts the supply a little bit too and restricts their access.*

On-Farm & Processing

For on-farm and processing stages of food production, small producers expressed a need for small to mid-size processing businesses and modern farming co-ops. Because of the industrialization of farming, small and mid-size canneries and other processing plants have become rare. Without a way to preserve their products for sale at a later time, small producers are limited in their ability to reach consumers and avoid waste:

> *We need to have small-scale canneries that we can take stuff too and then sell stuff later under our label, or under a cooperative label. The big bugaboo is because we've managed to push out all of the small and mid-size processors. All that's left are the big processors.*

Two small producers also modern co-operatives as a way to divert more waste, coordinate efforts, and reach more consumers:

> *I tried to get other farmers in our area to establish a co-op, which was kind of like going back to the old days but with a new spin. We haven't gotten off the ground yet, but we could do a lot more as far as diverting things from the waste stream, like collecting more grapes and getting more coordinated efforts, if we could form a co-op with the other ranchers. It would get everyone on the same page, and then we could all pool our money and get grant money and then we could buy bigger equipment and bigger trucks that we needed to do this on a bigger scale and it would benefit our community in a bigger way.*
>
> *It would also get people more involved with our products, and so I know more people would purchase them, even though it's not as cheap as the grocery store. But we can give them so much more. Everything we produce has a story behind it, and we can tell them what went into that food and show them if they're interested, and that's where the disconnect from our food has come from.*

The Value of Small Producer Perspectives

This study seeks to expand the literature focused on small producers by bringing their voice more fully into the field of study. In the preliminary research for this project, one other study was found to contain the voice of the small producer, though imperfectly because large producers were included in the study. Though some opinions from the small producers interviewed in this study are similar to previous findings, the new information offered by this study bolsters the argument that small producer voices are inherently valuable and should be included in the literature.

The small producers that participated in this study do not struggle with the supermarket-driven waste described in the literature studying large producers, which is understandable given that they do most of their business through direct marketing. Understanding the drivers of waste on their farms allows for further insight into the most common forms of waste on farms, free of influence from supermarkets.

This study found that small producers focus the majority of their energy on managing waste rather than preventing it. This is potentially because, if they overproduce, plowing back into the soil or feeding to livestock are readily available options that keep the food from going to landfill. However, this does not mean mall producers flippantly overproduce, as evidenced by one participant who described negatively the profuse overproduction they experienced one season when sales undershot their harvest.

This study did not seek to quantify waste on small farms, so these results cannot be used to determine if small producers struggle to estimate on-farm losses, which was a key finding in Campbell and Munden-Dixon's 2018 study. However, the study

corroborates the findings that unharvested food is often tilled back into the soil or fed to animals. This study does not corroborate the finding that gleaning and donations are largely tied to nonprofit connections. Instead, this study found that gleaning and donations are influenced more by community ties. Small producers with communities of people who would glean, take, or offer donations did more of these activities. When farms are small, it appears community takes the place of nonprofits.

Campbell and Munden-Dixon found that farmers were open to doing more with food banks, recommended a focus on the processing sector, and expressed interest in the creation of secondary markets for imperfect produce or by-products (2018). This study found different results. Farmers were interested in building their community connections and, potentially, the formation of cooperatives. The majority of their recommendations focused on consumer behavior and government action. They expressed interest in the expansion of small to mid-size processors, who could freeze or can their products and prevent waste by increasing the lifespan of the product. The voices of the small producers in this study indicate that small producers have different needs and drivers of waste than larger producers. As a result, their approaches to reducing waste also differ.

Small producers, through direct marketing and their dual role in the food supply chain, are uniquely positioned to understand consumer food waste. The participants in this study felt that consumer education on the value of food, proper portion sizes, and increased food prices would have the greatest effect reducing consumer food waste. Small producers also argued for the elimination of government subsidies that decrease the price of food and relaxation of laws preventing producers from collecting waste

from restaurants and grocery stores. When compared against Tristram Stuart's, admittedly quite comprehensive, set of recommendations in *Waste*, the participants of this study frequently had similar ideas. Stuart shares the argument for smaller portions, consuming leftovers, and planning meals realistically. He also encourages buying directly from farmers (2009). Stuart critiques subsidies, but not for the purpose of raising prices. He also calls for removal of bans on feeding swill, which is a relatively parallel argument to the relaxation of donation restrictions that small producers would like to see (Stuart 2009).

Given that *Waste* is considered one of the most comprehensive books on food waste, it is not a sign of invalidity that the small producers' arguments were not identical to Stuart's. Both value education of the consumer: Education of consumers is the purpose of *Waste* and was also the top recommendation from small producers. Both share core understandings of how to decrease consumer waste through better planning, portion control, and an overall enhanced understanding of the value of food. Small producers discuss how industrial farming affects consumers by separating them from their food, which Stuart does not address in as much detail. Their recommendation, to reconnect consumers through experiential agriculture, is not something Stuart considers or recommends, and is something that small producers can uniquely contribute to the literature.

No other literature could be found that included recommendations from small producers for reduction of consumer food waste, and their focus on connection with the non-industrial food system is unique to their voice and something they alone bring to

the literature. Their ethics, rooted in food's intrinsic value, are a strong motivator. Bringing this ethic to the rest of society is another quality unique to small producers.

Study Limitations

This study did not use random sampling, and those who participated did so voluntarily (as required by IRB standards). Recruitment materials made it obvious that understanding small producer perspectives on food waste was the goal of this research. Therefore, it is possible small producers with strong opinions about food waste were more likely to participate. This may have resulted in an overrepresentation of small producers that make concerted efforts to manage and reduce their waste. Low response rates may also have led to the overrepresentation or underrepresentation of some opinions.

The group of participants for this study could have been expanded to yield more nuanced and detailed results. Geographic distribution of participants further limits this study. If a larger number of producers in Oregon had participated, a geographically based analysis could have been done to determine whether region affects drivers of waste, opinions of waste, and efforts to reduce waste. Similarly, had larger numbers of farmers and ranchers participated, drivers of waste and opportunities to prevent waste unique to these two kinds of production could have been studied. The participants of this study generally lived in rural areas. A more thorough sampling could include small producers growing in urban spaces.

COVID-19 inhibited visits to the farms and ranches of participating producers. On-site observation of how these producers manage waste and what drives waste would have yielded a more complete understanding of their waste operations.

Future Research

This study can be improved upon. In ideal circumstances, a larger number of small producers, maybe somewhere between ten and fifteen people, would have been interviewed and a more even distribution would have been from Oregon in order to better balance the geographical differences. The study could also be improved by interviewing multiple small producers from the same organization. If this had been the case, this study could have investigated the following questions: Do the owners of the small ranches and farms hold the same opinions as their employees? Is there a difference in who is more conscientious or informed on the food waste issue? Do they offer different suggestions? Inclusion of the voice of the small processor, given their influence and importance according to small producers, could also have been included. These are all ways that future research could expand upon this study. Given the opportunity to follow up on this study, these are the methods I would use to deepen and broaden the research done here.

In the future another Clark Honors College student, for example, could use this research as a touchstone in their own investigation into the voice of the small producer or processor. These voices offer some insight but are by no means comprehensive. Comparing these voices against the literature and also against the voices of small producers from Oregon, Texas, or other regions would offer impactful insight and would further narrow the gap in the literature. I cannot recommend highly enough that future students use this research, given the literature gap that exists. Determining if the conclusion of food waste as a bipartisan issue stands when other small producers are interviewed is one point that deserves future investigation. Insight into the benefits of

food waste reduction, and the motives behind these efforts, is also worthy of future study. Do other small producers see consumer connection with food production as the primary method of reducing food waste? In the CHC we are learning to build on each other's work, and this is work than can and should be built upon.

Discussion

Understanding this new information this bolsters the argument that they should be included.

Small producers in Texas and Oregon believe food waste is an ethical problem influenced by economic and pragmatic concerns. Environmental opinions and religious beliefs frequently factored into the how these ethics were defined. It was important to the participants of this study that food not be wasted, and they felt strongly that the wasteful behaviors of our society are unsustainable and unreasonable. Small producers recognize the many costs of food waste.

On-farm waste is driven mostly by the inherent perishability of food. Direct marketing all of the food grown by these small producers is not realistic, and perfectly matching supply to demand is not possible. Because there are few mid to small-sized processors, small producers have little means of extending the lifespan of their products. It is also common for harvests to be larger than what small producers can realistically harvest. Thus, food often perishes in the field during these times. Inedible byproducts like grapes skins and canes are also examples of waste on-farm. These unavoidable byproducts are inherent to any organization. Further down the supply chain, small producers point to consumer disconnection from the supply chain. Small producers believe that because consumers mostly shop in grocery stores for relatively cheap food they do not see the intensive process and many inputs necessary in the production of food. This situation allows consumers to undervalue their food. Subsidies further lower the prices of food and contribute to the false perception of food as a cheap commodity. Consumers also seek convenience. Eating out and buying larger quantities of food than

they need because of artificially low prices are examples of how consumers seek convenience in their food habits. The larger portions in grocery stores and in restaurant meals drive waste among consumers by providing more than a person could realistically eat. Consumer cosmetic preferences and lack of social responsibility were two less commonly mentioned but important drivers as well.

Small producers donate waste, take donations, compost, and feed waste to livestock to prevent it from going to landfill. Though this food is technically waste because it is not fed to people, which is its intended purpose, it is not going entirely to waste because some part of its value is regained so long as it is not sent to landfill. Gleaning, though only practiced by one small producer, was the only method of managing food that allowed it to be fed to people. All of the participants indicated some effort to reduce in-home waste. One producer had access to curbside organic waste pickup, as well as chickens and compost bins. The other small producers all composted, and two other small producers with livestock fed their waste to their animals. Waste prevention is primarily motivated by the ethics of the participants. Each of the participants indicated that they believe wasting food is morally wrong. Though small producers receive economic benefits by reducing their waste, it is the use of their time in service of a moral philosophy they support that motivates them more than the economic benefits of waste reduction.

The voices and opinions of small producers are both similar and different from those in the literature. Because so few small producer voices are present it is difficult to determine whether this research is consistent with small producer opinions or different. Overall, small producers do not experience waste driven by relationships with

supermarkets. Their waste is more often the result of the inherent perishability of food and overproduction.

When compared against research with other producers, the study found that small producers are more community-oriented and tend focused on consumer behavior and government action as solutions to food waste. In contrast, larger producer or mixed groups of producers were more focused on organizations, like nonprofits, and felt waste reduction should happen at the processing stage (Campbell and Munden-Dixon). When the recommendations of small producers were compared against the recommendations Tristram Stuart makes in *Waste*, both encouraged consumer education, smaller portions, direct buying from farmers, reworking of food waste regulations, and the need to adjust government subsidies (2009). While Stuart's recommendations went beyond these and took a more in-depth, scientific approach, which focused mainly in education and behavioral shifts (2009). Small producers, on the other hand, focus more on how the negative effects of industrial farming have distanced consumers from food and therefore the value of their food. Stuart recommends behavior change whereas small producers recommend reconnection through experiential agriculture and connection with the non-industrial food system. The recommendations of small producers carry their ethics of food's intrinsic value, something few other groups can contribute to the literature.

This study indicates that few other groups can contribute the same ethics and perspective that small producers have to offer and reinforces that small producers are understudied in the literature. As a study of the voice of the small producer, this research contributes to food waste literature, specifically regarding the voice of the small producer as it contributes to understanding, reducing, and managing food waste.

Though this study had a small participant population and can be researched in greater depth, this research offers valuable insights into the beliefs, motivations, and perspectives of small producers as well as drivers of was on small farms and how small producers manage their waste.

Appendix A: Interview Script

Introduction: I am a student at UO studying environmental studies, and in my classes I've been introduced to the topic of food waste. As I've become more aware of how much we waste, and the environmental, social, and economic issues arising from food waste, it has become important to me to understand this subject as best I can. The voice of small producers is a gap in the research on this subject, and I think small farmers can offer an expert opinion that is important and should be included and considered in the literature on this subject. Which is why I wanted to interview you, and talk about your opinions of food waste, how you value food, and what you think contributes to food waste.

Personal

Since you grow food, you have a deeper understanding of what goes into producing it and you are more familiar with its value. With this unique background, I'd like to hear what your opinion is on food waste.

It seems like, because food is cheap and plentiful in this economy, many people don't appreciate the full value of food. If you agree, why do you think people undervalue food?

> Optional Question: What is it about our food system that perpetuates the undervaluing or lack of appreciation for good food?

> Optional Question: Do you have any personal waste prevention habits? (Maybe ask: what motivates you to do these things? Or What do you wish you could do more easily/what services do you wish were more available?)

On-Farm

Of course, there is an inevitable amount of waste in any operation, how do you attempt to minimize it?

Of course, no one wants to waste food, but what do you believe contributes or causes food waste on this farm, and how do you manage it?

Do you take any food/or compost donations here, that you process or compost?

Bigger Issue

Obviously, you understand the value of food and everything that goes into the production of it, why do you think food waste is still so high among consumers?

What do you believe contributes to food waste in the US as a whole? Why do you think people waste food?

What do you think might motivate people to waste less food?

Is food waste just an economic or pragmatic problem, or do you think there is an ethical side to food waste too?

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