

Rotting Food and Hungry Bellies:  
Investigating the Food Waste and Hunger Nexus of Southern Arizona

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### **Abstract**

The paper revolves around the intersection of food waste and food insecurity within the built environment. A sample of grocery stores were asked to explain their policies regarding food waste, specifically how they divided this waste stream between food recovery and composting. It was determined in the end that the potential to grow composting as a waste management practice is far greater than the potential to expand food recovery, for all the participating grocery stores could not donate more food than they had historically.

## Table of Contents

Introduction.....	4
Literature Review.....	6
<i>History of the American Food System.....</i>	<i>6</i>
<i>How the Food Supply Chain and Built Environment Create Food Waste.....</i>	<i>9</i>
<i>Hunger &amp; Insecurity in America.....</i>	<i>11</i>
<i>The Local Food System of Southern Arizona.....</i>	<i>13</i>
Methodology.....	15
Results.....	16
<i>Quantifying Grocery Store Food Waste in Tucson.....</i>	<i>16</i>
<i>Grocery Store Survey Results.....</i>	<i>20</i>
Discussion.....	27
Conclusion.....	31
Works Cited.....	32

## Introduction

In the blaring heat of the summer of 2014, about twelve college students, including myself, were handed over the daunting task of processing roughly 500,000 lbs. of discarded produce into compost, box by individual box. It didn't take long for the long line of shrink-wrapped pallets to transform into a sea of rotting vegetables. I remember wading through its acidic waters alongside my co-workers, tiny white maggots inching up my legs, as I continued to dump what seemed to be an infinite supply of boxes. As I surveyed the abyss of waste around me I imagined a farmer in Mexico tending to these vegetables. I marveled at the amount of water, fossil fuels, land, human labor, and time expended to produce what was now squishing beneath my boots. I was only marginally consoled to know that the produce would be given a second life by being diverted to the Compost Cats' hands: the University of Arizona's student-run, windrow composting operation. Rather than ending up in a landfill where it would have decomposed anaerobically, which produces the potent greenhouse gas methane, it would reenter the cycle of food production by returning to the medium from whence it came. What was defeating was to know that it never reached a plate.

My experience working with the UA Compost Cats demonstrates to me time and time again that the 21st century food system is a simultaneous dichotomy of abundance and scarcity. The intensification of agriculture over the past century has increased yields exponentially, but the rise of monocultures has decreased the variety of crops to a small handful of commodities. The rise of food processing has created a plethora of new high calorie products that are substantially lacking in nutritional content. And most shamefully, the world sends millions of pounds of food to rot in landfills while some 793 million people go hungry worldwide, all while the developed world battles an obesity epidemic. The reasons for these discrepancies are of course extremely

complex, varied, and interdependent, yet one fact stands out clearly: nearly every sector of the 21st century food system produces tremendous amounts of waste. From the massive feedlots of factory farms, to the runoff of agrochemicals into sensitive waterways, to the disposal of hundreds of tons of fresh produce at the Nogales, AZ border, the production and mishandling of waste is one of the most serious barriers to creation of a more sustainable food system, nay world. Furthermore, the loss of once edible food- for reasons as varied as a lack of transportation from field to market to throwing away food based on confusing expiration dates- is a considerable roadblock to addressing food insecurity.

In the United States, the U.S. Department of Agriculture (USDA) estimates that roughly 40% of the nation's entire food supply is wasted annually; 31% comes from the retail and consumer levels alone (“U.S. Food Waste Challenge”, n.d.). This is the equivalent of throwing away 386.9 billion calories a year, or put another way, \$161 billion (Buzby, Wells, & Hyman, 2014). Within the built environment specifically, retail food waste accounts for ten percent- 43 billion pounds- of the entire national food supply (Buzby et al., 2014). At the same time, in 2014 the USDA determined that 14% of households in America were food insecure, meaning they lacked reliable access to enough food to carry out healthy lives (Coleman-Jensen, Rabbit, Gregory, & Singh, 2015). In Pima County specifically, the overall food insecurity rate is 15.8%; childhood food insecurity however is a staggering 28% across the state (“Map the Meal Gap”, 2015).

These statistics help to illustrate the gaping disconnect between food production and consumption in our modern society, begging the question: can these disparate parts be reconnected? Can food waste in Tucson be channeled effectively as a resource for those in need? The intent of this writing is to investigate these questions, as well as understand the conditions

that lead to food waste and insecurity within our built environment, and the roadblocks that currently prevent edible food from reaching hungry bellies. More specifically, this writing will investigate the grocery stores currently participating in the City of Tucson's new commercial food waste collection service. As large producers of food waste, are they donating some of their unsellable food to anti-hunger organizations? If so, what is the scale and makeup of their food donations in comparison to their compost stream? What factors determine what unsellable food will be donated or composted, and is there a potential to more efficiently channel these resources toward local hunger alleviation? In challenging our perception of food waste from an unavoidable consequence to a potential resource, we take a step forward in creating a more sustainable, equitable food system.

## **Literature Review**

### *History of the American Food System*

In order to understand how food waste and insecurity came to affect our cities today, it is necessary to track how our current model of food production developed over time. Authors Clenndenning, Dressler, and Richards summarize a theory that suggests the inefficiencies of the modern food system are the result of three successive 'food regimes', the first of which is coupled with onset of the Industrial Revolution (2015). The process of industrialization is directly related to the means in which people produce their food: it is the transformation of a primarily agrarian society to one based on the manufacturing of good and services. Industrialization is also predicated upon a revolution of agricultural production that frees up a larger segment of the population to work in the manufacturing sector than are consumed by the timely endeavor of feeding one's family. Industrialization, in terms of both agriculture and

manufacturing, is delivered through the marriage of technology and science, informed by a philosophy of standardization, and comes to fruition through mass production (Fitzgerald, 2003). This process transformed western society in nearly everyway, and the application of this logic to agriculture formed the bedrock of our contemporary food system. Clenndenning and her colleagues suggest the first global food regime occurred from the mid-19<sup>th</sup> century to the beginning of WWI, and was characterized by the widespread adoption of the steam-engine and other machinery. This period was also marked significantly by colonization and the exportation of raw agricultural products from colonized states to Europe in exchange for valuable manufactured products (Clenndenning et al., 2015).

Industrialization continued throughout the first half of the 20<sup>th</sup> century but was put into overdrive following WWII, signaling the beginning of the second food regime. In a global context, the United States inverted the previous regime's flow of agricultural products from the global south to the north as American wheat surpluses (that were the result of subsidized overproduction) became the major import of post-colonial developing nations, whose domestic agricultural products in turn became more specialized and destined for export to far away places (Clenndenning et al., 2015). It was also during this time that agricultural production intensified and rural, small scale farms began to consolidate: "Rather than producing for domestic populations, nations were now producing high-yielding cash crops for global markets, squeezing farmers and farmland for surplus accumulation" (Clenndenning et al., 2015). Throughout the 20th century every sector of the economy was transformed by new technology and mechanization, and the desire to 'modernize' agriculture effectively meant applying the logic of factories to farming. One major response was that farms across the globe had no choice but to substantially increase in size and commit to a single crop, or monoculture, in order to stay

economically viable. Not surprisingly, with increased scale came proportional increases in inputs, which during the post WWII era was a catalyst for the rise of synthetic fertilizers, pesticides, and fossil fuels used to power massive machinery.

The consolidation and intensification of agriculture that began with the industrial revolution and came into full force after WWII, laid the foundation for the rise of the global, corporate food system that exists today. Experts and academics argue that the current third food regime came along with the rise of neoliberalism in the 1980's, and the institutionalization of free trade in the 1990's. The wave of deregulation that spread across both the global north and south led to "the accumulation of large tracts of land and capital for intensive, mechanized mass-produced food, fuel and feed for domestic and international production and consumption" (Clenndening et al., 2015). Evidence of this can be seen in the fact that from 1982 to 2007 the average acreage of cropland for an American farm roughly doubled from 589 to 1,105 acres, with many farms being 5 to 10 times that size (MacDonald et al., 2013).

The developing world's agricultural sectors were reoriented for exportation as tariffs and price guarantees were dismantled, causing domestic food supplies to dwindle (Clenndening et al., 2015). Northern governments in exchange for the vast quantities of fruit and vegetables they imported, exported large amounts of cereal and grain crops for feed and food aid to the global south (Clenndening et al., 2016). In the in the United States heavy federal subsidies continue to scaffold these cereal crops- like wheat, corn, and soybeans-, and are controlled by a handful of massive corporations that have a near monopolistic control over the food system. But because the corporate food system is now globally integrated its consequences have "similar impacts across diverse geographies" (Clenndening et al., 2016). Small to mid-scale farmers across the U.S. and the nations of the global south are unable to compete in the global marketplace due to

insufficient economies of scale and the institutional support of agro-industrialism (Clenndenning et al., 2016).

For better or worse, due to the rise of transnational agricultural corporations it is essentially impossible for a single country to have a self-sufficient, domestic food system. The integration of the global economy and the mass production and transportation of goods across borders allows food produced in specific regions to be accessible all over the world. This is exemplified by the tremendous amount of food that crosses the border between the United States and Mexico every year as a result of international treaties like the North American Free Trade Agreement (NAFTA): “the “Mariposa” port of entry at Ambos, Nogales...is the gateway for the third highest flow of food into the U.S., after New York and Los Angeles” (Nabhan, Alvarez, Banister & Fitzsimmons, n.d.). Imported food from Mexico accounts for 30% of the food consumed by Americans; conversely, 72% of the food consumed by Mexicans was imported from the United States (Nabhan et al., n.d.). Because of the dominance of the corporate food system, food today must travel extremely long distances to reach its consumers, and yet it is never guarantee.

### *How the Food Supply Chain and Built Environment Create Food Waste*

Before food reaches a consumer it travels across vast distances through a complex supply chain as a result of the global nature of the corporate food system, and waste is created at every step from production and processing, to retail and consumption. However, the concentration of food loss along the supply chain differs greatly between the developing and developed worlds. Food waste most often occurs at the pre-consumer level in developing nations because of issues regarding proper storage and refrigeration, combined with inadequate transportation infrastructure (Hargreaves, Pulford, & Balakrishnan, 2013). Conversely, food waste is

concentrated at the opposite side of the supply chain in developed countries with the majority of waste occurring within the retail and household spheres, or essentially the built environment (Hargreaves et al., 2013). Regardless of its concentration along the supply chain, it's estimated that 40% of all food produced globally is wasted (Hargreaves et al., 2013).

The Natural Resource Defense Fund (NRDC) reports that approximately 43 billion pounds of food was lost at the retail level in 2008 (Gunders, 2012). Fresh food, such as fruits and vegetables, are the most vulnerable to waste throughout the supply chain: 20% of the total supply of fresh produce is lost at the production level and an additional 12% is lost at the retail level (Gunders, 2012). Not only is this a loss of natural and human resources, the "USDA estimates that grocery stores lose about \$15 billion annually from fruits and vegetables alone" (Gunders, 2012). This is not surprising due to their highly perishable nature, which is fundamentally at odds with the extensive distances fresh food must now travel in order to reach retail outlets. Waste at the retail level is also the result of a misalignment between supply and demand. With the rise of supermarkets and grocery stores as the primary outlets for consumers to purchase their food, retailers must consistently offer a high volume of wide array of products in order to meet consumer demand (Kosseva, 2013). An average grocery store carries 42,214 different products, and the pressure on retailers to maintain adequate supplies of all these products, at all times, can lead to surpluses and back of the house waste ("Supermarket Facts", n.d.).

For the U.S. the largest loss of food along the supply chain is the very last stop: the household. American families throw away about  $\frac{1}{4}$  of all the food they purchase, costing the average family of four an estimated \$1,350 to \$2,275 a year (Gunders, 2012). There are many theories as to why Americans waste so much of their food, but substantial data on the subject is sparse. Researchers suggest a general devaluing of food due to the superficial abundance of

grocery stores, lack of awareness, confusion over expiration dates, poor planning, and spoilage in general (Gunders, 2012). Regardless of the reasons roughly 19% of the retail-level food supply is lost through the combined waste produced by households, restaurants, cafeterias, caterers, and fast food: 82 billion pounds in 2008 (Gunders, 2012). The woe of food waste does not end in the garbage can, for food waste sent to landfills decomposes anaerobically to produce 23% of the United States' annual methane emissions (Gunders, 2012). In fact, food waste is now the largest component of municipal landfills across the country (Gunders, 2012). Furthermore, because agriculture consumes 80% of the U.S. freshwater supply, a full 25% of our this supply is embedded into the food that goes wasted throughout the supply chain (Gunders, 2012).

The structural inefficiencies built into our corporatized food system enable an incredible amount of goods to be lost from farm to landfill. Certainly this is a tragic loss and abuse of natural resources, but the true human cost of our food systems inefficiencies come to light when food waste is viewed in context of those who struggle to secure food in the first place.

### *Hunger & Insecurity in America*

Although the United States is one of the most affluent countries in the world a significant share of its citizens are impacted by food insecurity: 14% as of 2014 (Coleman-Jensen et al., 2015). In 2003 food *security* was defined by the UN Food and Agriculture Organization (FAO) as “a situation in which all households have both physical and economic access to adequate food for all members and...are not at risk of losing such access.” (Chen, Clayton, & Palmer, 2014). Embedded within this definition are three important dimensions: physical access, cost, and stability (Chen et al., 2014). Food *insecurity* therefore is the lack of these three conditions, often measured in the timeframe of the past twelve months.

The single most important determining factor of food insecurity is poverty. The concept of food security grew out of the understanding by anti-hunger advocates that focusing exclusively on hunger- a symptom of being economically disadvantaged- enabled the systemic causes to continue unabated. The FAO illuminates that “access draws attention to the fact that, even with bountiful supplies, many people still go hungry because they are too poor to produce or purchase the food they need” (Chen et al., 2014). Hunger therefore, specifically in the developed world, should not be viewed as the result of a shortage of distributable resources, but as the disenfranchisement of certain segments of the population to access the resources they need. The fact that our food system is structured to accommodate incredible losses and waste throughout its supply chain is clear evidence that we have more than enough total resources to meet the entire populations needs. One estimate suggests that just a 15% reduction in food waste in the U.S. could feed an additional 25 million people; about 40 million are currently food insecure (Gunders, 2012). In Southern Arizona, where millions of pounds of produce cross over the border every year, and yet roughly one in three children are food insecure, this fact is particularly potent.

Geography and demographics also contribute to the accessibility of a household to put food on the table, and often times the most vulnerable people are most likely to experience food insecurity. 19.2% households with children were food insecure in 2014, as well as 35.3% of households headed by a single woman (Coleman-Jensen et al., 2015). Importantly, 26.1% and 22.4% of all Black and Hispanic households respectively experience higher than average levels of food insecurity, even though their populations make up less than half of the total U.S. population (Coleman-Jensen et al., 2015). 10.4% of food insecure Black households are additionally defined as having very low food security, meaning they are considerably more

vulnerable than even the average food insecure household (Coleman-Jensen et al., 2015). Food accessibility also varies greatly from state to state, county to county, and within neighborhoods in a city. Historically our cities urban cores were hungrier than the surrounding suburban areas, but with Great Recession, skyrocketing housing prices, and wage stagnation, suburban food insecurity has doubled since 2007 (McMillan, 2014). Rural and metropolitan communities still have the highest rates of household food insecurity in America, at 15.5 % and 16.9% respectively (Piontak et al., 2014).

Within urban areas, geography also factors into the nutritional quality of accessible food. According to the USDA a ‘food desert’ is as low-income area where at least one third of its residents do not live within a mile of a grocery store or supermarket; this distance increases to ten miles for rural areas. Lacking convenient, walkable access to a grocery store means low-income communities are considerably more limited in their food choices. Often times the only food that is accessible, both in terms of price and travel distance, for residents in food deserts are convenience stores and fast food restaurants. For many families fighting to make ends meet on full-time (if they are lucky), low-wage work, access to fresh food and the time required to prepare it is simply not an option. For so many Americans “the extra pounds that result from a poor diet are collateral damage—an unintended side effect of hunger itself” (McMillan, 2014).

### *The Local Food System of Southern Arizona*

Luckily, a robust network of grassroots organizations are diligently working to create an alternative food system in Tucson, AZ, supplying healthy and nutritious food to those in need through a myriad of creative solutions. A wonderful example is the Ishkashitaa Refugee Network, which fights both food waste and insecurity through its urban gleaning program.

Central Tucson has a vast network of edible trees- most notably citrus and olive- that more often

than not go to waste than are eaten. Rather than asking for food donations, Ishkashitaa asks households if they can glean edible produce from their fruit trees, all of which is donated to the large refugee population living in Southern Arizona. Ishkashitaa also works to form connections and promote knowledge sharing between refugee and American communities through food workshops and volunteering opportunities.

The Community Food Bank of Southern Arizona is one of the most important institutions fighting hunger in Southern Arizona. It has a variety of educational programs to teach gardening skills to low-income families, ranging from its community farm Las Milpitas, to the gardens they install in families backyard gardens. The Caridad Community Kitchen, a program of the Food Bank, offers culinary training and job skills for low-income individuals. All the food the students make during their training is donated to other hunger-relief organizations. Volunteers work daily to prepare hundreds of sack lunches to be distributed across Tucson; this food is donated from local grocery stores. Tucson also has a growing number of local resultants, businesses, and farmers markets that source their products from Southern Arizona farms. And a vast network of community gardens provide Tucson residents with the opportunity to grow additional food for their family and friends, and there is growing momentum to establish and incorporate gardens into public schools.

In July 2014 the City of Tucson took a progressive step towards combating food waste by entering into a trilateral agreement with the U of A Compost Cats and San Xavier Co-op Farm on the Tohono O’Odham nation to begin a first of its kind commercial food waste collection service. The City of Tucson is responsible for the collection, while the San Xavier Co-op Farm provides the space, some machinery, and water. The student workers of Compost Cats carry out the processing of the organic waste into compost, getting the opportunity to operate

heavy machinery and monitor the ecological process that enables the decomposition to occur. Today the program services multiple national grocery store chains, restaurants, and businesses within Tucson. Most recently Amphi and Tucson Unified School Districts joined the service, representing a very large number of Tucson public schools. 10 million pounds of organic waste have been diverted from the local landfills by the Compost Cats since 2011, producing a valuable product for the community in return.

### **Methodology**

A case study of Tucson grocery stores currently participating in the City of Tucson's commercial food waste collection was conducted in order to understand the magnitude of commercial food waste and the factors that determine its fate in Southern Arizona. Grocery stores were selected because they are currently the largest share of business contracted with the City of Tucson's service, and because of the incredible rate at which grocery stores produce organic waste. The intent of this case study is to investigate if grocery stores participating in the composting program also donate a portion of their unsellable food to hunger-relief organizations in Tucson. If so, this research will investigate if joining the food scraps collection program has affected their ability to donate to food recovery organizations, as well as the frequency, magnitude, and content of their donations. A comparison of the factors that determine their donation and composting streams will also be drawn. This information will be collected through an online survey or informal phone interview with representatives from participating stores.

This information will be analyzed in conjunction with the Compost Cats' annual food waste data for 2015, with specific focus on two grocery store's compost streams, in order to gain a fuller picture of the scale and fate of commercial food waste within Tucson's built

environment. I will also supply an informal audit of the types of food being composted by grocery stores based off my observations working for Compost Cats. The hope is to determine if there is a potential for grocery stores to more efficiently move food that is currently being composted to the donation stream in order to provide more resources toward hunger alleviation.

This research is comprised of both qualitative and quantitative data, and based in a part-critical theory and part-constructivist paradigm. However, because I myself am involved in one of the organizations I am studying, there will also be a secondary participatory element.

## **Results**

The results from my survey indicate that all of the grocery stores chains participating in the City of Tucson Food Scraps Collection service do donate to food recovery organizations in Tucson, and have been doing so consistently prior to and after joining the service. Furthermore, all of the grocery store chains indicated that joining the composting program has not influenced their ability or the frequency at which they donate to food recovery organizations. All of the interviewed grocery store chains indicated to some degree that safety is the biggest concern when determining what types of food waste will be sent to either their donation or composting streams. Lastly, all of the grocery store chains indicated that is not feasible to donate all of their food waste stream to hunger relief charities, and that joining the composting program has positively impacted their stores ability to manage its organic waste.

### *Quantifying Grocery Store Food Waste in Tucson*

**Figure 1:** Amount of grocery stores participating in the Food Scraps Collection Service overtime, and end of the year food scraps diversion weights.

Year	# Of New Grocery Stores joining the Collection Service Each Year	Total Number of Participating Businesses	% Grocery Stores Out of Total Businesses	End of the Year Food Scraps Diversion (lbs.)
2014	3	21	14%	1,309,086
2015	8	38	30%	1,347,359
2016	12	50	46%	-

The participating chains are as follows: Whole Foods Market, Trader Joe's, Food City/Bashas, and the Food Conspiracy Co-op. Fry's, a subsidiary of the Kroger Corporation, is currently in the process of joining the composting program and will be fully operational by the end of spring 2016. The total number of individual grocery stores participating in the Food Scraps Collection, with the addition of the incoming Fry's stores, is twenty-three. As seen in Figure 1, the current total of businesses participating in the service (thus far) in 2016 is fifty. The addition of twelve Fry's stores this spring brings the percentage of grocery stores as a type of business participating in the collection service to 46%. Since the program began in the summer of 2014, the share of grocery stores joining the service has grown consistently each year.

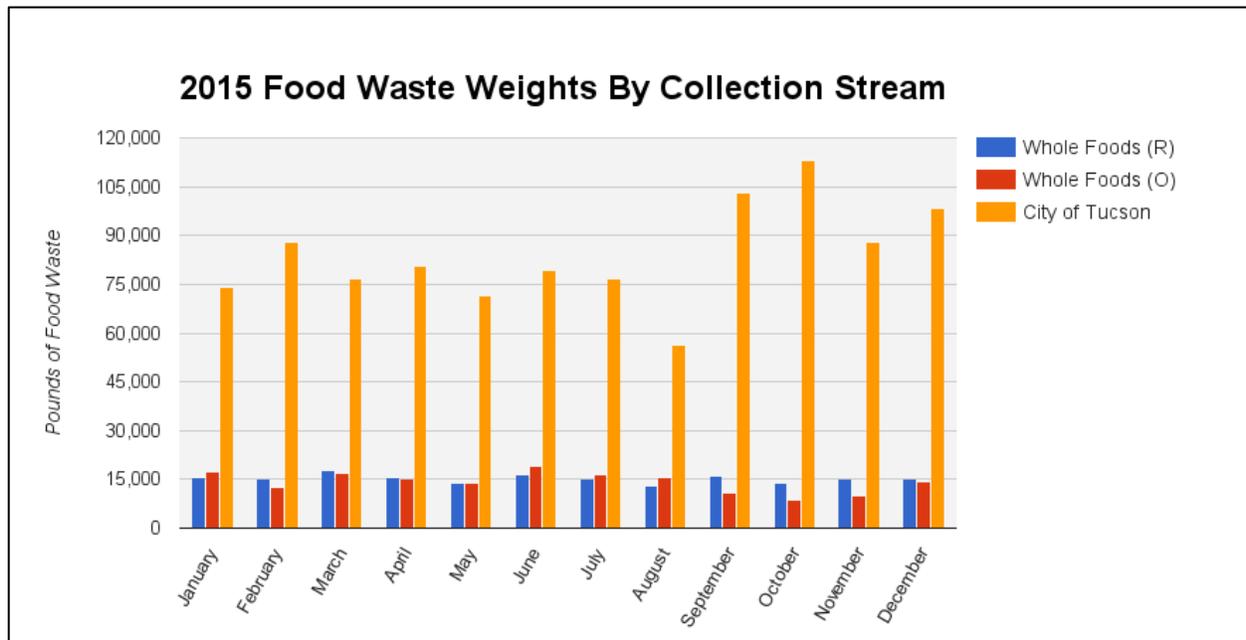
In 2015, Compost Cats processed nearly 1.35 million pounds of food waste into a valuable, organic soil amendment. The exact percentage of food waste that came from the aggregate grocery store stream is difficult to determine. Logistically, the food scraps are collected in large trucks that can pick and dump sixty-five gallon bins or three cubic-yard dumpsters, essentially identical to the system that collect recycling and garbage in the City of Tucson. And much like other waste streams, multiple store's waste will be collected in a single day, by a single truck. Consequently, it is only possible determine a total daily truck weight; it is not feasible for the trucks to weigh an individual business's compost. However, in 2015 Compost

Cats still directly collected the organic waste of two Whole Foods stores that are located outside City of Tucson limits, and were partnered with Compost Cats before the City took over collection. Unlike the City of Tucson, the Compost Cats can weigh these stores compost because the individual bins are manually loaded into a stake bed truck. In 2015 these two stores combined produced a total of 338,787 pounds; this represents a full 25% of the total food waste diverted by Compost Cats for the entire year. Analyzing these two store's compost diversion weights provides a window into how much organic waste a typical grocery store produces throughout a year.

*Figure 2: Average compost diversion of two individual grocery stores, and the aggregate compost collected by the City of Tucson*

<b>Average (lbs.)</b>	<b>Whole Foods (R)</b>	<b>Whole Foods (O)</b>	<b>City Food Waste</b>
Daily	1,810	1,677	5,563
Weekly	3,480	3,153	18,529
Monthly	15,211	14,148	82,486

Figure 2 summarizes the average weight of food waste produced by two Whole Foods locations, as well as for the entire food waste stream collected by the City of Tucson. The two Whole Foods stores are differentiated by the letters “R” and “O”; this is shorthand for the major streets they are located on, River Rd. and Oracle Rd. respectively. The averages of the two Whole Foods locations are relatively close, with the store on River Rd. producing on average about 1,000 lbs. more per month. In 2015 thirty-eight businesses together produced 82,000 lbs. of food waste on average per month; embedded within this aggregate weight are eight grocery stores. By the end of the year, the City of Tucson collected over one million pounds of food waste from participating businesses.

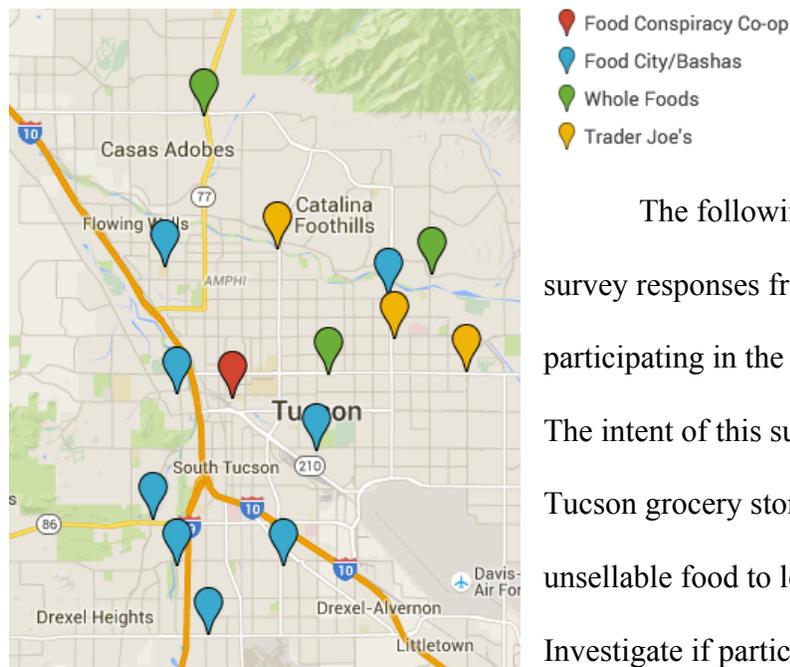
**Figure 3: 2015 Food Waste Weights By Collection Stream**

The amount of food waste diverted from landfills in the past year fluctuated from month to month, and was affected by the addition of new businesses joining the service. 2015 began with twenty businesses contracted with the City's collection service, which included five grocery stores in addition to the Whole Foods stores directly serviced by the Compost Cats. Over the course of the year the service grew by an additional sixteen businesses, of which half were grocery stores. Seven of these eight stores were added between July and December, which is reflected in Figure 3 in the increase of nearly 50,000 lbs. of waste between the months of August and September. Additionally, October brought in the most food waste in a single month for the entire year: just over 113,000 lbs. This is most likely the first time in Compost Cats' history that the waste of 13 grocery stores was brought the San Xavier Co-op Farm in a single month. Looking ahead in 2016, another steep increase will most likely happen over the summer once the additional twelve Fry's stores are fully incorporated into the aggregate collection stream. This will nearly double the total number of grocery stores that were composting with the City of

Tucson and Compost Cats at the end of 2015, an impressive feat considering that only two Whole Foods locations had their organic waste collected by the Compost Cats at the beginning of 2014. Based off the actual data of these Whole Foods stores, if a grocery store produces an estimated 15,000 lbs. of food waste per month, the Compost Cats could be looking at processing in the realm of 375,000 pounds of food waste per month from grocery stores *alone*. Remember, another twenty-five businesses, made up of restaurants, coffee shops, and offices, also have their organic waste collected through the Food Scraps Collection service. And in addition to food waste the Compost Cats also receive an average of 100,000 lbs. of manure, and 76,000 lbs. of landscape debris a month. Certainly, there is no shortage of organic waste in Southern Arizona, nor potential customers for the City of Tucson.

### ***Grocery Store Survey Results***

**Figure 4:** *Geographic context of the grocery store chains participating in the Food Scraps Collection service*



Courtesy of google.com/maps

The following section is comprised of the survey responses from each grocery store chain participating in the City of Tucson's collection service. The intent of this survey was to: 1) Investigate if Tucson grocery stores are donating some of their unsellable food to local hunger relief charities, and 2) Investigate if participation in the City of Tucson's Food Scraps Collection Service affects a grocery stores

choice and/or ability to donate unsellable food to local hunger relief charities. All of the grocery store chains participating in the collection service at the end of 2015 were surveyed: Food Conspiracy Co-op, Trader Joe's, Food City/Bashas, and Whole Foods Market. Although Fry's is not yet fully incorporated into the collection service, I was able to find information about their corporate food waste and sustainability policies.

Each of the grocery chains were asked a series of questions in order to fulfill the intent of the survey, either through an online form or by phone interview. First, they were asked if their stores donated to local food recovery organizations prior to joining the Food Scraps Collection Service, and if they continued to do so after. Next, they were asked how long their stores have been donating to hunger relief charities, what types of material they donated, and about how many times a month they made donations. They were asked if they could estimate the average weight of a food donation, and if the joining the City of Tucson's Food Scraps Collection Service affected the frequency at which they donated to local charities. After I inquired about their donation stream I asked how many times a week their compost stream is collected, and if they could estimate the average weight of a compost pick-up. Lastly, I asked every grocery chain what they believed was the most important factor in deciding how their stores divided their organic waste stream between donations and compost.

#### *Food Conspiracy Co-op*

This location is one of the many local businesses contracted with the City's service. It is also the only grocery store participating in the collection service that is owned cooperatively through membership and is not a chain franchise. According to the Food Conspiracy Co-op's outreach representative the organization has been donating unsellable food to an array of local hunger relief organizations long before it began composting with the City's Food Scraps

program; it was also one of the first businesses to join the Compost Cat's collection service prior to its partnership with the City of Tucson. The Co-op currently divides its food donations into a variety of streams including food scraps for chickens and three local nonprofits: Casa Maria, Neighbors Feeding Neighbors, and Casa Mariposa. All Co-op employees are also encouraged to take home unsellable food.

Casa Mariposa, a faith-based non-profit in Tucson's Menlo Park neighborhood, supports immigrant men and women held in detention centers in Florence and Eloy, AZ. The Co-op specifically donates their unsalable fresh produce to this organization about three to four times a week ("The Casa Mariposa Community", 2009). Casa Maria Catholic Worker Community runs a soup kitchen everyday of the year, with the exceptions of Thanksgiving and Christmas ("Casa Maria", n.d.). They receive dairy, bread, prepared foods, and cold salads from the Co-op on a daily basis. The Co-op's outreach representative did not mention the specific types of food donated to Neighbors Feeding Neighbors: a volunteer-led meal-sharing program run through St. Andrew's Episcopal Church in Armory Park.

The Food Conspiracy Co-op estimates that their average food donation weighs about ten pounds. In contrast, they estimate they send on average 10,000 lbs. of food a month to the compost collection stream. The Co-op's outreach representative expressed gratitude for the compost collection service, saying that the addition of a composting stream has broadened the ways in which they can positively manage their organic waste. She added that even if the Co-op wanted to, it would be impossible to donate all their food waste to hunger relief organizations primarily because of safety concerns. Furthermore, much of the food waste they produce simply isn't edible (at least by people), such as scraps leftover from juicing or chopping vegetables. Consequently, before composting was available they had no choice but to send much of their

unsellable food to the landfill, after donating as much as possible to local charities. Therefore, the compost collection has not affected their ability to donate to hunger relief organizations, but has improved their waste handling overall.

#### *Trader Joe's*

The Trader Joe's franchise joined the City of Tucson Food Scraps Collection service in the late summer and fall of 2015, adding three locations from July to December. According to an employee from the Grant Rd. site, it has been the standard practice at Trader Joe's to donate unsellable food to charities "forever". All of the locations were donating food to the Community Food Bank of Southern Arizona before joining the compost collection service, and continue to do so on a daily basis.

The employee I spoke to says that Trader Joe's donates an array of food to the Food Bank, such as produce, non-perishable packaged goods, and more. However, she said that new food safety restrictions have narrowed the types of food they can donate over last few years, and there are many items they once donated that they no longer can. She informed me that they used to send the Community Food Bank of Southern Arizona more food waste, only to find out that the Food Bank had to dispose of third of it due to safety regulations. She added that Trader Joe's is grateful for the compost collection because now their stores can recycle food they were once able to donate but are no longer allowed. For example, food that arrives to a store with a broken seal cannot be sold, but it used to be able to be donated; now the only fate for such food is a landfill or composting. Joining the compost collection program itself has not affected the frequency at which they can donate to food, but food safety regulations have affected the type and quantity of material they give to the Food Bank. All three of the locations have their compost collected twice a week, but are unable to estimate how much food waste is collected in a month.

The employee I spoke with was adamant that joining the City of Tucson's organic waste program has positively impacted their store's waste management.

#### *Food City/Bashas*

Based in Chandler, AZ, Bashas Inc. is the owner of over 130 Bashas, Food City, and AJ's Fine Food grocery stores across the state; seven Food City and one Bashas locations joined the City of Tucson's Food Scraps Collection program in 2015 ("Bashas", n.d.). According to their website, the three store formats "enable the company to serve different 'demographic neighborhoods'" ("Bashas", n.d.). For instance, Food City stores specifically cater to Arizona's Hispanic community by offering a "full range of ethnic and Hispanic food varieties", whereas AJ's locations are gourmet grocers "catering to discriminating tastes" ("Bashas", n.d.).

A representative for Food City confirmed that it is the priority of all stores participating in the City's composting program to divert unsalable food to hunger relief charities before sending it to be composted. All their stores donated to local food banks before joining the collection service, and all continue to do so, some on a daily basis. The eight stores tend to donate produce, perishable packaged foods, and dairy to local food banks, whereas they send inedible produce, bread, and tortilla products to the compost stream; some locations have their compost collected three times a week. In line with the other grocery store chains surveyed for this research, Food City reported that the frequency of their food donations to local charities was not affected by joining the Food Scraps program, and that joining the compost collection service has been beneficial to their stores. Lastly, Food City's representative commented that grocery stores could better manage their food waste by "controlling our inventory, proper ordering, and production of prepared foods to better meet the needs of our customers".

#### *Whole Foods Market*

Prior to Compost Cats partnership with the City of Tucson, commercial food waste collection in Tucson was performed manually by college students, and transported in a single stake-bed truck. The Whole Foods Market was one of the first grocery store chains to work with the Compost Cats, first at their location on Speedway Blvd., and subsequently at their other stores on River Rd. and Oracle Rd. However, only the Speedway Blvd. store is within official City of Tucson limits, resulting in the Compost Cats continuing to service the other two stores individually while the Speedway location handed over collection to the City of Tucson. All of the Whole Foods Markets in the Tucson metro area donated to hunger relief organizations before joining the compost collection service, and still continue to do so.

An employee from the Speedway Blvd. location reported that the stores tend to donate canned foods and bread to food banks, excluding anything past an expiration date. He also reported that the stores tend to compost the waste created from juicing and cooking prepared foods. After two years of personal experience collecting the food waste generated by the Whole Foods Markets in Tucson, I can report that they compost a wide variety of food products: vast amounts of bread, juicing pulp, uneaten prepared food such as rice and pizza, both spoiled and perfectly edible produce, flowers, and much more. Referring back to Figure 2, an average compost pick-up from Whole Foods weighs between 1,700 and 1,800 lbs. The frequency of food donations to anti-hunger organizations has not been affected by joining the compost service, citing safety concerns, expiration dates, and amount of time food is left unrefrigerated as the main determinates between donation and composting.

In an effort to expand their donation capacity the Whole Foods Market that still has its waste collected by the Compost Cats will soon start setting aside some of its unsellable (but still edible) food to be directly picked up by the Compost Cats, who will then transport it to the UA

Campus Pantry so it may be donated to food insecure students. This decision by Whole Foods is intended to more efficiently direct its food waste to donation first, then composting. Now located underneath the Student Union Memorial Center, the UA Campus Pantry has recently foraged a new partnership with the U of A Student Unions in order to address growing food insecurity amongst college students. Leftover food produced at the Student Unions can now immediately be donated to a hunger relief organization located on its premise. This new partnership between Whole Foods and the Campus Pantry is mediated by the Compost Cats, and signals a new effort by the Compost Cats to be directly involved in prioritizing food donation before composting; they will deliver Whole Foods donations to this new location on a weekly basis.

### *Fry's/Kroger*

Although the twelve incoming Fry's stores are not completely operational with the Food Scraps Collection program at the time of this writing, they will be by the end of the year. Once they are operational, Fry's will have the most stores of any franchise participating in the City's service. I had the chance to speak with the regional sustainability manager for Fry's, and he explained some of Kroger's (the parent company of Fry's) corporate wide sustainability initiatives. Kroger's Perishable Donations Program (PDP) is a company-wide mandate that has been operational at 100% of its national stores since 2014, requiring donations to food banks within the Feeding America network ("Kroger Sustainability Report-Social", 2015). According to their 2015 Sustainability Report, Kroger has donated 54 million pounds of food from its many stores across the country, equating to approximately 45 million individual meals (2015). In addition to a robust donation program, 1,061 Kroger's stores accepted the company's Zero Waste Challenge as of 2014, which strives to reduce waste throughout the company's supply chain; food waste diversion specifically increased by 12% from the previous year ("Kroger

Sustainability Report-Environment”, 2015). Kroger reports that they diverted 33,000 tons of food waste to anaerobic digestion, composting, and animal feed programs across the country (“Kroger Sustainability Report-Environment”, 2015). Having Fry’s join the City of Tucson’s Food Scraps Collection service will positively contribute to Kroger’s inspiring desire to make its company more sustainable.

## **Discussion**

In investigating the food waste and hunger nexus of Southern Arizona, I set out to explore the following questions. Are the grocery stores currently participating in the City of Tucson Food Scraps Collection service donating a portion of their waste to food recovery organizations? If so, what is the scale and makeup of these donations, and how do they compare to the food waste they divert for composting? Lastly, what are the factors that determine which food waste will be donated or composted, and what is the potential to encourage food recovery before composting?

The results of this research expose two major interrelated themes. First, there is consistent and increasing action on the part of Southern Arizona grocers to combat the parallel problems of food waste and insecurity within their communities. Donating as much unsellable food as possible has been a longstanding practice at every franchise and independent business I spoke with, and their participation in the compost collection service is clear evidence that want to dispose of their food waste in the most positive manner, after donating whatever they can first. They also all expressed to some degree that the greatest considerations when deciding where to send their food waste are safety and edibility. The second major theme amongst grocers participating in the Food Scraps program is that the scale and rate at which supermarkets produce

organic waste, in conjunction with logistics and restrictions imposed to protect food safety, are so high the potential to donate more edible food waste cannot realistically expand past current practices. The frequency at which their donations and compost are collected reflects the enormous rate at which grocery stores produce food waste: all of the businesses interviewed donate to food recovery groups on a daily basis, as well as have their inedible food waste collected for composting on a bi to tri-weekly basis. All of the interviewed grocery stores expressed their gratitude for the compost service, as well as grief over the amount of waste their businesses produced in general, and their inability to direct more of it towards hunger alleviation.

There are a handful of roadblocks that prevent the vast amounts of edible, unsellable food produced by grocery stores from being donated to food recovery organizations. As the grocery stores I interviewed expressed, one of the foremost considerations is safety. There is a common fear amongst food sector businesses that if they donate their food, and someone was to become sick from that donation, they will be held liable. However, the Bill Emerson Food Donation Act, which was signed into law twenty years ago by President Bill Clinton, explicitly protects “donors from food safety liability when donating food to a nonprofit organization” (Gunders, 2012). Awareness about this protection is low and even though businesses are protected the fear of negative publicity discourages donations (Gunders, 2012).

The feasibility of donating more perishable foods, like produce and protein products, is greatly hindered by transportation logistics between donors and food recovery organizations. Unsellable, perishable food often has a very short lifespan remaining once it is removed from the shelves, and the burden of transportation is more likely than not on the side of the food recovery organization. Luckily, this does not completely eliminate the donation of perishable foods as seen by the fact that all the grocers interviewed claimed to do so, but the rest of the available

supply is being composted, or thrown away, instead. Food recovery organizations are most likely to be churches, nonprofits, and food banks. These groups often have very little resources to start with, and the transportation infrastructure needed to transport perishable foods, such as refrigerated trucks, would constitute a major investment. In addition, the fact that all the participating grocery stores already make donations on a daily basis to food recovery organizations shows that transportation logistics have to be very reliable and consistent in order to ensure as much edible food waste is transported as quickly as possible. The new partnership between Whole Foods, Compost Cats, and the UA Campus pantry is a great example of how creative partnerships can help circumvent these transportation concerns. Neither the UA Campus Pantry nor Whole Foods has the time or resources available to transport food donations between themselves, but with the Compost Cats- who already have the proper infrastructure and labor in place- mediating the transportation, the Campus Pantry can now rely on consistent donations from Whole Foods. I believe partnerships like this could be an effective solution for other grocery stores participating in the Food Scraps program to expand their donation capacity, and transfer more of their food waste out of the compost stream and into the donation stream- something they all expressed they would like to see.

Overall, the potential to expand composting as a waste service in Tucson is far greater and more feasible than the potential to expand food recovery, specifically grocery store food recovery. A quick survey of Compost Cats diversion rates from 2015 expose that food sector businesses produce an incredible amount of food waste, at a staggering rate: it only took 38 businesses to produce 1.35 million pounds of food waste in 2015. In the five years since Compost Cats began over ten million pounds of organic waste (food waste, manure, and yard waste combined) have been diverted from entering local landfills. What is remarkable about this

statistic is over 7 million pounds of that total were diverted between 2014 and 2015 alone. This impressive increase is directly related to the City of Tucson taking over and expanding food waste collection. Grocery stores were critical to the spike in organics diversion from 2014-2015, as seen by the percentage of grocery stores participating in the service rising from 14% in 2014 to 46% at the beginning of 2016. This research reinforces the importance and necessity of adding composting to the waste service canon of the built environment, particularly for grocery stores. The latent potential of food waste collection in the built environment is immense and certainly not limited to the Southern Arizona region. Biocycle magazine reports that of the 4,914 composting operations in the United States as of 2014 only 7% processed food waste; the vast majority only processed yard waste (Platt & Goldstein, 2014). The potential growth of the compost industry is an encouraging solution to ease the negative environmental effects of food waste entering landfills.

Additional research into the logistics of food recovery within the built environment is needed in order to generate more effective strategies. A review and analysis of successful food recovery organizations from across the country, from players as large as Feeding America to ones as small as Casa Mariposa and Casa Maria, could lead to the development of resources that detail a range of effective models, as well as practices to avoid. Understanding that different regions and locations will require different and specialized solutions, such resources could be advantageous to organizations wishing to increase the efficiency of their operations and partnerships. Further research into the makeup of grocery store food waste and its true lifespan could provide a clearer picture of what retail food waste is actually edible. A good place to begin this investigation would be ‘good-by’ and ‘sell-by’ dates; an overhaul of these standards would require new policies, but could go a long way at reducing both retail and household food waste.

This would require educating both the public and food sector businesses about the true lifespan of their food, and would most likely require massive campaigns and sufficient time in order to be implemented. Overall, I believe my research was limited by a lack of specificity in the research questions. If I were to do this research over, I would focus my questions on a more specific junction within the food supply chain.

## **Conclusion**

The only way to truly tackle, and hopefully eliminate, the massive problems of food waste and hunger within our society is to overhaul the structural forces that enable extreme, simultaneous abundance and scarcity. For the greatest reflection of inefficiency within our food system is not the millions of pounds of food that rot in landfills, but in the fact that we have created a system that allows so many people to struggle to meet their most basic needs. Rising to the challenge of solving these crises is an almost incomprehensibly daunting task given how entrenched and powerful our current model is. But it is necessary we do so. The abuse of the earth's resources has pushed our ecosystems to the brink of collapse, and the reality of our future is that their vulnerability will only intensify. Climate Change and population growth will only continue to add immense pressure on an already unsustainable agricultural system, built on unending expansion and intensification. We cannot continue to rely on our conventional agricultural practices, transportation methods, and consumption patterns for they are the very root of the rapidly escalating climate catastrophe.

Our current food system, and society as a whole, is an incredibly complex, interdependent, global phenomenon. As a result no region or nation on earth is capable of being completely self-sufficient; we are all locked into the problem together. When a problem is

global, the solution must be as well. Fixing our broken food system will require the cooperation and unification of many levels and players within the food system- from growers to processors, from conglomerates to farmers markets, from retailers to consumers. We must revolutionize our food system in order to adapt to an inevitability warmer, drier world. If we can rise to the challenge, we can most certainly make the world a better, more equitable place.

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