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BRIDGING THE FOOD GAP:
FOUNDING AND SUSTAINING A FOOD RECOVERY NETWORK CHAPTER AT
WKU

A Capstone Experience/Thesis Project Presented in Partial Fulfillment
of the Requirements for the Degree Bachelor of Science
with Mahurin Honors College Graduate Distinction
at Western Kentucky University

By
Elaine M. Losekamp
December 2020

CE/T Committee:
Dr. Leslie North, Chair
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ABSTRACT

Food waste is a pervasive global issue with many environmental and social repercussions. While about one-third of all food produced for human consumption goes to waste, many people in the United States and the world are affected by food insecurity. Food recovery, the process of rescuing edible food that would otherwise go to waste and delivering to hungry people, is an effective solution for both food waste and food insecurity. The author of this capstone created a food recovery program at Western Kentucky University (WKU) in January 2019 and has grown the program's scope and impact since that time. This paper explains the need for a food recovery program, the development of the Food Recovery Network (FRN) chapter at WKU over time, the outcomes of the program, and goals for the program in the future.

Keywords: food recovery, food waste, food insecurity

ACKNOWLEDGEMENTS

I would like to thank Beth Gafford, Dr. Leslie North, Madona May, Courtney Martin, and all of the staff at Food Recovery Network's national office for offering me guidance through the process of forming an FRN chapter at Western Kentucky University. Additionally, I would like to thank all of the volunteers who have donated their time to WKUFRN; without them, this program would not exist. I would like to thank my parents and sister for supporting me emotionally through the ups and downs of developing this program. I would like to thank Carol, Bill, and Ginna Greer for being enthusiastic supporters of my many food recovery-related ideas and allowing me to conduct my first gleans at Top Crops. Finally, I would like to thank Lacy, Oliver, and Wilson for providing me with constant friendship and support throughout this whole process.

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FOOD WASTE

Food waste and food insecurity are pervasive problems throughout the Bowling Green community, the United States, and the world. Food recovery initiatives such as the Food Recovery Network chapter at Western Kentucky University provide a solution to both of these problems. The importance of these initiatives can only be fully comprehended when the gravity and extent of the issues of food waste and food insecurity are understood.

It is widely accepted that between 30 and 40% of all food produced in the United States is wasted (“Food Loss and Waste”). The global rate of food waste is comparable; the United Nations estimates that one-third of food produced worldwide goes to waste (Heller 3). Food waste occurs at all stages in the food supply chain, but in developed nations such as the United States, food waste at the processing and packaging, distribution, and consumption stages is most prevalent (Heller 15). Much of the food that is wasted by food distributors and consumers is safe to eat; food distributors and consumers frequently discard safe-to-eat food because of cosmetic imperfections and mismatched demand and supply (Gunders 14). The relative edibility of food discarded by consumers was assessed in a study published by the National Resources Defense Council in 2017 which examined the results of 613 kitchen diaries, 1,357 completed surveys, and 277 household waste bin audits in three United States cities (Hoover 6). The authors of the study found that 68% of all food discarded by the participants in the

study was potentially edible, demonstrating the pervasive issue of wastage of food that is safe to eat (Hoover 6).

Consumers in wealthy nations waste a large portion of the food that they purchase (Gunders 10). Suppliers in these countries thereby overproduce food to meet these excessive demands. This overproduction of food exacerbates the environmental problems posed by modern industrial agriculture.

Industrial agricultural practices such as monoculture diminish biodiversity by displacing wildlife and reducing area for natural habitats. Overapplication of fertilizers, which usually contain nitrogen, to soils leads to nutrient runoff. Nutrient runoff in turn can cause algal blooms in waterways because it creates unusually high concentrations of nutrients. Algal blooms block sunlight, killing plant life in marine environments, thus ceasing the release of oxygen and leading to hypoxic conditions that kill fish and other aquatic organisms (“What is Eutrophication?”).

Furthermore, nitrous oxide is a highly potent greenhouse gas. According to the Environmental Protection Agency (EPA), nitrous oxide molecules remain in Earth’s atmosphere for 114 years on average, and one pound of N_2O has three hundred times the impact of one pound of CO_2 on warming the atmosphere (“Nitrous Oxide Emissions”). In 2018, the EPA calculated that 78% of nitrous oxide emissions in the United States were caused by agricultural soil management (“Nitrous Oxide Emissions”). Ultimately, reducing food waste, thus reducing total production of food, would have a sizeable impact on total emissions of this potent greenhouse gas.

Nitrous oxide is not the only GHG emitted by food waste. Most food waste ends up in landfills; the EPA estimated that in 2017, 75% of the food wasted in the United States was landfilled (“Food: Material-Specific Data”). After food is discarded in landfills, it rots and produces the potent greenhouse gas methane. Although methane persists in the atmosphere for less time than carbon dioxide, the impact of one pound of methane is 25 times that of one pound of carbon dioxide because methane has a much greater ability to trap radiation (“Methane Emissions”). Ultimately, all of the greenhouse gas emissions from global food loss and waste have a combined impact of about 4.4 Gt of carbon dioxide equivalent, making up about 8% of total anthropogenic greenhouse gas emissions (“Food Wastage Footprint & Climate Change” 1). To put this number in perspective, the greenhouse gas emissions from food waste can be considered on a household level. The United States and Canada have comparable rates of food wastage, although the United States has a slightly higher rate of food waste per capita (Heller 15). Researchers at the University of Guelph in Canada conducted a study that examined the waste from 94 families living in Guelph, Ontario over the course of several weeks and calculated that the global warming potential from the avoidable food waste produced by each household each year was equivalent to 1.2 tons of carbon (Von Massow et al). The researchers noted that this is equivalent to one quarter of the emissions that are produced from driving a car for one year (Von Massow et al).

In addition to being environmentally devastating, food waste leads to tremendous economic losses. The Food and Agriculture Organization of the United Nations (FAO) estimated that the total market value of all lost and wasted food products was about \$936 billion USD in 2012 (“Food Wastage Footprint & Climate Change” 1). This figure does

not include the negative externalities of environmental damage from food waste. For the same year, the FAO estimated that the social cost of carbon emissions caused by food waste and loss equaled \$411 billion USD (“Food Wastage Footprint & Climate Change” 1). When the total market value of lost and wasted food and the costs of negative externalities caused by greenhouse gas emissions from food waste – such as extreme weather events influenced by climate change that damage infrastructure – are combined, the total costs of global food waste surpass one trillion USD per year. The monetary savings from reducing food waste would be significant and could be used to address other pressing social issues.

FOOD INSECURITY

While food is wasted at an alarming rate, causing tremendous environmental and economic damage, a significant percentage of people struggle to get enough food to eat. In the state of Kentucky, Feeding America estimates that one in seven people and one in five children are food insecure (“Hunger in Kentucky”). Food insecurity is comparable in Warren County, where Bowling Green is located, and on a state-wide level.

According to the latest available Map The Meal Gap data from Feeding America, in 2018, 13.5% of the population of Warren County suffered from food insecurity, while 14.8% of all Kentuckians were food insecure (“Food Insecurity in Kentucky”). The same study by Feeding America found that in 2018, the national food insecurity rate in the United States was 11.5% (“Food Insecurity in The United States”).

Many members of the Western Kentucky University community face food insecurity as well. The need for food assistance is great enough that there has been a food pantry on campus for many years. The WKU Office of Sustainability Food Pantry is open to the wider community but primarily serves staff, faculty, and students. Between March 20, 2020 and August 10, 2020, over 10,000 individual items were distributed to 687 visitors to the pantry (North).

On a global level, food insecurity is an even more serious problem than it is in Kentucky and the United States. In 2019, the Food and Agriculture Organization of the United Nations (FAO) estimated that about 26.4% of the world population suffered from

moderate or severe hunger (FAO et al. 19). The FAO categorizes moderate food insecurity as inconsistent access to food, causing those who experience it to reduce the quantity or quality of food that they consume at times (FAO et al. 5). Severe food insecurity, which is more dangerous and less common, entails a complete lack of access to food for up to days at a time (FAO et al. 5). In 2018, about nine percent of people worldwide experienced severe food insecurity (FAO et al. 15). Since 2015, the worldwide number of people experiencing food insecurity has been rising (FAO et al. 6).

Since the COVID-19 pandemic began, the problem of food insecurity has affected a rising number of people. The COVID-19 pandemic has disrupted food supply chains, caused a massive economic downturn, and led to the death or illness of millions of people worldwide. According to the World Food Programme, 130 million additional people will likely experience acute hunger (also known as famine) because of the COVID-19 pandemic by the end of 2020 (Anthem). The rising level of food insecurity worldwide and in the United States shows the pressing need for solutions that feed people in need.

THE FOOD RECOVERY CONCEPT

Food recovery is an efficient solution for the dual issues of food waste and food insecurity. It is the process of capturing surplus food that would otherwise go to waste and delivering it to people in need (Gunders 29). After source reduction, the Environmental Protection Agency identifies recovering surplus food and donating it to people in need as the most economically, environmentally, and socially beneficial option for food waste reduction (“Food Recovery Hierarchy”). The simplicity of food recovery and its unarguable benefits for society make it a rarity amongst solutions to environmental problems.

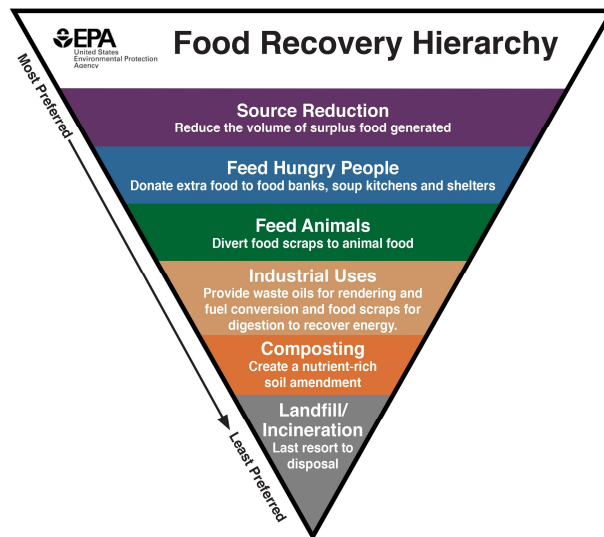


Figure 1. *Food Recovery Hierarchy*. 18 Nov. 2019. *United States Environmental Protection Agency*. <https://www.epa.gov/sustainable-management-food/food-recovery-hierarchy>.

Food recovery programs have existed in communities across the United States, run both by dedicated individuals and organized nonprofits, for decades. Organized food recovery programs at colleges and universities tend to be much younger. Within the past decade, food recovery programs have sprung up upon many college campuses across the country. Food Recovery Network (FRN), which began operating its first chapter at University of Maryland College Park in 2011, is the largest organization of student-run food recovery programs at colleges and universities in the United States (“Our Story”). At least one formal attempt was made to form a chapter of Food Recovery Network at Western Kentucky University before I founded the current chapter, which immediately applied to join the Network, in 2019.

Food Recovery Network chapters are able to share resources and ideas. Through Food Recovery Network, I have been able to network with local chapter leaders from the Ohio and Kentucky region as a panelist at the 2020 Cincinnati Regional Outreach Conference. I have been able to rely on FRN staff for support and advice throughout the process of forming and growing a chapter. As a leader within FRN’s network, I was also able to join FRN’s Student and Alumni Advisory Board, where I have served as the Resource Development and Program Support Committee Chair for the 2019 through 2020 and 2020 through 2021 terms. Furthermore, my connections and experience within FRN led me to be hired as a Food Recovery Verified intern for Food Recovery Network in the fall of 2019. I was subsequently hired for two more internships with FRN. Participation in Food Recovery Network has provided me with many opportunities on a personal level and will continue to provide opportunities for leaders within WKU’s chapter of FRN and for the WKUFRN chapter as a whole.

ORIGIN OF THE WKU CHAPTER OF FRN

I have been interested in food systems for many years. I first learned about the model of food recovery programs on university campuses led by students when I attended a sustainability conference in 2018. That October, I attended the annual conference for the Association for the Advancement of Sustainability in Higher Education (AASHE) with a delegation of Western Kentucky University staff and students. While at AASHE, I attended seminars given by Food Recovery Network staff and chapter leaders. These seminars provided me with both an understanding of the logistics involved in developing a food recovery program on a university campus and the inspiration to spearhead the development of a similar program at WKU. After the conference, I expressed my interest to the full-time staff members of the department of Resource Conservation at WKU, Beth Gafford and Courtney Martin. With their guidance, I began the process of creating a food recovery program.

During October 2018, I met with the leadership of the WKU Restaurant Group. The WKU Restaurant Group endorsed the project idea, with the stipulation that I attain ServSafe Certification before recoveries commenced. I was given permission to conduct the first recovery at the beginning of the spring semester of 2019. In the remaining months before the semester began, I had many tasks to accomplish. During the 2019 winter term, I passed the ServSafe Certification test. I created a social media presence for the program and used both my personal social media and the newly formed

@wkufoodrecovery Instagram account to recruit volunteers from the student body. I conducted outreach to local nonprofits to identify a recipient agency for the food that would eventually be recovered. This step proved to be surprisingly difficult, as many people are unaware that federal and state laws protect food recovery and donation. Thus, many nonprofits are wary about accepting donations of prepared food because they worry about legal liability. Eventually, I was able to identify several nonprofit organizations that were willing and able to accept donations of prepared foods. During the months preceding the first food recovery, I also began the process of forming an official chapter of Food Recovery Network. This process involved filling out an application and complying with FRN's requirements for chapter leaders, such as completing food safety training, scheduling regular check-ins with FRN staff, and tracking information about recoveries and partner agencies.

Both FRN and the WKU Restaurant Group required that data be collected from recoveries. Following sample recovery logs provided by FRN, I developed a spreadsheet for data collection. A portion of the spreadsheet that I created to track food recoveries during the spring semester of 2020 is shown below in Figure 1. The spreadsheet I developed is housed in a Google Sheet associated with a Gmail account for the WKUFRN chapter so that the data can be referenced in the future by other chapter leaders. After each recovery, I record the date, source of food, total weight, type of food, names of volunteers, and associated partner agency in the spreadsheet. The database of spreadsheets has yielded useful statistics for the program and is the basis for the program statistics discussed in the Program Outcomes section of this report.

Spring 2020 Food Recoveries								
Recovery #	Date	Source of Recovery	Pounds	Type of Food	Volunteers Present	Partner Agency	Total Pounds	
147	1/27/2020	Einstein Bros. Bagels	13	Mostly bagels, some pastries	Elaine Losekamp	Christ Episcopal Church	13	
148	1/28/2020	Einstein Bros. Bagels	10	Mostly bagels, some pastries	Elaine Losekamp	Meals Inc	23	
149	1/29/2020	Einstein Bros. Bagels	3	Mostly bagels, some pastries	Bo Cooper, Elaine Losekamp	Meals Inc	26	
150	1/30/2020	Einstein Bros. Bagels	6	Mostly bagels, some pastries	Josiah Garcia, Maria Thorp, Elaine Losekamp	Meals Inc	32	
151	1/31/2020	Einstein Bros. Bagels	23	Bagels, pastries, drinks	Savannah Huffman, Austin Brown	Meals Inc	55	
152	1/31/2020	DaVinci's	10	Cookies, soup	Savannah Huffman, Austin	Meals Inc	65	

Figure 2. Example of food recovery data collection spreadsheet.

I employed several different strategies to build awareness of the program and recruit students. One method was developing an online presence. I created an Instagram account for the chapter, through which I regularly posted graphics that I created. An example of an Instagram slide show that I created using Canva is shown in Figure 2 below. I used the Instagram account to share updates about the program’s impact and encourage students to join. In addition to the online presence of the program, I conducted outreach to several other student organizations, sought out club fairs and campus events in which the club could participate, and distributed posters across campus. The campus events in which WKUFRN has participated as of October 2020 are listed in Table 1 below. In October 2020, I asked WKUFRN volunteers to fill out a survey indicating the way in which they had learned about the program; the results are shown in Figure 3. Over half of the 22 volunteers who responded had learned about WKUFRN through word

of mouth. About one in five had learned about the program through social media, while the remaining six respondents had been introduced through club fairs, Market on the Avenue, or promotion via the WKU Office of Sustainability.



Figure 3. Instagram slideshow of Spring Semester 2020 outcomes.

Ways That Volunteers Learned About WKUFRN

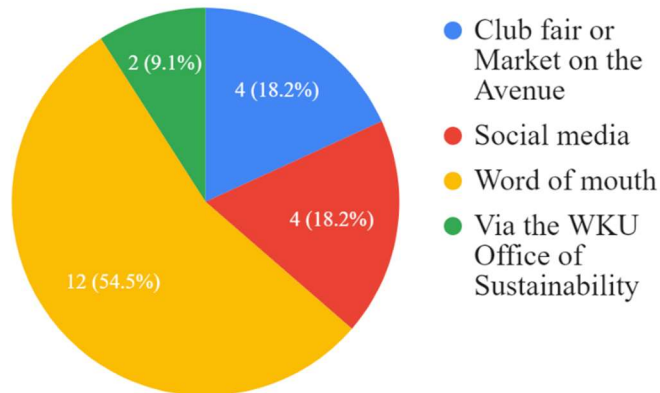


Figure 4. Ways that volunteers learned about WKUFRN.

Table 1. Recruitment events in which WKUFRN has participated.

Recruitment Event Name	Semester	Description
Fix-It Fest	Spring 2019	Volunteers provided an educational activity (DIY beeswax wraps).
Earth Day Celebration	Spring 2019	Volunteers staffed an informational booth to recruit interested new members.
DiscoverFest	Fall 2019, Fall 2020	Volunteers staffed an informational table at the club fair to recruit interested new members.
Market on the Avenue	Fall 2019, Spring 2020, Fall 2020	Volunteers staffed an informational table to recruit interested new members.
Potter College Fall Festival	Fall 2019	Volunteers staffed an informational table to recruit interested new members.
WKU Greeks Go Green	Fall 2019 - Spring 2020	Participants in the Greeks Go Green competition could volunteer with WKU Food Recovery to earn points.

Beginning in early February 2019, I led meetings most weeks at the WKU Office of Sustainability, which has served as a base of operations for WKUFRN. Meetings were used to share pertinent information and recruit, retain, and organize volunteers. From the beginning of the program, consistent volunteers were given the opportunity to take on leadership positions. Experienced volunteers were encouraged to run for leadership positions to provide them with qualifications to list on their resumes and to establish a clear structure of seniority within the organization to simplify decision-making processes in situations when multiple volunteers work together. The current organizational hierarchy is shown in Figure 5.

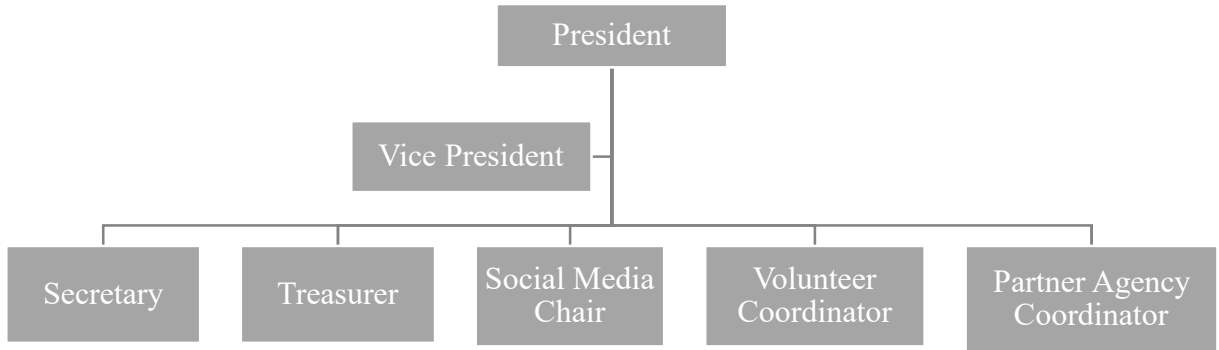


Figure 5. Organizational hierarchy of WKUFRN.

At many meetings I organized group-bonding activities. Some examples of these activities include potlucks, a viewing party of a food-themed documentary, and various crafting sessions. These group-bonding activities helped volunteers get to know each other and created a more inclusive and friendly atmosphere.

RESTAURANTS AND FOOD WASTE ON CAMPUS

As of October 2020, there were 23 dining locations on WKU's campus.

Thousands of pounds of food go to waste at these dining locations and in dorms across campus every single day. Figure 6, courtesy of Beth Gafford, is a graph of the daily average pounds of primarily preconsumer food waste composted at all campus dining locations each month. The amount of preconsumer food waste that is generated by campus restaurants varies greatly depending on the time of year (for example, many dining locations are closed during summer months, so the total preconsumer food waste from dining locations tends to be low during these months), enrollment that semester, and a variety of other factors. Generally, a total of between 800 and 1800 pounds of preconsumer food waste is generated by all campus dining locations and composted each day. While much of this food waste consists of inedible food such as vegetable peelings, fruit rinds, and food that was cooked improperly, a portion of it is safe to eat and can be rescued and donated. WKUFRN works with the WKU Restaurant Group to identify and divert this edible food waste away from compost to people in need. WKU pays at least \$0.14 per pound of food waste to compost it; thus, participating in food recovery has resulted in financial savings for the university (Gafford). To date, the roughly two tons of food that have been recovered by WKUFRN that otherwise would have been composted by campus restaurants would have cost the university a minimum of \$560 for disposal.

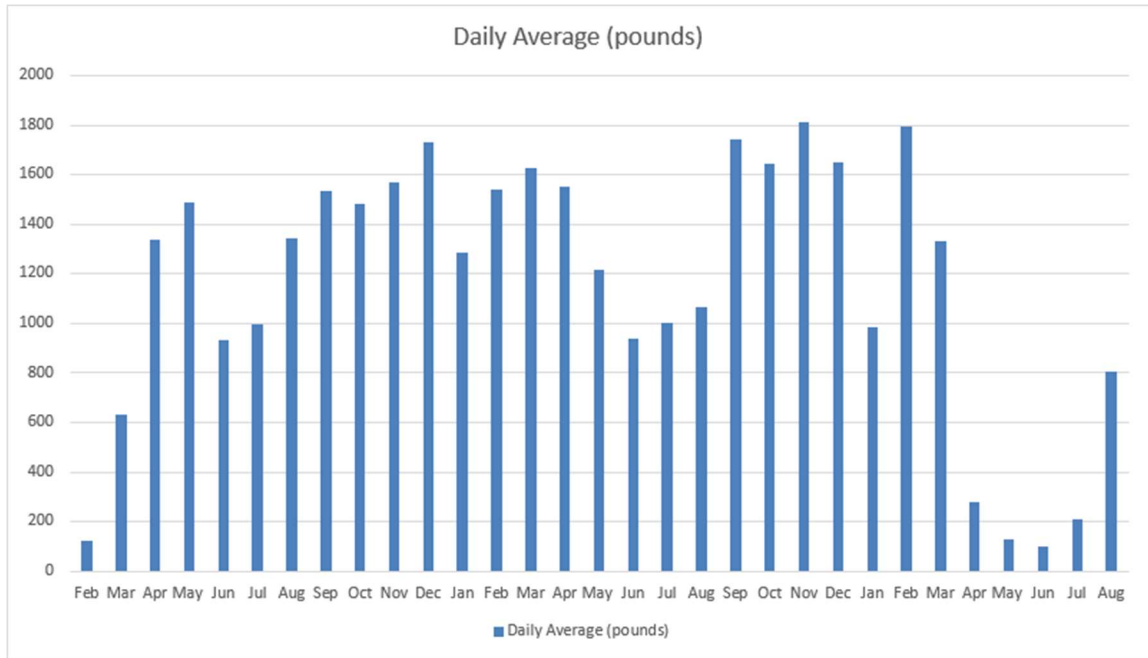


Figure 6. Daily average pounds of preconsumer food waste from WKU campus dining locations that is composted since Feb. 2018. Gafford, Elizabeth. “Re: Compost/Food Waste Data for Honors Capstone Project.” Received by Elaine Losekamp, 12 Sept. 2020.

The WKUFRN program has worked with a variety of different dining facilities at different times since its inception. The majority of the sources of recovered food have been campus restaurants, but WKUFRN has worked with several other sources of food in the wider Bowling Green community. WKUFRN and the WKU Restaurant Group have worked together to identify campus dining facilities that generally produce a consistent type and general quantity of surplus food on a set basis to simplify the process of food recoveries. To limit the risk of foodborne illness, WKUFRN primarily recovers relatively shelf-stable food products such as bagels, bread, and pastries. Einstein Bros. Bagels has been the primary source of recovered food for WKUFRN because company policies dictate that the café discard all of its baked goods at the end of each business day,

meaning that the restaurant produces a reliable stream of baked goods which are relatively low-risk to donate in terms of potential foodborne illness. Other cafes and sandwich shops on campus, such as Java City, DaVinci's, and one of the Subway locations, have also become partners for WKUFRN. More recently, WKUFRN began regularly recovering prepackaged, perishable sandwiches, salads, fruit cups, and similar food items that have reached their sell-by date but still appear safe to eat from Pit Stop and Garrett Food Court, two dining locations with refrigerated grab-and-go sections. Food product dating is not regulated or mandated by Federal regulations for any foods except for infant formula ("Food Product Dating"). Food product dating for foods other than infant formula simply show when food is freshest and of best quality, not simply when it is safe to eat; thus, it is safe and legal under federal guidelines to donate food that has passed its product date but appears safe to eat and has been stored in food-safe conditions ("Food Product Dating").

In the future, WKUFRN hopes to work with the WKU Restaurant Group to expand operations to include more campus dining facilities. The COVID-19 pandemic has brought about new dangers and altered dining patterns on campus; after the pandemic ends, it will be safer and more feasible for WKUFRN to expand its operations. The WKU Restaurant Group and WKUFRN have discussed initiating food recoveries from the concessions and catering departments. Once the pandemic has subsided, these options will likely be explored.

COMMUNITY CONNECTIONS

WKUFRN has developed relationships with a variety of nonprofit organizations in the Bowling Green community throughout its existence. In total, WKUFRN has delivered recovered produce to twelve different nonprofit organizations in the Bowling Green community and Nashville, TN in its history. Several of the nonprofit organizations with which WKUFRN has worked have only received one-off or very occasional donations. Five nonprofit organizations with feeding programs in the Bowling Green area have had significant, long-standing relationships with WKUFRN. As can be seen in Figures 7 and 8 on the following page, Christ Episcopal Church, MEALS INC, Salvation Army of Bowling Green, Room In The Inn and Hope House have received numerous donations of food. Several of these organizations have received a large portion of the total quantity of food that WKUFRN has recovered.

Percentage of Recovered Food Delivered to Each Partner Agency, by Weight

Percentage of the 5,277 pounds of food recovered before October 26, 2020

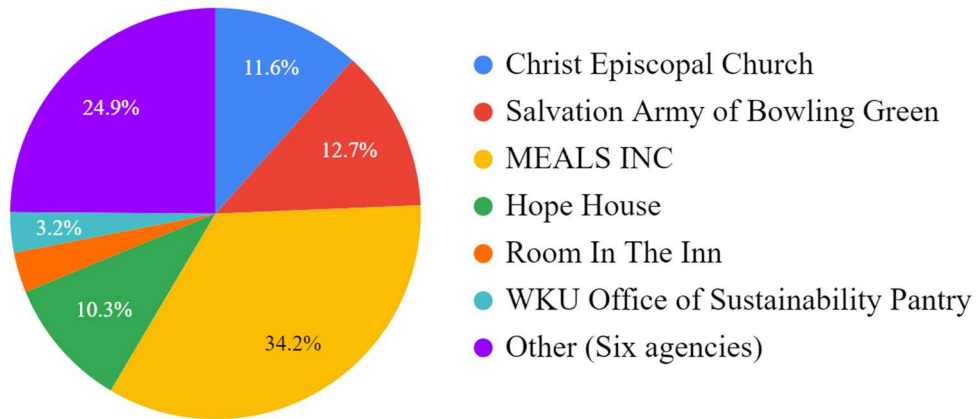


Figure 7. Percentage of recovered food delivered to each partner agency.

Recoveries Delivered to Partner Agencies

Percentage of the 288 recoveries completed before Oct. 26, 2020 that were delivered to each recipient

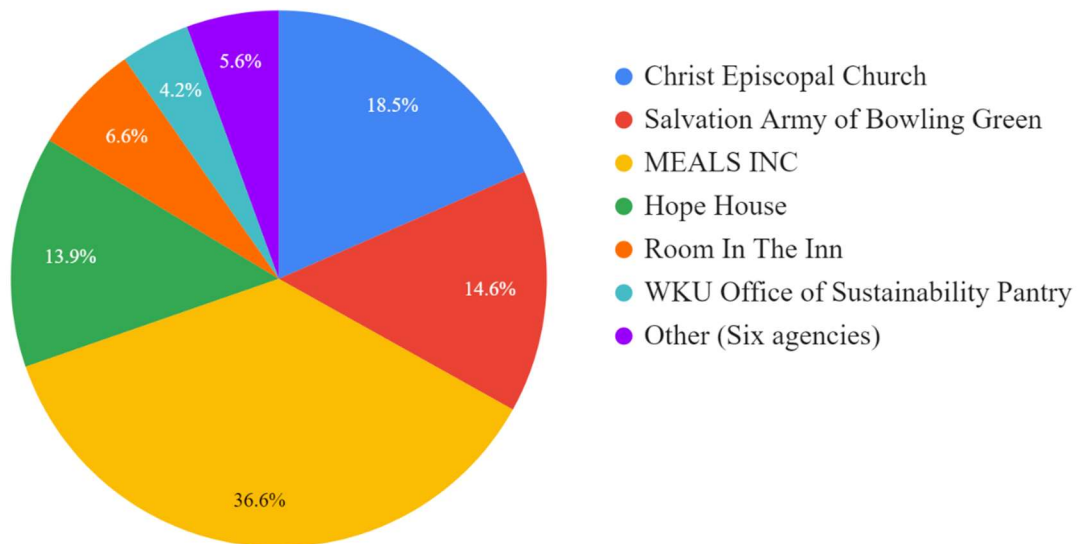


Figure 8. Recoveries delivered to partner agencies.

Christ Episcopal Church (CEC) was one of WKUFRN's very first recipient partner agencies. Before the onset of COVID-19, CEC had a free lunch program open to all members of the community. The coordinators of CEC's free lunch ministry incorporated the bagels that WKUFRN donated into the lunches and donated surplus bagels to Barren River Area Safe Space (BRASS), a local shelter for victims of domestic violence. WKUFRN typically donated recovered food once or twice per week from Spring 2019 until Spring 2020.

MEALS INC was WKUFRN's other primary partner agency prior to the COVID-19 pandemic and the recipient of the vast majority of the food that WKUFRN recovered. MEALS INC has received 1803.5 pounds of food from 105 separate food recoveries. Like CEC, MEALS INC ceased operations of its feeding program due to safety concerns in March 2020. MEALS INC prepared meals and boxes of food, which volunteers distributed to for families experiencing food insecurity and homebound elders every Saturday morning. Like CEC, MEALS INC redistributed any surplus food that their clients were not able consume to BRASS. WKUFRN typically delivered recovered food to MEALS INC three or more times per week from Spring 2019 until the middle of Spring 2020.

Immediately before WKU ceased in-person instruction due to the pandemic in March 2020, WKUFRN began delivering recovered food to Room In The Inn (RITI). Deliveries resumed again in Fall of 2020 and will likely continue in the future. RITI is based out of an office that is open during weekday mornings in the warm months and evenings in the colder months. RITI works with homeless individuals in the Bowling Green area to provide temporary nighttime shelter at various houses of worship in the

community during the winter. During the Fall of 2020, RITI has been serving serve sack lunches to about fifteen to twenty homeless individuals each day. WKUFRN donates prepackaged sandwiches, salads, fruit cups, bagels and pastries that are added to these sack lunches about once per week.

Another partner agency that began receiving regular donations of recovered food in Fall of 2020 was Hope House, a nonprofit organization that includes a transitional living program for up to twenty men at a time who are recovering from addiction. Hope House provides three meals per day to their residents. Any food that WKUFRN donates to Hope House is used to provide breakfast and lunch for residents. Generally, donations are delivered once per week.

Throughout the entirety of WKUFRN's existence, donations have been intermittently delivered to the Salvation Army of Bowling Green. The Salvation Army has a soup kitchen and distributes free boxes of food each week to people in need in the community. WKUFRN typically donates food when we recover large quantities of food within a short period of time and do not want to overwhelm our regular partner agencies. The Salvation Army has much larger storage facilities than most of the other nonprofit organizations with feeding programs in the Bowling Green community, as well as extended business hours, and are thus able to take more food at once. During the Fall 2020 semester, recovered food has typically been donated to the Salvation Army once per week.

Although these partner agencies have received the majority of our donations of recovered food, WKUFRN has delivered food to other nonprofit organizations in unusual circumstances. While WKUFRN focuses its efforts on recovering food from campus

food donors, the organization has never turned down an opportunity to recover food off campus. In February 2020, a sports bar in Bowling Green that catered to the student population closed its doors. The management of the sports bar, which was located on the edge of the WKU campus, reached out to the WKU Office of Sustainability to inquire about donating food to its food pantry. Much of the leftover food at the sports bar was perishable, so the WKU Office of Sustainability was not able to take it. The staff at the Office of Sustainability connected WKU Food Recovery to the sports bar's manager; the manager gave the organization two days before the perishable food had to be removed from the sports bar's frozen storage. At this point in time, WKU Food Recovery had never recovered more than 100 pounds of food at one time. I was able to mobilize seven volunteers before the deadline and recover just over half a ton of food from the sports bar. All of the perishable foods were immediately distributed to a local nonprofit, MEALS INC, but the nonprofit reached its capacity before it could accept the nonperishable foods.

Within a week of this recovery, a series of tornadoes struck Nashville and the surrounding area in Tennessee. WKU Food Recovery still had several hundred pounds of nonperishable foods in our care. We wanted to help those affected by the tornadoes in Nashville, so, with the help of Food Recovery Network's national office, I connected with a national nonprofit, Operation BBQ Relief, that had deployed hunger-relief resources to Nashville. Another volunteer and I drove to Nashville and donated the remaining recovered, nonperishable foods to Operation BBQ Relief and the Nashville Rescue Mission.

PROGRAM OUTCOMES

In this section, the outcomes of the WKUFRN program between January 2019 and October 26, 2020, the date of defense of this paper, are explored. Table 2 below displays a selection of important statistics for each semester that the program has operated, as well as the grand total for all time. In the remainder of this section, these statistics are explored in greater depth. Only two recoveries were performed (both from off-campus locations and totaling only 35 pounds together) during the summer of 2020. Data from the summer of 2020 is not included in graphics after Table 2 for the sake of simplicity and readability.

Table 2. Total outcomes of the program by semester.

	Spring 2019	Fall 2019	Spring 2020	Summer 2020	Fall 2020	Total
Total Pounds Recovered	753	837.5	2356.5	35	1295.5	5277.5
Number of Recoveries	71	75	50	2	90	288
Pounds per Recovery	10.6	11.2	47.1	17.5	14.4	18.5
Number of Restaurants/ Food Sources	3	3	7	2	6	13
Number of Nonprofits	5	2	9	2	5	12
Number of Volunteers	16	18	15	2	28	50+

The total weight of food diverted by WKUFRN from landfills or compost operations to people in need between January 2019 and October 26, 2020 amounted to a reduction of 9.59 metric tons of CO₂ equivalent (“Versions of the Waste Reduction Model”). This figure was found using version 15 of the Environmental Protection Agency’s Waste Reduction Model (WARM) Tool. The emissions reduction was calculated with the assumption that the 2.084 tons of food recovered from campus restaurants would have otherwise been composted, while the 0.5545 tons of food recovered from off-campus restaurants would have been landfilled. As the program continues to grow in the future, WKUFRN will continue to reduce greenhouse gas emissions.

There have been significant fluctuations in the number of pounds of food recovered each week. The weekly total has ranged from a low of 13 pounds to a high of 835 pounds. The weekly average for all time as of October 11, 2020 (including summer 2020 data) was 103 pounds recovered per week. A difference of hundreds of pounds of food presents challenges because it can be difficult to distribute recovered food to nonprofit partners without overwhelming their capacity. Fluctuations of even tens or scores of pounds can present challenges as well, as volunteers have limited time, resources, and space in their cars to transport food. Figure 9 shows the total weights of food recovered each week of each semester during which WKUFRN has operated to date. The difference of over 800 pounds between the peak in the spring of 2020 and the lowest total to date (in the spring of 2019) makes Figure 9 challenging to read. Because of this, all weekly totals greater than 150 pounds were excluded from the data set for Figure 10. In this figure, the tremendous variation from week to week is still extremely clear.

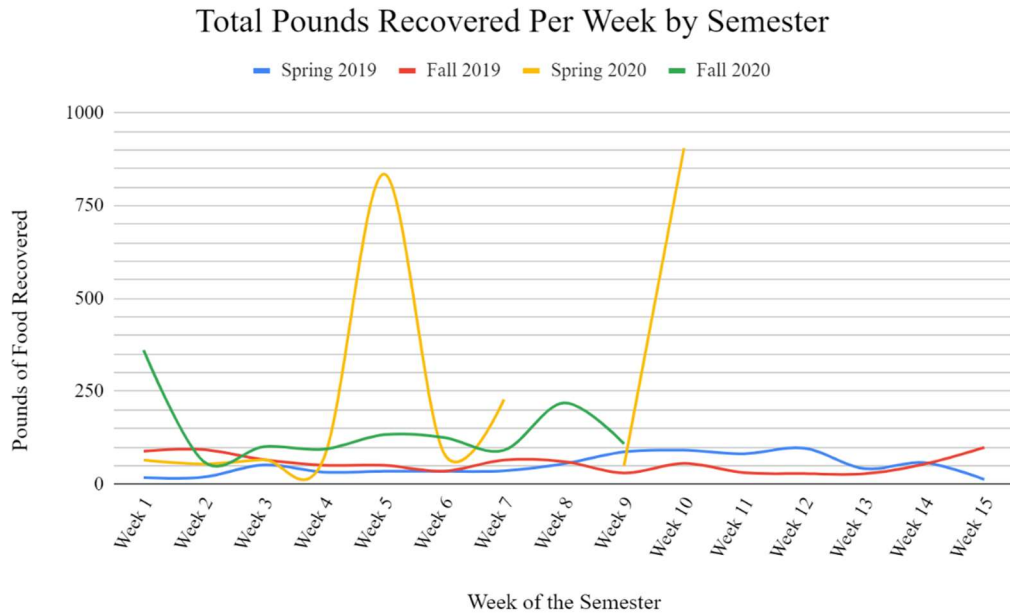


Figure 9. Total pounds of food recovered per week, by semester.

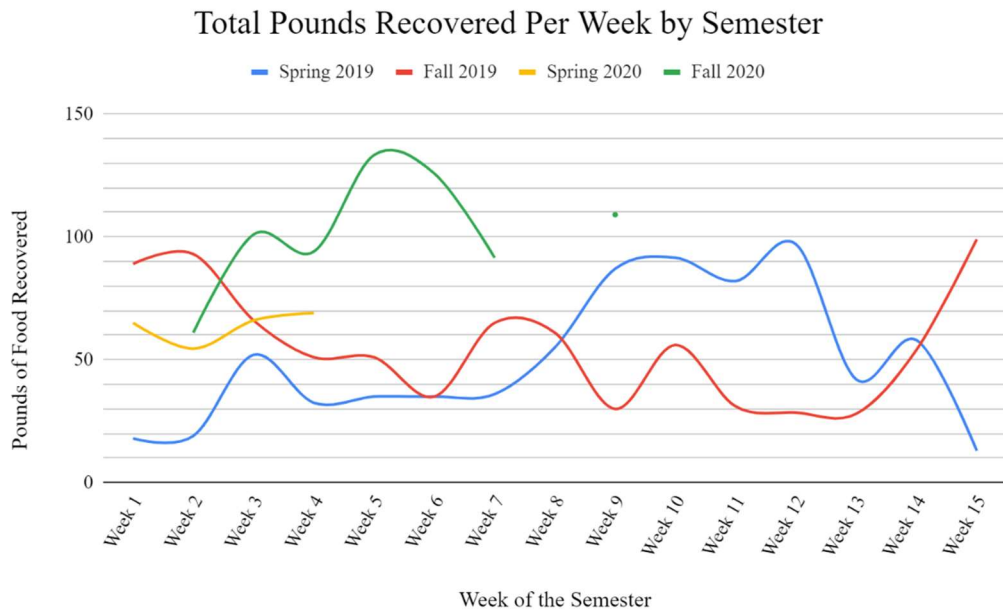


Figure 10. Total pounds recovered per week, with totals over 150 lb. excluded.

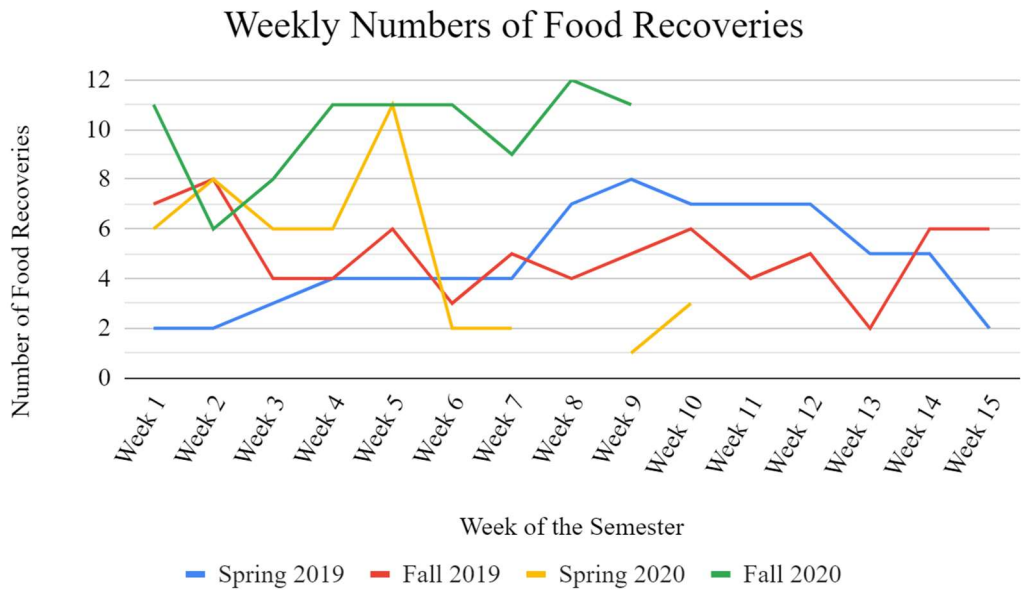


Figure 11. Weekly number of separate food recoveries, by semester.

Similar to the weight of food recovered each week, the number of weekly recoveries has fluctuated tremendously, as can be seen in Figure 11. While the number of recoveries will often rise or fall from week to week within a semester, the average number of weekly food recoveries has risen over time. During the first semester of WKUFRN’s existence, the number of recoveries conducted per week rose quickly from two weekly recoveries at one location (Einstein Bros. Bagels) to recoveries from Einstein Bros. Bagels every weekday in addition to recoveries from Java City and DaVinci’s on Fridays. From one semester to the next, the number of weekly recoveries has fluctuated as we have removed recoveries from our schedule (such as our weekly recovery from Java City, which downsized its kitchen in Fall 2019), added regular recoveries (such as twice weekly recoveries from Subway starting in Fall 2020), and included sporadic, non-

scheduled recoveries (such as our first recovery from Pit Stop in the Fall of 2020, which had a surplus of sandwiches near their expiration date due to a shipping error).

Throughout the fall 2020 semester, the average weekly number of recoveries has risen to about ten to twelve per week and remained consistently in this range. Executing this many recoveries per week requires a consistent stream of volunteers. To date, about fifty individuals have volunteered with WKUFRN. The majority of these volunteers were students, but several were alumni, current university staff, or members of the community. The volunteer base of WKUFRN has been extremely diverse. At least 20 different majors have been represented by WKUFRN's volunteers. Volunteers from a variety of different service-based or affiliated organizations, such as Student Dietetics Association, Delta Zeta, Omega Phi Alpha, and Alpha Phi Alpha have become active members of WKUFRN. Over time, relationships between WKUFRN and other service organizations will likely continue to strengthen and grow.

Historically, between 4 and 5 unique volunteers have recovered food each week. Many of WKUFRN's volunteers regularly volunteer multiple times per week. There are huge variations in the number of volunteers who help out with recoveries each week, as can be seen in Figure 12 below. Some weeks only two people will volunteer, while other weeks as many as eleven or twelve students will join recoveries. This graphic only accounts for the total number of volunteers in one week and does not take into account the number of recoveries that week or distribution of volunteers across recovery slots. For example, during the week of September 28th through October 3rd, 2020, only one volunteer was present either for the recovery or delivery of food each day from Monday through Thursday. On Friday, eight volunteers were present simultaneously. Because of

uneven distributions of volunteers throughout a given week, volunteer workloads can be very unbalanced.

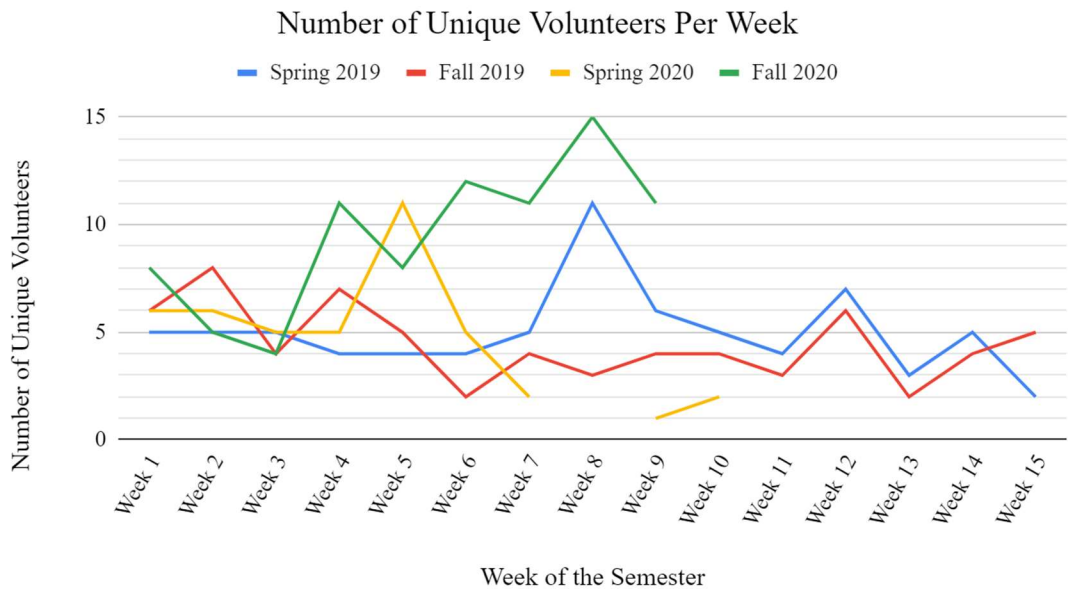


Figure 12. Number of unique volunteers per week.

Figure 13 attempts to show the link between the number of separate volunteer opportunities and the number of unique volunteers within a given week. To create this graphic, I divided the number of unique individuals who volunteered each week by the number of food recoveries that occurred that week. The weeks that dip below one volunteer per recovery indicate that at least one individual volunteered on multiple occasions that week. The frequency of weeks with values under one demonstrates that WKUFRN relies on committed volunteers who often devote an hour or more each week to volunteering with the organization.

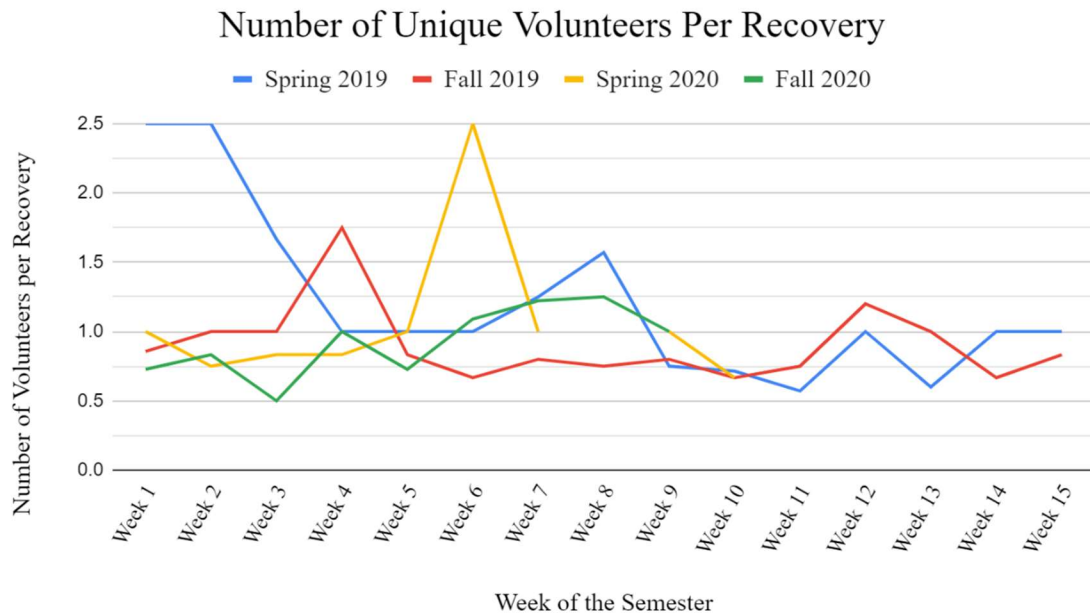


Figure 13. Number of unique volunteers per recovery each week.

Figure 14 below shows the distribution of total food recoveries completed by each unique, recurring volunteer, each semester that that individual volunteered. Volunteers who only volunteered once with WKUFRN are not included in the dataset. The graphic gives a glimpse into the regularity with which committed members of the club volunteer. The average number of food recoveries completed by one recurring volunteer in a single semester is 10 (rounded up from 9.89). This shows that on average, recurring volunteers volunteer once a week for two thirds of the weeks in a semester. On average, if an individual volunteers more than once, that individual is likely to become a committed volunteer. WKUFRN is only able to operate because of its committed volunteers.

Distribution of Recoveries Completed By Each Recurring Volunteer

This graphic shows the distribution of total recoveries completed each recurring volunteer each semester.

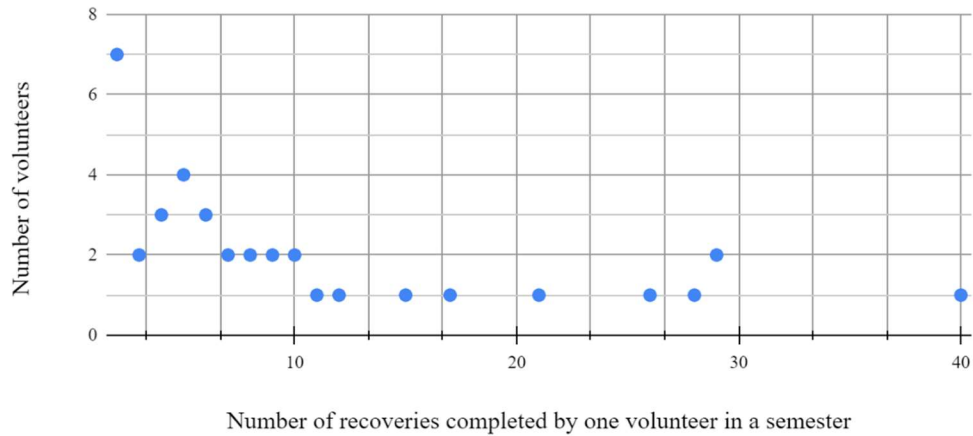


Figure 14. Distribution of total number of recoveries completed each semester by each volunteer who has volunteered two or more times in a semester.

I asked volunteers (both current students and alumni) to fill out a survey in which they marked the top reasons that motivated them to join and stay involved with WKUFRN. I sent the survey to all of the members of the WKUFRN GroupMe in October 2020, as well as several graduated volunteers who were formerly active. There was no limit to the number of choices that respondents could pick; the number of choices selected by each respondent ranged from two to six. Thirteen people responded to the survey. Figure 15 below shows the percentage of respondents who marked that each factor was a motivator. Volunteers tended to mark more altruistic motivations, such as feeding hungry people, giving back to the community, and environmental concerns, rather than more personal reasons, such as fulfilling service hour requirements or meeting new people.

What Motivates Volunteers to Remain Involved With WKUFRN?

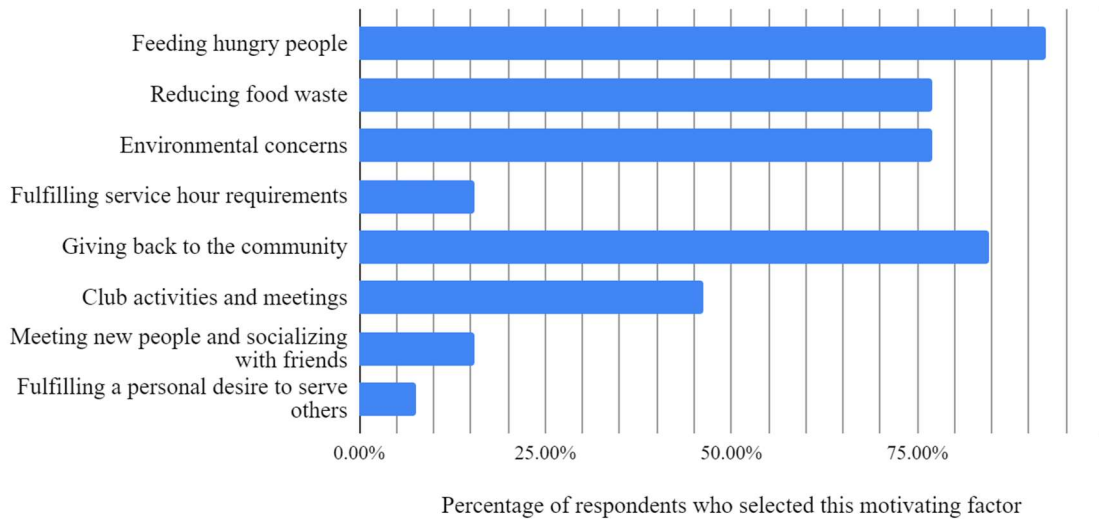


Figure 15. Motivations for volunteers to become involved with WKUFRN.

A statistical demonstration of the increasing variety and nutritional value of the food that WKUFRN has recovered over time would be a useful metric to include in this section, but unfortunately data collection methods to date have not been sophisticated enough to allow for any such analysis. It is challenging to calculate the total weight of each type of food recovered. Volunteers typically record the total weight of food recovered from each location each day, but the separate weights of each individual type of food are not usually recorded. Doing so would not be feasible; at times, all of the food that is to be recovered has already been packaged by restaurant staff by the time that volunteers arrive, so calculating the weights of each food item would be impractical. Time constraints – either a limited window of time in which perishable food must be transported to a refrigerator because of food safety considerations, limited time in which volunteers can be in a restaurant after closing before staff leave for the day, or a tight

schedule of recoveries from multiple locations within a certain window of time – prevent volunteers from weighing food superfluously. However, occasionally additional metrics are recorded to provide insights into the types and quantities of foods recovered by WKUFRN. A case study of a typical week (August 31st through September 4th, 2020) is shown in Tables 3 and 4 below.

Table 3. Case study: recoveries from the week of August 31 – September 4, 2020.

Day of the Week	Date	Source of Recovery	Weight of Recovered Food (lbs.)	Description of Food	Initials of Volunteers	Nonprofit Partner Agency	Cumulative Weight This Week (lbs.)
Monday	8/31/2020	Einstein Bros. Bagels	7	30 bagels and muffins	A.A.	Room In The Inn	7
Tuesday	9/1/2020	Einstein Bros. Bagels	6.5	32 bagels and muffins	A.A., E.L.	Room In The Inn	13.5
Wednesday	9/2/2020	Einstein Bros. Bagels	11	41 bagels and muffins	E.L., A.C.	Room In The Inn	24.5
Thursday	9/3/2020	Einstein Bros. Bagels	4.5	Bagels	J.G.	Office of Sustainability	29
Friday	9/4/2020	Einstein Bros. Bagels	30	Bagels, cookies, fruit cups, lemonade, sandwiches, yogurts	A.B., E.L.	Hope House	59
Friday	9/4/2020	DaVinci's	2	Cups of soup	A.B., E.L.	Hope House	61

Table 4. Food recovered from Einstein Bros. Bagels, September 4, 2020.

Type of Food	Number of Items	Pounds of Food Item Recovered	Total Pounds
Cookies (individually packaged)	12	1	1
Pastries (including muffins)	16	4	5
Bagels	55	12	17
Cups of cookies	7	2	19
Fruit cups	9	2	21
Yogurt	2	1	22
Lemonade	8	6	28
Individual sandwiches	3	2	30

Table 5. Metrics from the week of August 31, 2020 – September 4, 2020.

Week of August 31 - September 4, 2020 Metrics
Five unique volunteers
Six food recoveries
Three partner agencies
61 total pounds of food recovered
48 pounds of bagels, cookies, and pastries
5 total volunteer hours (30 minutes per volunteer Monday through Thursday, 1 hour per volunteer on Friday)

Each week, I organize all of the daily recoveries. I personally lead these recoveries or else organize and direct all of the volunteers. I maintain communication with contacts at multiple nonprofit organizations and ensure that volunteers are following through with deliveries to nonprofits. I record data from every single recovery and make decisions about where the food from each recovery should be delivered. I prepare for and lead weekly meetings. I maintain communication with representatives from the WKU Restaurant Group and WKU Office of Sustainability and fulfill obligations to FRN's national office. From physically being present at food recoveries to leading meetings to communicating with volunteers to planning to recording data, I dedicate on average

seven to ten hours per week to WKUFRN. Future leaders will need to understand the extent of the time commitment required to lead WKUFRN for the organization to succeed.

Table 6. Recoveries which the author personally attended, all time.

Semester	Number of recoveries
Spring 2019	40
Fall 2019	26
Spring 2020	29
Summer 2020	2
Fall 2020	35
Total	132

CHALLENGES

Throughout the development of the food recovery program at WKU, a plethora of different obstacles have been encountered. One of the first and most surprising obstacles was the difficulty that I faced when I first tried to identify nonprofit organizations that accept donations of prepared, perishable foods. Many food pantries and other nonprofits that feed people in need do not accept donations of perishable foods because they are associated with greater risks of foodborne illness, must be stored and handled in more expensive equipment (such as refrigerators), and must be redistributed to clients within a much shorter window of time than nonperishable foods. An even more limited selection of nonprofits that feed people accept donations of prepared foods, as prepared foods are associated with more risk of foodborne illness and mishandling. WKUFRN has struggled at times to find nonprofits that are willing to accept donations of perishable, prepared foods. Conflicting schedules have also made donations to certain nonprofits difficult or impossible. Recoveries typically occur when dining locations close at the end of business hours; nonprofit partner agencies often close at or near this time, which limits the selection of nonprofit organizations to which we can donate. Furthermore, we strive to not overwhelm any given nonprofit with a greater quantity of donations than that nonprofit is able to use; all of these factors make aligning donations of food with receiving nonprofit agencies a complicated mathematical equation.

It has been challenging to find volunteers for all of the available food recoveries during the entirety of the WKUFRN program's existence. Over 300 accounts follow WKUFRN's Instagram account as of October 2020 and both its GroupMe and email Listserv consistently maintain about 70 members, but each semester to date no more than ten people have volunteered more frequently than on a monthly basis. Food recoveries are somewhat complicated and involve a relatively high level of responsibility. The vast majority of the food recovered by WKUFRN is delivered to nonprofit organizations off campus, requiring many of the volunteers to use their personal vehicles to deliver donations. New potential volunteers may be intimidated by what they perceive as a steep learning curve. However, during the Fall 2020 semester the number of new volunteers has been steadily rising and many new volunteers have continued to volunteer week after week, so this trend may be changing.

Another major challenge has been human error. At times when I am unavailable and other volunteers have recovered food, problems have arisen because volunteers are not able to contact me with questions. This has led to problems such as volunteers not arriving at restaurants to recover food before the restaurants close, thus leading to the surplus food and the volunteers' time being wasted. Volunteers also sometimes do not record or report data about recoveries, leading to some uncertainty in the total numbers of all-time volunteers and pounds of food recovered.

Packaging the surplus food that we recover has become another challenge. WKUFRN must provide all of the packaging for food that is not already packaged (for example, bagels from Einstein Bros. Bagels or loaves of bread from Subway). Funding for this packaging comes from club members or outside sources of money, such as grants.

Plastic bags are by far the cheapest, most food safe, and most convenient material in which to package food. However, the use of plastic is incredibly environmentally detrimental. Environmental protection is one of WKUFRN's missions; our use of plastic bags calls our ability to fulfill that mission into question. WKUFRN has explored a few alternatives to plastic bags. Paper bags are biodegradable and thus have a lesser environmental footprint, but they do not keep food as fresh. WKUFRN owns several large reusable containers, but we do not have a convenient way to sanitize them and we have lost multiple of our reusable containers after loaning them to nonprofits. The option that seems most sustainable and efficient would be to use biodegradable and compostable bags, but these are much more expensive than plastic bags. WKUFRN does not currently have the funding to make replacing plastic bags with compostable bags fully possible.

One of the biggest challenges associated with WKU Food Recovery is the level of responsibility associated with running it. WKUFRN volunteers often conduct ten or more recoveries per week. The president of WKUFRN must organize or lead each of these recoveries. As a student-run organization, WKUFRN will always be limited by the time constraints that school enrollment, jobs, and other commitments place upon leadership and volunteers.

The COVID-19 pandemic has brought multiple unforeseen challenges to the food recovery program. The first challenge came when WKU suspended in-person classes in March 2020. WKU Food Recovery ceased its typical operations for the spring semester, as the restaurants from which we normally recovered were closed. However, in the two weeks immediately following the announcement that classes would not return to an in-person format until the fall, I was called upon to orchestrate the recovery of hundreds of

pounds of perishable foodstuffs that would expire before the WKU Restaurant Group could resume operations in the summer or fall. Prior to the onset of COVID-19, the largest recovery I had organized was 70 pounds. The abrupt closure of dining facilities necessitated the formation of relationships with several new nonprofits.

In the fall of 2020, other challenges arose because of the continuing COVID-19 pandemic. Two of the nonprofit organizations with which WKU Food Recovery had the most long-lasting and strong partnerships, Christ Episcopal Church and MEALS INC, ceased operations because of concerns about spreading the COVID-19 virus through their feeding programs. Whether WKU Food Recovery itself would be able to operate in the fall was uncertain until within two weeks before the semester began. It was challenging to identify nonprofits that were still willing to accept donations of prepared foods during the COVID-19 pandemic. The pandemic also caused the population of students dining on campus to drop drastically, leading to a large gap between supply and demand in the first week of the semester. During the first week of the fall semester 2020, we recovered 361 pounds of food, compared to 65 total pounds recovered in the first week of the previous semester. While it was stressful and difficult for the volunteers of WKU Food Recovery to complete the additional recoveries and identify recipients for hundreds of pounds of food the day-of, these challenges were ultimately beneficial. WKUFRN formed working relationships with several dining locations (Pit Stop and Garrett Food Court) in the first week of school that have resulted in regular food recoveries since.

Although transmission of the virus via a recovery is a frightening and prescient concern, the volunteers of WKUFRN have decided that continuing to recover food, whilst following all applicable safety precautions, such as regular and thorough hand

washing; wearing of gloves, masks, and hair coverings whenever food is handled; and social distancing, is worth the risk. The rate of food insecurity is rising globally because of the pandemic, which has disrupted food supply chains and devastated livelihoods. Fortunately, awareness of food insecurity and food waste have been rising as well as news media have highlighted the problems caused by the pandemic. The increased awareness has motivated many students to begin volunteering with WKUFRN and has increased the dining staff's understanding and appreciation of the importance of our food recovery program.

SUSTAINABILITY OF THE PROGRAM

The sustainability of the program ultimately cannot be guaranteed. Numerous schools have hosted active food recovery programs for several years that have subsequently disappeared after their founding members graduate. However, I have done my best to prepare for the future. Since I first began thinking about forming a food recovery program, I have kept the longevity of the program at the forefront of my mind. The sustainability of WKU Food Recovery depends on the transfer of information and the continued participation of dedicated volunteers. My replacement as president has been selected and has spent this semester preparing to take over. I have compiled a master guide of procedures, tips, and contacts to pass on to my successor, which is stored in a Google Doc associated with a Gmail account (wkufoodrecovery@gmail.com) specifically created for the club. As long as the username and password of the Gmail account are passed from one president to the next, members of the organization will be able to access the information stored in the master guide. The master guide includes information about the resources possessed by the club, such as the club's funds and materials for packaging and transporting food donations.

The future of the WKU Food Recovery program also depends on the continued participation and dedication of volunteers. After graduation, I will continue to offer my support to the student volunteers in an advisory role. I am working with other active members of WKU Food Recovery to form relationships with other student organizations

I am currently employed by Glean Kentucky, a nonprofit organization that recovers fresh produce from farms, gardens, and grocery stores, as the Western and South-Central Kentucky Field Coordinator. For this position I am developing a gleaning program in the area surrounding Bowling Green. I will continue to build a food recovery infrastructure through my job with Glean Kentucky. The Glean Kentucky program and WKUFRN program will develop interconnections and support each other over time, providing better odds for the chance of success of both programs.

CONCLUSION

In its two years of existence, the Food Recovery Network chapter at Western Kentucky University has grown from a small operation that recovered food twice a week from one restaurant to a well-established fixture of the campus community that mobilizes a wide range of dedicated student volunteers to recover food from five dining locations each week. In that time WKUFRN has recovered and redistributed about two and a half tons of food that would otherwise have gone to waste, reducing the WKU community's environmental impact and feeding people in need in the Bowling Green community. A well-established framework exists for future volunteers and student leaders to sustain WKUFRN in the future.

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