

**FOOD WASTE CASE STUDY: EMPOWER CITIES TO PREVENT, RESCUE, AND RECYCLE**

# DREXEL FOOD LAB

## CONVERTING SURPLUS FOOD TO VALUE-ADDED FOOD PRODUCTS



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**LOCATION:**  
Philadelphia, PA

**DATE STARTED:**  
March 2014

**LEAD ORGANIZATION NAME:**  
Drexel University Food Lab

**ORGANIZATION TYPE:**  
University

**TYPE OF FOOD:**  
Unsold supermarket food, focusing on produce and bakery items

**STRATEGY IN A NUTSHELL:**  
Designing low-cost, easy recipes to add value to surplus supermarket food to feed people; create a profitable microenterprise model and create job

**TECHNOLOGY/EQUIPMENT USED:**  
Standard commercial kitchen equipment

**AVAILABLE LOCAL PRODUCE IDENTIFIED FOR REPURPOSING:**  
35,000 pounds per month from 11 Philadelphia-based supermarkets

### THE CHALLENGE AND OPPORTUNITY

Each year, more than 10 percent of retail food—a total of about 43 billion pounds—goes unsold across the United States.<sup>1</sup> The vast majority of retail food loss consists of perishable items, such as baked goods, produce, meat, seafood, and prepared foods. Supermarkets lose approximately \$15 billion each year in unsold fruits and vegetables alone, according to the U.S. Department of Agriculture (USDA).<sup>2</sup> In total, \$218 billion worth of food is wasted in the United States each year, the majority of which is discarded by grocery stores, restaurants, food-service companies, or individuals at home.

Grocery retailers and food wholesalers have historically viewed food waste as an unavoidable part of doing business or even as an indicator that a store is meeting quality control and full-shelf standards. Retailers generally encourage store clerks to remove blemished items and fully stock shelves at all times.<sup>3</sup>

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“The reality as a regional grocery manager is, if you see a store that has really low waste in its perishables, you are worried,” says a former president of Trader Joe’s. “If a store has low waste numbers, it can be a sign that they aren’t fully in stock and that the customer experience is suffering.”<sup>4</sup>

The USDA estimates that in 2010, retail-level losses represented 10 percent of the available food supply, including 12 percent for fresh fruit and 10 percent for fresh vegetables.<sup>5</sup> However, losses vary for individual crops from year to year. In 2005 and 2006, losses varied from 0.06 percent for sweet corn to as high as 63 percent for mustard greens.<sup>6</sup>

The vast majority of discarded food ends up in landfills, where it decomposes and emits methane, which contributes to global warming. Meanwhile, millions of Americans face food insecurity. Just 30 percent of the food wasted each year in the United States would be enough to feed 50 million people their entire diet, highlighting the importance of channeling food that otherwise might be discarded to productive use. In light of this, Drexel University is working on ways to better distribute rescued food by developing simple recipes that incorporate commonly discarded produce. Based on this strategy, the Drexel Food Lab has built a creative business model to repurpose rescued food from grocery stores.

## RECIPE FOR SUCCESS

Founded in 2014, the Drexel Food Lab is a research group of faculty and students from Drexel University’s Culinary Arts and Food Science department. The group aims to solve real-world problems through recipe development, product development, and social entrepreneurship opportunities. In March 2014, the Drexel Food Lab partnered with the U.S. Environmental Protection Agency and Brown’s Super Stores, a Philadelphia-based supermarket chain, to identify priority items that could be used in creative recipes for use in shelters and other local hunger relief organizations.

The Drexel Food Lab started by studying the most commonly wasted food items across Brown’s Super Stores’ 11 locations. In April 2015, the Food Lab sampled from 68,039 pounds of surplus food destined for compost, landfill, or donation, including 34,870 pounds (more than 50 percent) of highly perishable fresh produce. The Food Lab’s analysis found that 25 percent of the donated produce was unusable because of mold, bruising, or extensive browning by the time it reached the shelters.

“Meats can easily be protected and frozen in their existing packaging before the marked sell-by dates, then distributed for defrosting right before cooking and serving at a shelter,” explains Jonathan Deutsch, a Drexel Food Lab participant and professor of Culinary Arts and Food Science. “However, it’s not easy to do the same with perishable produce.”

The Food Lab found that another 8 to 10 percent of the remaining usable produce was undamaged, but comprised of a mix of specialty items, such as prickly pear cactus or

kumquats, that were not recovered in high enough volumes to process cost-effectively. This reduced the total volume of usable food extracted from the sample to 22,665 pounds – 33 percent of the original volume of surplus food, some of which could be used whole without any processing.<sup>7</sup>

Next, the Drexel Food Lab gathered feedback from local community shelters on the effectiveness of existing food donations. The feedback confirmed that shelters are unable to use approximately one-third of the most frequently donated product—fragile excess supermarket produce.<sup>8</sup> This produce can be bruised, overripe, or even moldy by the time it reaches shelters or it can be difficult to incorporate into a meal before becoming unusable. The Food Lab also found that shelters are hesitant to accept large volumes of bakery items, the second most frequently donated type of food, because many bakery items are not very nutritious. Making foods that are high in sugar or sodium content abundantly available to the food insecure may perpetuate the very types of inequities, such as lack of access to healthy food, that emergency feeding sites are struggling to overcome.

Drexel identified a fundamental problem: a significant portion of excess produce was not usable and baked items were available in quantities greatly exceeding what was needed. In addition, if shelters are unable to serve donated food, they have to dispose of it, increasing their labor and disposal costs. The Drexel Food Lab realized that these foods could be turned into a valuable asset and that unless these donations could be repurposed into wholesome, desirable foods, disposal costs are being shifted from supermarkets to small nonprofit organizations. This unintentionally subsidizes businesses that are participating in food donation programs with the best of intentions.

Informed by this research, the Drexel Food Lab developed simple, low-cost recipes for repurposing the most commonly donated produce and bakery items into value-added food products, such as veggie chips, jams, granola bars, and smoothie bases. Lab students designed the recipes to include ripe and sometimes bruised surplus produce like bananas, leafy greens, and sweet potatoes as bases.

“We took unsold brown bananas, peeled them, and blended them with water to create a banana smoothie base,” says Deutsch. The smoothie base can easily be served at community shelters, or sold in supermarkets. “If some of the smoothie base is also sold at wholesale prices back to the grocery store, it could be sold at nearly double the cost of producing it and fund ongoing operations of any organization repurposing wasted food using our recipes,” adds Deutsch. “The simple, repurposed smoothie base, made from the store’s own bananas, would also replace the more expensive processed alternative made with high fructose corn syrup currently sold in food-service channels.”

In mid-2015, the Drexel Food Lab tested its recipes at local shelters, such as Lutheran Settlement House and My Brother’s House, and received overwhelmingly positive feedback. To expand the scale and impact of this project,

Drexel then began mapping out a replicable and profitable business model for repurposing excess supermarket food that would also support local jobs and entrepreneurs across the United States. This model could be implemented by food rescue organizations as a revenue generator, by community shelters for using items they might otherwise discard, or by grocery businesses as a new line in the prepared foods department.

The business plan incorporates inexpensive or donated surplus food so that the price of final products can compete with those of popular foods in underserved, lower-income neighborhoods. For example, as an alternative to using donated produce, businesses could purchase surplus produce at a reduced price of \$0.25 per pound and local workers could make it into value-added products. A percentage of these products can be donated to local shelters, with the rest sold back to the supermarket it came from or other community-based retailers. Drexel has found that a wholesale price averaging \$2.00 per pound may be possible for a variety of foods, such as frozen desserts, snacks, and beverages. Drexel estimates that retailers could sell these final products for more than \$4 each, generating approximately \$90,000 in monthly gross revenue based on estimates of total usable donated food, enough to pay a wage that could support a family to several employees.<sup>9</sup> For supermarkets, this model could also reduce waste disposal expenses and create an additional revenue stream from selling healthy products, all while supporting local jobs that recycled wages back into the local economy.

The Drexel Food Lab hopes its collection of recipes and its insights into viable business models will encourage food retailers nationwide to repurpose excess food into value-added products. To that end, Drexel is providing its expertise to a broad range of clients.

“Helping our clients see the opportunities of repurposing food that was previously being discarded is an exciting challenge,” says Alexandra Zeitz, manager of the Drexel Food Lab. Drexel has helped retailers find new uses for healthy, high-quality food that previously had been going to waste. For example, through a collaboration with the food distributor Baldor Specialty Foods, Drexel developed applications for dried vegetable blends for culinary and food-service applications, such as a muffin that contains a full serving of vegetables, designed to be served in Boston public schools.

Drexel has also worked with Philabundance Community Kitchen (PCK) to develop value-added products from surplus food. In a pilot program, PCK had workforce trainees produce Rescued Relish®, made from surplus food, at PCK’s food bank. PCK then distributed the product through three channels: donations, discounted sales at the food bank’s supermarket, Fare & Square, and sales at premium prices at co-ops and food stores with a good food mission. This allows PCK to generate revenue to cover some of its costs.

To promote the Lab’s work, Deutsch and four colleagues published a research paper about the Food Lab’s business model in the July 2015 issue of *Journal of Food and Nutrition Sciences*.

“An important way to address global food security is to make better use of the food already produced,” according to the report. This business model “could help relieve chronic hunger and address the cost barriers that prevent these important sources of healthy dietary nutrients from reaching lower-income people in the United States.”<sup>10</sup>

Researchers have found that, nationwide, produce is sold from 37,716 large supermarkets, from which 1.1 billion pounds of surplus produce is available annually that could be used as ingredients for producing high-value food products, according to the Food Marketing Institute.<sup>11 12</sup>

## KEY SUCCESS FACTORS

### TRACK DONATED FOOD AND ADAPT RECIPES BASED ON MOST

**COMMONLY DONATED FOOD.** The Drexel Food Lab’s recipes have been a success thanks to the lab’s detailed research into Brown’s Super Stores food donations and analysis of waste in shelters. Organizations that donate food should regularly track the volume and types of food donated by location throughout the year so that recipes can incorporate the most frequently donated ingredients by season and donation source. Partnering with local grocers like Brown’s Super Stores and other large surplus food generators who are willing to openly share their data is critical to understanding what types of surplus foods are available for donation and value-added processing.

**DESIGN SIMPLE-TO-FOLLOW RECIPES.** “[Drexel Food Lab’s recipes are] intentionally easy to prepare to preserve the natural health benefits of the produce and to help provide jobs for those in need,” explains Deutsch. “Combining recovered food with low-cost, easy recipes provides a stronger and more profitable business opportunity for more supermarkets, shelters, or other organizations to replicate.” Simple recipes also allow organizations to hire from a wider range of local workers who do not necessarily have kitchen experience but can contribute with minimal training.

### USE HEALTHY, READILY AVAILABLE, AND LOW-COST INGREDIENTS

**TO ENSURE RECIPES ARE REPLICABLE.** Recipes should use inexpensive, readily available, and healthy ingredients so that they are universally accessible and affordable. Examples of ideal low-cost ingredients include water, rice, garlic, salt, and pepper.

### INTEGRATE ALL PARTNERS CONNECTED TO FOOD DONATIONS TO CREATE A STRONGER MODEL.

“The Drexel Food Lab approach considers food waste from the perspective of many local stakeholders in order to discover all possible economic, social, and environmental benefits,” says Deutsch. “Based on our ongoing research into the fate of wholesome fruits and vegetables discarded from grocery stores, we are encouraged that the economic opportunities may launch new methods to reduce all of the various impacts of food waste, while creating new sources of healthy foods and jobs where both are in high demand. This represents an expanded sustainability model sensitive to new elements of the food system that are linking nutrition to social, economic, and environmental development.”

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**CONSISTENT SUPPLY AND EFFECTIVE DISTRIBUTION OF RECOVERED FOOD AT SCALE.** “With a conservative estimate of a billion pounds of edible produce lost each year from retail sources alone based on Food Marketing Institute reports, the quantity of supply is not an issue,” says Deutsch. “However, arranging for distribution from supermarkets at a high-enough volume may limit the locations for higher-volume commercial repurposing.” To address this challenge, Drexel expanded beyond working with retailers to include wholesalers and distributors to obtain greater volumes of surplus produce.

### SUPPORTING ROLES FOR CITIES

**ENGAGE LOCAL BUSINESSES AND COMMUNITY ORGANIZATIONS.** The Drexel Food Lab’s research and recipes are great resources that cities can promote to retailers and hunger relief organizations. The resources can contribute to a strategy for engaging local food retailers and other high-volume donation sources. This can lead to partnerships that increase the effectiveness of food donation systems and processes.

**LEAD BY EXAMPLE.** Cities can review their own procurement practices for ways to increase the procurement of cosmetically imperfect foods, repurposed ingredients, and value-added items. By exercising their own purchasing power, cities can help drive market uptake of menu items that use surplus food.

**EXPAND FOOD RECOVERY AND INFRASTRUCTURE CAPACITY.** Surveying local food assistance organizations about their food needs is a great way to identify gaps and opportunities. This can help cities and partner organizations develop strategies to fill the gaps and facilitate expanded food rescue.

### EQUITY IMPACT

**UNDERSTAND THE NEEDS OF DONATION RECIPIENTS.** Drexel’s direct collaboration with local shelters to understand their needs contributed to the development of practical resources that were relevant to the shelters’ needs. By gathering their feedback, Drexel was able to hone strategies to maximize the value and nutritional benefit of available foods.

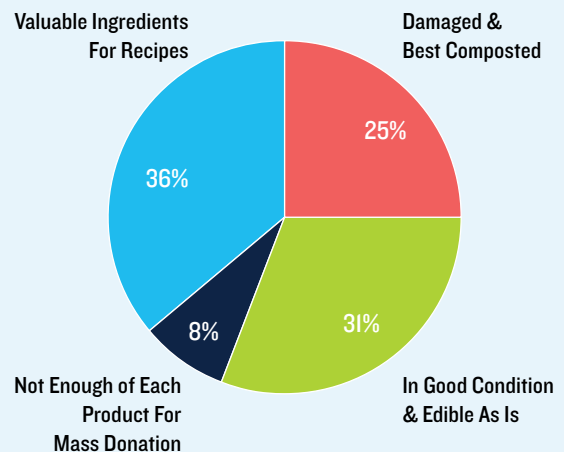
**FOCUS ON HEALTHY AND APPEALING RECIPE OPTIONS.** The Drexel Food Lab focused on developing healthy and appealing recipes and products. For example, in the past, some shelters and soup kitchens received and served blemished or overripe bananas that were healthy, but not appetizing. To both

extend the life of the bananas and create a compelling food product, Drexel Labs developed a banana smoothie base that can be made from overripe bananas rescued from disposal. The smoothies can be easily transported to and served at community shelters as a better quality product than overripe or bruised bananas. In another example, Drexel Food Lab developed a relish using surplus vegetables that is both provided to shelters and sold at high-end food markets. By producing food from surplus that appeals to both premium and subsidized markets, Drexel Food Lab is tackling the stigma that can be associated with repurposed food items.

### ABOUT THE DREXEL FOOD LAB

The Drexel Food Lab is an interdisciplinary research group within Drexel University’s Culinary Arts and Food Science department that aims to solve real-world problems with recipe and product development. It is made up of approximately 20 undergraduate and graduate students working on projects for the food industry, government, and nonprofit partners, as well as its own commercially viable products. The Food Lab is funded by philanthropy, contracts with private-sector partners, collaborative grants stemming from pro bono work, and revenue from developed food products.

### Excess Brown’s Super Stores Produce





## DREXEL FOOD LAB STUDY OF THE VALUE OF EXCESS SUPERMARKET PRODUCE FOR REUSE

According to the Drexel Food Lab's study of discarded Brown's Super Stores produce, approximately one-third should be composted because it is excessively bruised or moldy, or is insufficient quantities of certain item to make sense to donate. Two-thirds of the discarded produce is recoverable for consumption.

### SAMPLE RECIPES FROM THE DREXEL FOOD LAB

#### ICEBERG STIR-FRY

(ideal for repurposing wilted iceberg lettuce, disfigured carrots, and bruised onions)

##### INGREDIENTS:

- 2 cups rice, cooked
- 1 tablespoon olive oil
- 1 head iceberg lettuce, shredded
- 1 carrot, julienned
- 1 medium onion, sliced
- 1/2 cup soy sauce
- 1/2 cup sugar

##### INSTRUCTIONS:

1. In a sauté pan, heat oil. Add carrots and onion and sauté until soft.
2. Add the iceberg lettuce and stir to combine with the onions and carrots.
3. Add the rice, soy sauce, and sugar. Stir to combine and allow flavors to blend.
4. Cook for 5 minutes and serve.

*(Recipe developed by Drexel student Peter Schoemer.)*

#### EGGPLANT STEW

(ideal for repurposing bruised peppers, eggplant, fennel, and tomatoes)

##### INGREDIENTS:

- 1 tablespoon olive oil
- 1 small onion, sliced
- 1 clove of garlic, minced
- 1 green pepper, sliced
- 1 red pepper, sliced
- 1 small bulb of fennel, cored and sliced thin
- 1 small eggplant, diced into large pieces, about 2 cups
- 1 sprig of rosemary
- 2 cups canned, whole tomatoes (or fresh)
- Salt and pepper to taste

##### INSTRUCTIONS:

1. Add olive oil to a large sauté pan over medium heat. Add onions and sauté until translucent, about 5 minutes. Add garlic and sauté until fragrant.
2. Add red and green peppers and fennel. Sauté until slightly softened. Add eggplant and cook for five minutes. Add tomatoes and rosemary. Season with salt and pepper.
3. Simmer stew for 15 minutes until thickened and eggplant is tender. Remove the rosemary sprig from the stew and serve immediately.

*(Recipe developed by Drexel student Silvia Pinto.)*

#### BANANA ICE CREAM

Main ingredient: bananas  
Prep time: 15 minutes  
Serves: 4

- 4 overripe bananas, peeled and frozen
- 1/4 cup milk or water
- 1 tablespoon honey or agave nectar

1. In a food processor, place frozen bananas, milk, and honey. Pulse until the bananas break down and become light and smooth. Pour ice cream into an airtight container.
2. Freeze ice cream for 2 hours before serving.

*(Recipe developed by Alexandra Zeitz, Drexel Food Lab)*

## ENDNOTES

- 1 J.C. Buzby et al., "The Value of Retail- and Consumer-Level Fruit and Vegetable Losses in the United States," *The Journal of Consumer Affairs* 45, no. 3 (2011), p. 492-515.
- 2 Dana Gunders, NRDC, *Wasted: How America Is Losing up to 40 Percent of its Food from Farm to Fork to Landfill*, 2017, <https://www.nrdc.org/sites/default/files/wasted-2017-executive-summary.pdf>.
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- 4 Ibid.
- 5 J.C. Buzby et al., *The Estimated Amount, Value, and Calories of Postharvest Food Losses at the Retail and Consumer Levels in the United States* (U.S. Department of Agriculture, Economic Research Service, 2014) EIB-121.
- 6 J.C. Buzby et al., *Supermarket Loss Estimates for Fresh Fruit, Vegetables, Meat, Poultry, and Seafood and Their Use in the ERS Loss-Adjusted Food Availability Data* (U.S. Department of Agriculture, Economic Research Service, 2009) EIB-44.
- 7 T.H. O'Donnell et al., "New Sustainable Market Opportunities for Surplus Food: A Food System-Sensitive Methodology (FSSM)," *Food and Nutrition Sciences*, 6, (2015) p. 883-892. <http://dx.doi.org/10.4236/fns.2015.610093>.
- 8 Ibid.
- 9 T.H. O'Donnell et al., "New Sustainable Market Opportunities for Surplus Food: A Food System-Sensitive Methodology (FSSM)," *Food and Nutrition Sciences*, 6, (2015) p. 883-892. <http://dx.doi.org/10.4236/fns.2015.610093>.
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- 12 T.H. O'Donnell et al., "New Sustainable Market Opportunities for Surplus Food: A Food System-Sensitive Methodology (FSSM)," *Food and Nutrition Sciences*, 6, (2015) p. 883-892. <http://dx.doi.org/10.4236/fns.2015.610093>.

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