Spent Grain
Creative Waste Solutions

Authors
Lorenza Zebell
Erica Deming
Jake Heitland
Table of Contents

So what are spent grains anyway? 4
An overview of spent grains and why wasting them matters.

Spent grain nutrition 6
See how spent grains can actually make food healthier.

Options to reuse spent grain:

1 From beer to bread! 8
Learn about how to use spent grains in baked goods.

2 Turning waste into a business 12
Read case studies of successful businesses using spent grains.

3 Other sustainable uses 14
Find out how breweries are putting their spent grains to other creative uses.

Next Steps 16
Simple tips on how to get started resusing spent grains.
Introduction

Why wasted food matters

In America, it is estimated that 31-40 percent of all food produced is wasted each year. The Food and Agriculture Organization of the United Nations estimates that North Americans waste 1520 kcal/capita/day. That’s three fourths of a healthy 2,000 kcal diet wasted, while one in six Americans still struggle with hunger. Because of this carelessness, wasted food is the largest part of municipal solid waste in U.S. landfills. The organic material decomposing in landfills releases the powerful greenhouse gas methane, contributing to 16% of the U.S.’s greenhouse gas emissions. These factors make food waste a unique opportunity to address social and environmental issues.
“6 billion pounds of brewers grains are produced in the United States each year, and much of that simply gets landfilled.”
So what are spent grains anyway?

Brewing Waste

Spent grains, also known as brewer’s grains, are the coproduct of brewing beer. They may comprise of wheat, maize, rice, sorghum, millet, or barley, the most commonly used in the United States. At the beginning of the brewing process, the grains are milled (crushed) and soaked in water, which absorbs the sugars. The resulting sugary liquid, wort, is drained away, brewed with hops, and fermented. The grains exit the process at an early stage, and never come into contact with alcohol.

The grains are wet and drained of sugars, but are still good sources of fiber and protein. Some researchers even claim that this makes for a healthier bread (fewer sugars, fewer calories).

Traditionally, brewers have allowed farmers to pick up grains for supplemental animal feed. However, many growing breweries are finding it increasingly difficult to give all of their grains to farmers, and resort to disposal. With six billion pounds of brewers grains produced in the United States each year, that’s a lot of waste! For every six pack of beer, one pound of grains are generated, much of which is landfilled.

Today, breweries, bakeries, and home-brewers are realizing the potential in these grains and redirecting them for human consumption. In alignment with the FDA’s food recovery hierarchy, we feel that redirecting these grains from animal feed to human use is a more valuable use of calories. In this guide we illustrate several options for reuse of these grains. We hope to inspire innovative breweries and bakeries to prevent this massive waste and use spent grains to their highest potential!

**EPA Food Recovery Hierarchy**

In this guide we refer to this hierarchy when analyzing the virtue of a spent grain reuse method. Because less beer is not an option, we see feeding people as the best alternative!
According to a report by the Journal of Cereal Science, replacing regular flour with spent grain in a loaf of bread will double the fiber content, increase the protein content by 50%, increase the essential amino acid content by 10%, and decrease the calories by about 7%. This drastic change in the nutritional content of the bread is truly remarkable, and can be marketed to a specific market segment. Consumers interested in Lifestyles Of Health And Sustainability or LOHAS are a huge and growing segment of the market. With as many as one in four North Americans a part of this group, these incredible nutritional benefits will be attractive to many people. Additionally, reusing spent grains as a sustainable food waste solution appeals to the environmentally-conscious consumer. Turn the page to learn that while spent grains are healthy and sustainable, they’re also tasty!
When replacing regular white flour in a standard loaf of bread, spent grains will...

- double the fiber content
- decrease the calorie content 7%
- increase the protein content 50%
- increase the essential amino acid content 10%
From beer to bread!

Creative & delicious uses in the kitchen

Spent grain open up lots of creative ways to rework beloved recipes. Use a batch of chocolate stout in a pan of brownies, or grains from a nut brown stout in your old banana bread recipe! You can use spent grain in as many recipes as you can use flour; when dehydrated and ground, spent grains become just that! We want to highlight a few that do not require these longer steps. Here is just a taste of the many recipes that incorporate the moisture and texture of spent grains straight from the brewery for a flavorful new result.

German Beer Bread

Who better to ask how to bake bread with brewer’s grains than Germany? This simple recipe includes almost a full bottle of beer, and results in a flavorful loaf with a satisfyingly crispy crust.

**Ingredients**

- 1 cup fresh spent grains
- 2 cups white flour
- 8 ½ oz. beer
- 1 packet yeast
- 1 Tsp. salt

**Instructions**

Mix everything but the salt together. Let rise for one hour. Stir in salt. Let rise for fifteen more minutes. Bake in buttered bread pan at 430 degrees Fahrenheit for an hour.
Brownies, spent grain style!

You could hide anything in a brownie, but spent grains actually make them better! This recipe creates a thick, textured brownie that’s satisfying to bite into.

**Ingredients**
- ½ cup butter
- 1 cup sugar
- ¼ Tsp. salt
- 1 cup cocoa powder
- 1 Tsp. vanilla extract
- 2 eggs
- ½ cup white flour
- ½ cup wet spent grains
- ½ cup chocolate chips

**Instructions**
Melt butter and stir with sugar and salt. Stir in cocoa powder, then the eggs and vanilla. Stir in white flour and mix well. Add wet spent grains. Add water if batter is too thick to spread to make a runny batter. Bake in a greased 8”x8” pan at 350 degrees F for 35 to 40 minutes.
Banana Bread

This seemingly ordinary banana bread recipe becomes something completely new with spent grains! Namely, a hearty, textured short bread with a delicious nutty flavor.

**Ingredients**

- 1 cup spent grains
- ¾ cup all purpose flour
- 2 Tsp. baking powder
- ½ Tsp. salt
- 5 T. butter
- ¾ cup sugar
- 2 over-ripe bananas
- 2 eggs
- ½ cup chocolate chips

**Instructions**

Mix together wet ingredients in one bowl and the dry ingredients in another. Add the dry mixture to the wet ingredients. Add chocolate chips. Pour into buttered loaf pan and bake at 350 degrees F for about 30 minutes.
Drunk Pizza

**Ingredients**
- 1 packet active dry yeast
- ½ cup warm water at 110 degrees F
- 1 ½ cups flour
- ¾ cup spent grain
- 1 ½ Tspn salt
- Olive oil

**Instructions**
Gently mix yeast into water, let sit for five minutes to bubble. Add flour, spent grain and salt mixture and knead by hand or with mixer for 8 to 10 minutes.

Place dough in a bowl lined with olive oil. Cover with a towel and leave in warm place for about two hours.

Shape dough into pizza crust shape over floured pizza pan or stone. Add toppings and bake at 475 degrees F for about 20 minutes.

Spent Grain Flour

**Ingredients**
The spent grains of your choice!

**Instructions**
Set your oven to its lowest setting (170-200 degrees). Spread out the grain in a 1/4 inch thick layer on a pan. Any thicker and the grains may not dry properly, so keep it thin.

Dry the grains in the oven for about 7 hours. You can also use a food dehydrator.

Toss about halfway through the 7 hours. This seven hours will vary depending on the humidity of your area. More humidity and you will need more time. The grains are done when they are completely dry!

A coffee grinder, spice grinder, or food processor will grind the grain into a flour.

The flour can be stored and used like normal flour! We recommend an airtight container in a dark place. This flour will keep as long as regular flour, so up to 2 years!
Overview

The US generates six billion pounds of spent grains every year! In the wake of so much waste, bakeries, breweries, and home-brewers are finding new ways to incorporate these grains in their businesses. Bakers have partnered with brewers for access to the plentiful grains, creating new and healthy snacks for their shops. Our vision is a closed loop system in which brewers and bakers share spent grains and baked goods; both businesses profit from a novel product and work to mitigate food waste all at once! The following page provides an overview of three business ventures that repurpose spent grains in unique ways.
Regrained

A number of entrepreneurs have built their business on the growing interest in spent grains. One such company, Regrained, is a San Francisco start-up that collects spent grain from local breweries to bake into granola bars. They market their business as a sustainable and ethical project grounded in local activism with their mantra “Brew good. Eat good. Do good.”

They partner with local breweries, incorporate organic ingredients, and strive to use sustainable packaging. They’ve identified urban breweries as particularly suited to their market model, as they are often too distant to give their grains to farmers. However, they currently occupy a narrow corner of that market, limited by size, locality and high prices. There is still plenty of room for more spent grain entrepreneurs!

Brew Bones

California residents Heloise Love and Jennifer McFadden started Brew Bones, a spent grain dog biscuit business, when Love’s older dog contracted a rash as a result of commercially-made dog food. Love solved the issue by switching her pup to a homemade biscuit diet. Love and McFadden decided to make a business out of the biscuits to bring healthy treats to dogs everywhere.

They pride themselves on the short ingredient list of their biscuits, just peanut butter, brown-rice flour and flaxseed meal, and spent barley grains supplied by local breweries. The company has grown quickly, selling dog treats on location in seven states as well as online.

Hewn Bakery

Hewn Bakery is an artisan bakery run by classically-trained chef Ellen King and businesswoman Julie Matthei in Evanston, Illinois. Their mission is to provide sustainable preservative, chemical, and additive-free bread to their community. They use 100% organic ingredients, and bake bread in a traditional stone oven.

The bakery features a spent grain bread as a regular part of their offering, and report major success with it. Their use of spent grain proves that bakeries can source spent grains from local breweries inexpensively and incorporate them into their regular breads with great success!
For as long as beer has been brewed, brewers and farmers have worked closely together. In this age-old friendship, farmers collect brewers’ grains at little or no cost. It’s a match made in heaven: farmers get a nutritious and cheap food source for cows and pigs, and brewers are saved the trouble of disposing of the seemingly useless coproduct of brewing. In comparison to a compost pile, an incinerator, an anaerobic digester or the landfill, animal feed is a better destination for spent grains, because it brings some of their nutrients back into the system. However, we find that breweries are outgrowing this relationship, leading to more spent grain waste. For urban breweries, the distance from rural farms has impeded a feasible partnership, given that the highly perishable wet grains cannot travel too far. Most of all, we are concerned with redirecting spent grains to human consumption, the most valuable use of this overlooked food source.
Energy

Deriving energy from spent grain waste is the next most sustainable option. One innovative brewery is closing the loop on their spent grain waste flow and directing it right back into their operation by turning it into energy! Tired of the expensive process of drying their grains and shipping them out to farms, the Alaskan Brewing Co. purchased a custom $1.8 million furnace that burns their spent grains, making steam that powers most of their brewery. This system offsets the brewery’s energy costs by nearly $450,000 each year. That’s about a 70% savings!

This closed loop design is a unique solution; however, on the EPA Food Recovery Hierarchy incineration is the least desirable form of waste recovery. However, given the brewery’s fairly remote location in Juneau, Alaska, the economic and environmental cost of shipping their grain to farmers for feed makes that an undesirable option as well. A more sustainable option for breweries looking to generate energy out of their spent grains would be through anaerobic digestion, a biological process that breaks down organic material into biogas for energy and a solid co-product that can be used for compost or fertilizer.

Composting

The next most sustainable destination for spent grains is the compost pile. Grains and other organic materials can offer up nutritious fertilizer perfect for gardens and urban greenhouses all across the country. The Milwaukee Brewing Company understands this well, as they give their spent grains to Growing Power, a national nonprofit focused on equal access to quality food.

Although this ultimately results in the production of food for human consumption, the energy lost from composting places this option near the bottom of the EPA’s food recovery hierarchy. The least sustainable use of spent grains is tossing them in a landfill!
Next Steps

Brewers

Do you have a brewpub for your brewery? Try incorporating spent grains into your menu. If you source your bread and baked goods from a bakery, talk to them about starting a ‘discount spent grain for discount baked goods’ exchange. If you don’t have a brewpub, try contacting your local bakery and talk to them about spent grain reuse. Who knows, it may be the start of a fruitful partnership! Are you a homebrewer? Save some spent grains from your next batch of beer to bake with.

Bakers

Breweries are a vast resource for a tasty, healthy, and inexpensive ingredient for your bakery. Call up your local breweries and talk about spent grain. It’s possible they need someone to take it off their hands! Making baked goods with spent grain is a simple and novel way to create a unique product.

Find us online at www.gibbs-lab.com/foodwaste to get a digital copy of this report and a contact directory for Wisconsin breweries and bakeries.
To Do:
1. Call Local brewery or bakery
2. Meet to set up a relationship to exchange spent grain
3. Choose how to reuse the grain (bake with it!)
4. Create product
5. Market product as a smart use of waste!
Lorenza Zebell is interested in triple bottom line, systems thinking, management, and most importantly the ways in which these intersect with sustainable development. She is an Operations and Technology Management major at University of Wisconsin Madison, and is also earning a certificate in Sustainability. She has significant experience with creative problem solving and leadership from her time running WSUM 91.7 FM, UW Madison's award winning nonprofit radio station. She’s optimistic and excited for what her future holds!

Erica Deming is majoring in Environmental Studies and Gender and Women's Studies at the University of Wisconsin-Madison. She studied abroad in Germany and Jordan, learning the languages at least well enough to order a Berliner or Falafel. She is excited to work on the food waste issue, because it opens up a unique form of environmental activism that everyone can participate in. In the future, she hopes to continue studying gender and environmental issues, because she believes that they intersect in meaningful ways.

Jake Heitland is a graduating senior at University of Wisconsin - Madison studying Real Estate & Urban Land Economics with an additional Certificate in Sustainability. His passion for creating a greener future through changing perceptions on what the built environment can and should achieve shows as he seeks a career in sustainable development. This resource guide allowed the marriage of two other personal interests - reducing waste and beer - to come to life in a tangible way to create value for those across the industry and start new conversations in a systems thinking manner.
About This Guide

This was created as a part of a University of Wisconsin-Madison environmental capstone class dedicated to mitigating food waste on a local and global level.

For more information and to download a digital copy visit:
www.gibbs-lab.com/foodwaste

Sources:
2Gunders, Dana. “Wasted: How America is losing up to 40 percent of its food from farm to fork to landfill.” Natural Resources Defense Council (2012).
Thank you!