


NEW ENGLAND FEEDING NEW ENGLAND

BACKGROUNDER

# COMMON FOOD SYSTEM CHALLENGES

JULY 2023

# NEW ENGLAND FEEDING NEW ENGLAND


» **Backgrounder: Common Food System Challenges**

Volume 1: Estimating Resilient Eating Patterns

Volume 2: Estimating Production for 30% Regional Self-Reliance

Volume 3: Economic Impact of New England's Food System

Volume 4: Understanding Market Channels and Food Expenditures



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On the cover, clockwise from top left: flooded field in Vermont, July 2023 (Vermont Agency of Agriculture); Littleton Food Co-op in Littleton, New Hampshire (Nicole Cardwell, NHFA); broccoli harvest at Circle B Farms in Caribou, Maine (Circle B Farms); cereal aisle; Hunt Middle School in Burlington, Vermont (Hunger Free Vermont); chickens in compost, (Vermont Farm to Plate).

## What would it take for *30%* of the food consumed in New England to be regionally produced by *2030*?

What will it really take to grow, raise, produce, harvest, and catch more regional food and move it through a complex supply chain to our homes and other places we eat? What do we need to do in the near term, by 2030, to make tangible progress towards this bold goal? How might the increasing and escalating impacts of climate change impact our ability to feed ourselves? What can we do as a region to make our food system more equitable and fair, resilient and reliable? To answer these questions, the **New England State Food System Planners Partnership**—a collaboration between six state-level food system organizations—and Food Solutions New England—who are mobilizing their networks to strengthen and grow the New England regional food system—convened four teams of researchers.

Seven common food system challenges—from risks to long-term food production to limited progress reducing waste food—are explored in this backgrounder. Achieving the goal of New England Feeding New England will be difficult under any circumstances- and will not possible without addressing these seven food system challenges. Addressing these challenges with creativity, coordination, communication, collaboration, investment, and passion is likely the key to meeting our 30% by 2030 goal.

## Researcher


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*Some content for this backgrounder is drawn from Volumes 1 through 4 and the Volume 2 seafood supplement. A full list of New England Feeding New England researchers can be found here:*

https://nefoodsystemplanners.org/projects/research-team/


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# 1 Introduction

## Can the six New England states provide *30%* of their food from regional farms and fisheries by *2030*?

This question guided research conducted by the New England State Food System Planners Partnership to help policy-makers, funders, food system businesses and stakeholders, community groups, and consumers understand the relative resilience of New England's food system. Why does this question matter? After all, America's food and beverage production capacity—farms, fisheries, processors, and manufacturers—is enormous, abundant, and diverse. Food imports from around the world have steadily increased. Our food distribution systems are timely and efficient. Our grocery stores and restaurants are stocked, affordable, and convenient. Even our waste disposal systems are a flush and weekly pickup away.

In most of our lived experiences, we have not had to answer the question—***Where does our food come from?***—with specificity, although our ancestors certainly could. And yet, accumulating evidence indicates that we are entering a new era of human experience. Due to linked challenges that are *simultaneously taking place everywhere across the planet*, Americans will no longer be able to reasonably expect that every food they want will be easily available for them to buy year-round.

## New England Feeding New England

***If where our food comes from suddenly mattered, would New England be prepared with a reliable, safe, and abundant food supply?*** What will it really take to grow, raise, produce, harvest, and catch more regional food and move it through a complex supply chain to our homes and other places where we eat? There are very few examples of long-term planning for healthy, reliable food supplies. Unlike other systems that provide essential goods and services, like energy and water, *no one* is currently in charge of planning and preparing for healthy, reliable, and resilient long-term food supplies.

In 2014, Food Solutions New England published A New England Food Vision, which imagined what it would take to produce 50% of New England's food supply from regional sources by 2060. It found that the region *could* theoretically supply 50% of its food by focusing production on fruits, vegetables, dairy products, and grass-finished meats, while importing the majority of food grains, feed grains, oilseeds, and sweeteners. Based on a target of 2,300 calories per person per day, 4 million additional acres of land in agriculture would be required to do this (about three times more than is currently in active production, although about 6.8 million acres were in cropland and pasture in New England in 1945).

***New England Feeding New England*** updates the analysis from *A New England Food Vision* by exploring opportunities at an intermediate and more easily imaginable range: **what would it take for *30%* of the food consumed in New England to be regionally produced by *2030*?** No single county, state, or region can become food self-*sufficient*. But the quest for increased regional food self-*reliance* is both an investment in our shared future and an insurance policy against future risks, particularly due to climate change.

**We started with 5 key questions about our regional food system and assembled research teams from across New England to answer them:**

1. **What might change if we intentionally and regionally plan for our future, making significant investments in strengthening our regional food system and communities?**

   A regional approach to food system resilience means that we work collectively to adapt, expand, and fortify New England's food production and distribution systems to ensure the availability of adequate, affordable, and culturally appropriate food for all who call New England home.

   Within New England, the northern states have *most of the farmland*, while the southern states have *most of the consumers*. Maine and Vermont hold about 65% of land in agriculture in New England (note that *nearly half* of land in agriculture in New England is woodland). In fact, the county with the most acreage of farmland in New England—Aroostook County, Maine—is the farthest away from the population centers of the region. Massachusetts and Connecticut account for about 69% of New England's population, mostly in the Boston metropolitan region and Connecticut's I-91 and I-95 corridors.

   Moving toward 30x30 will require, for example, enormous investment in retaining and expanding land in agriculture in the northern states, with most of the people, political power, and potential sources of funding based in southern New England. **This dynamic—big population centers in the southern states, and major agricultural production in the northern states—sets the stage for exploring regional food self-reliance.**

   As a collaboration between state-level food system organizations and the region-wide Food Solutions New England network, the New England Feeding New England project provides increased focus for communication, collaboration, and coordination in the region.

2. **If we ate in a healthier, more resilient way, could more of our food be supplied by regional production?**

   **Volume 1: Estimating Resilient Eating Patterns**, discusses how transitioning to a more "resilient eating" pattern, aligned with USDA dietary guidelines presents a daunting challenge for New Englanders. To begin with, reducing the average caloric intake by over 600 calories—from about 2,940 today to 2,320 per day by 2030—would be no easy feat. Under this scenario, the average New Englander would need to reduce meat consumption by over a third, while increasing levels of both seafood and plant protein. We would need to cut our consumption of added fats and sugars in half, while increasing vegetables by 60%, and doubling fruit intake. These changes may not happen in seven years, but they point the way toward a future where the region eats more healthfully and resiliently.

### 3. Could the six New England states meet a goal of supplying 30% of the region's food by 2030?

The regional self-reliance scenarios presented in Volume 2: Estimating Production for 30% Regional Self-Reliance, fell short of the 30% regional food consumption goal if we only utilized our *existing* land in agriculture and fisheries landings. Following current eating patterns (i.e., Unchanged Eating), the region could provide 27% of major food group *servings* by maintaining current production of dairy products and increasing production of vegetables, fruits, grains, and grass-based meat production. Following healthier eating patterns (i.e., Resilient Eating), the region could supply 24% of major food group servings, due to higher consumption of fruits and vegetables. Both scenarios showed increased self-reliance compared to a 2019 baseline of 19% of the major food groups.

New England is most self-reliant with many species of seafood (e.g., clams, flounder, lobster), cranberries, blueberries, maple syrup, barley, rye, potatoes, and dairy products, and least self-reliant in sweeteners, fats and oils, grains, and many types of protein (e.g., pork, chicken, turkey). **Reaching 30% of regional food self-reliance would require bringing approximately 290,000 acres, based on the Unchanged Eating scenario, and 590,000 acres, based on the Resilient Eating scenario, of additional land into production.**

### 4. Do we have the right mix of industries to ramp up food production? What sectors are growing? What sectors are contracting?

Volume 3: Economic Impact of New England's Food System highlights that the economic contribution of New England's food system is significant, **employing about 1 million people (more than 10% of all jobs) and generating $190 billion in sales (11% of New England sales for all industries).** However, agricultural and seafood employment were essentially *flat* and sales were *down* during our period of analysis. Most New Englanders appreciate and value the community of people working together to catch, raise, and grow food across the region. But, we need to be concerned about the future of regional agriculture and fisheries: farmers, farmworkers, and fishermen are crucial—if undersupported—resources. Without their expertise—and a pipeline of new farmers, farmworkers, and fishermen—opportunities for healthy, reliable, and resilient regional food systems are drastically decreased.

### 5. What market channels offer the best opportunities for sourcing regional and local products?

Volume 4: Understanding Market Channels and Food Expenditures describes how our access to food is heavily concentrated in two major market channels: grocery stores and supercenters for food eaten at home, and full-service and limited-service restaurants for food eaten away from home. While substantial progress has been made supporting local and regional food via direct sales (e.g., farmers markets), co-ops, institutional sales (e.g., farm to college), and independent grocery stores, the majority of retail food sales

are made through grocery stores, supercenters, restaurants, and fast food.

**The unsatisfying reality is also that data for local and regional food purchases for most market outlets in New England is very limited.** Even estimating the overall size of the New England retail food market is not without complication. Currently, we estimate that total food and beverage expenditures in New England ranges between $57.4 billion and $87.1 billion. By 2030, food and beverage expenditures are estimated to reach $98.4 billion. On a per capita basis, the average New Englander would currently have to spend between $1,139 and $1,760 on regional food and beverage products per year to reach 30%. By 2030, that amount would increase to $1,890. Given the relative size of its population, Massachusetts would have to do the heavy lifting for the region, spending between $7.9 billion and $12.1 billion to reach 30% currently, and $13.2 billion by 2030.

**Market options are simultaneously ubiquitous and insufficient.** Across New England, there are thousands of outlets—dollar stores are the most common type of chain store in the region—to access food and yet often this food is inaccessible physically, culturally, and economically, to consumers due to a variety of factors. Over the past 15 years in New England, the prevalence of food insecurity has averaged 8.7% on the low end in New Hampshire, and 14.1% on the high end in Maine. Food insecurity in New England is one indicator that food availability alone is not enough.

Photo credit: Pete's Greens

**Dietary patterns...**

**food production...**

Photo credit: RIFPC

Photo credit: Cabot

**economic impacts...**

**...and market channels are analyzed in New England Feeding New England**


Photo credit: CFSA

# Key Findings

## Volume 1

### If we ate in a healthier, more resilient way, could more of our food be supplied by regional production?

TODAY NEW ENGLANDERS EAT ABOUT **2,940** CALORIES PER DAY (INCLUDES ALCOHOL)

THIS IS WELL ABOVE DIETARY GUIDELINES FOR MOST PEOPLE

A SWITCH TO "RESILIENT EATING" WOULD MEAN REDUCING CONSUMPTION BY 600 CALORIES

**2,320** CALORIES PER DAY

*REQUIRES SIGNIFICANTLY MORE*

*REQUIRES SIGNIFICANTLY LESS*

## Volume 2

### Could the six New England states meet a goal of supplying 30% of the region's food by 2030?

NEW ENGLAND'S FARMERS + FISHERMEN COULD MEET **30%** OF SERVINGS FOR A POPULATION GROWING FROM **15.3** MILLION TO **15.6** MILLION

THIS WOULD REQUIRE MAXIMIZING USE OF **401,000** EXISTING UNDERUTILIZED ACRES + **588,000** *ADDITIONAL* ACRES OF CLEARED LAND

## Volume 3

### Do we have the right mix of industries to ramp up food production?

NEW ENGLAND'S FOOD SYSTEM EMPLOYS **1,000,000** PEOPLE = **10%** OF ALL JOBS

AND GENERATES **$190** BILLION IN SALES = **11%** OF ALL SALES

***BUT*** EMPLOYMENT AND SALES IN AGRICULTURE AND FISHERIES ARE *FLAT OR DECLINING*

## Volume 4

### What market channels offer the best opportunities for sourcing local and regional food products?

**4** MARKET OUTLETS → GROCERY STORES, FAST FOOD, RESTAURANTS, WAREHOUSE CLUBS

ACCOUNT FOR **$71.5** BILLION **84%** OF NEW ENGLAND FOOD SALES

ACCESSING THESE MARKETS HAS BEEN CHALLENGING FOR SMALL PRODUCERS

## Common Food System Challenges

**People living in New England have worked hard to feed themselves, their families, and their communities healthy food for millennia.** Indigenous peoples living in this land ate local, regional, and seasonal food—wild game, corn, beans, pumpkins, cranberries, blueberries, maple sugar, seafood—for thousands of years. European colonists also mostly ate local, regional, and seasonal food—albeit from a mix of native and non-native livestock and crop species—for centuries. But, over the past 75 years, the way food is caught, raised, grown, processed, prepared, shared, and consumed has dramatically changed as waves of technological (e.g., refrigeration), societal, economic, and environmental shifts have made our modern world.[1]

This tiny, but momentous, window of change unleashed enormous benefits. New Englanders undeniably gain from linkages to national and global food systems. For example, our taste buds are used to the flavors of imported food and beverages that are challenging to grow in our region: coffee, cacao, tea, bananas, oranges, and more. New England farmers, fishermen, and food businesses benefit by exporting cheese, lobster, ice cream, and other products around the world. Tourism is a major contributor to the regional economy, and a key reason visitors show up is to sample our seafood, farm to table restaurants, craft beer, ice cream, and other culinary offerings.

Like everyone else, however, New Englanders are also vulnerable to the significant risks that the industrialization of food systems has created, whether from an epidemic of diet-related health problems, chronic food insecurity, climate change disasters, and extraordinary economic pressures exerted on small and midsize farms, fisheries, and food businesses.

Common challenges across all food systems include risks to long-term food production, challenges to farm, fishery, and food business viability, rising inequality and stagnant wages, and limited progress on reducing food and nutrition insecurity. Although conditions on the ground vary by local contexts, cultures, and ecologies, every food system on earth is grappling with the seven common food system challenges discussed in this backgrounder:

1. **Lack of Planning for Long-Term Food Supplies:** There are very few examples of long-term planning for healthy, reliable food supplies. *New England Feeding New England* marks one of the first regional approaches to food system planning in the country.

2. **Risks to Long-Term Food Production:** Climate change, land use changes, and lack of equitable access to land for Black, Hispanic/Latino, Indigenous, and others all pose a risk to long-term food production, including in New England.

3. **Challenges to Farm, Fishery, and Food Business Viability:** Market concentration—mergers and acquisitions among food system businesses—limits opportunities for small and midsize farms, fishing operations, and other food businesses in New England to succeed.

4. **Ongoing Exploitation of Food System Workers:** Food system workers, particularly retail and food service workers and farm-workers, experience some of the *lowest wages* of any occupational category in New England, as well as limited benefits.

5. **Limited Progress Reducing Diet-Related Health Problems:** Poor diet is the leading cause of death in the United States.[2] Many diet-related health trends continue to move in the wrong direction. For example, diabetes prevalence and the percentage of adults and children who are overweight or have obesity have increased. The United States also has the lowest life expectancy of any other wealthy country.[3] The amount of

food we eat and the *composition of ingredients* in our food have changed: ultra-processed foods—high in sugar, fat, sodium, and artificial flavors—comprise an estimated 58% of caloric intake in the United States.[4]

6. **Limited Progress Reducing Food and Nutrition Insecurity:** Black, Hispanic/Latino, Indigenous, and other communities of color are disproportionately burdened with food and nutrition insecurity and low food access throughout America and New England.

7. **Limited Progress Reducing Wasted Food:** We estimate that food waste makes up about 22.8% (2.4 million tons) of New England's municipal solid waste stream— the largest single material in the waste stream. When food is wasted, so are all of the resources that went into producing it. Food waste is also a major contributor to greenhouse gas emissions.

Achieving the goal of New England Feeding New England will not be possible without addressing these seven food system challenges. In fact, addressing these challenges with creativity, coordination, communication, collaboration, investment, and passion, is the key to meeting our 30% by 2030 goal. For example:

***Would it be possible to substantially reduce diet-related health problems and nutrition insecurity if the New England states proactively addressed our shared legacy of racism and inequality that disproportionately impacts the health and food access options of Black, Indigenous, Hispanic/Latino, and other Americans?***

***Would it be easier to meet a goal of supplying 30% of the region's food by 2030 if we wasted substantially less food?***

***Would it be possible to dramatically reduce food and nutrition insecurity if food system workers were properly paid?***

Photo credit: Paul Costello

Photo credit: The Intervale Center

On July 10, 2023, Vermont was inundated with extreme rainfall. Restaurants, stores, homes, and other businesses in the capital, Montpelier, were flooded. Farms across the state were again submerged, about 12 years after Tropical Storm Irene devastated the state.

# 2 Lack of Planning for Long-Term Food Supplies

Unlike other complex systems that provide essential goods and services, like energy and water, ***no one* is currently in charge of planning and preparing for healthy, reliable, and resilient long-term food supplies.** The de facto response is to imagine that "the market"—with some level of government regulation, oversight, and investment—will continue to generate enough supply to meet demand. After all, today the world is fed by a tightly linked global food system and a mind-boggling variety of foods, cuisines, and food delivery methods that are available 24 hours a day in many places. Perhaps because food supplies have been abundant in the United States—so abundant that 30% of the food produced in our country is never eaten[5]—the perception may have been that we have not had to reckon with risks to long-term food production.

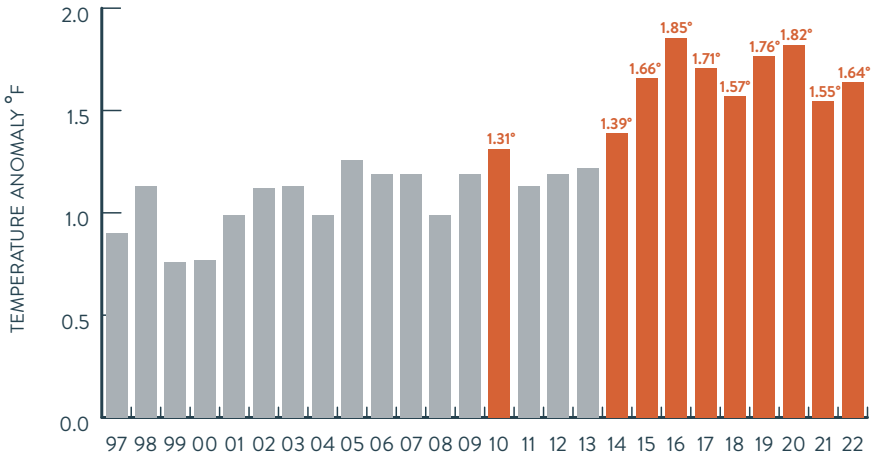
The USDA's agricultural projections to 2032—a "departmental consensus on a conditional long-run scenario for the agricultural sector"—are meant to reflect a "neutral benchmark" of how "markets would evolve under current conditions, existing laws, normal weather patterns, and underlying trends." Their analysis assumes that there are "no new domestic or external shocks during the projection period that would affect underlying global agricultural supply and demand trends," and contains *no* references to climate change. Acreage devoted to barley, corn, cotton, oats, rice, sorghum, soybeans, and wheat are expected to stay the same during the next decade: about 250 million acres. Meat, dairy, and egg production are expected to rise, as are vegetable and nut production and food imports. Fruit production is expected to decrease slightly due to a decrease in citrus production.[6]

In an era of compounding climate catastrophes—crops, livestock, fish, and other aquatic species are particularly vulnerable to the impacts of climate change—this type of approach and analysis seems unlikely to work. For example, in spring 2023, just as the USDA's projections were published, "America's wheat fields have become so plagued by drought that farms are poised to abandon crops at the highest rate in more than a century."[7]

Human activities—including food system activities such as land use changes, livestock production, and food waste generation—are undermining Earth's life support systems and this is triggering catastrophic changes. Harrowing news has become the norm:

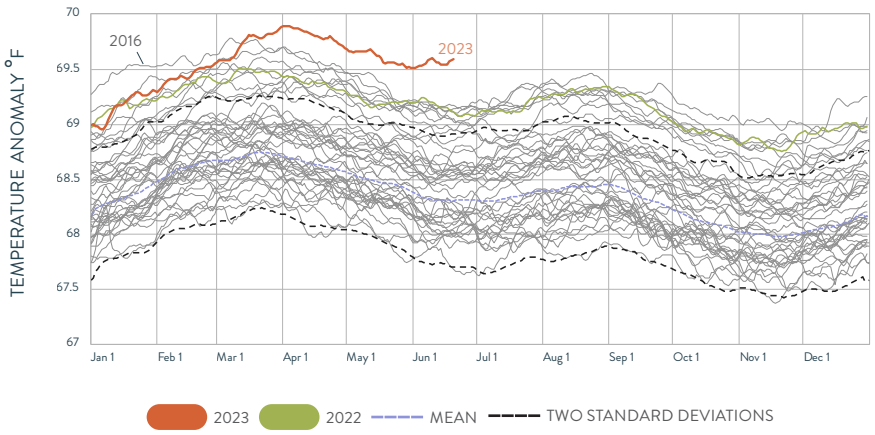
- The ten warmest years have occurred since 2010, and the eight warmest years on record have happened from 2014 to 2022[8] (Figure 1). Ocean heat content—the total amount of heat stored by the oceans—was the highest on record in 2022.[9] In what Vermont-resident Bill McKibben describes as "the scariest moment yet in the climate saga,"[10] in April 2023,

**FIGURE 1:** Ten Warmest Years on Record




**Source:** NOAA National Centers for Environmental information, Climate at a Glance: Global Time Series, published May 2023, retrieved on June 8, 2023 from https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/global/time-series. The global land and ocean temperature anomaly is compared to the average temperature from 1901 to 2000.

**FIGURE 2:** Ocean Sea Surface Temperature Anomaly, 1981-2023




**Source:** Birkel, S.D. 'Daily Sea Surface Temperature', Climate Reanalyzer (https://ClimateReanalyzer.org), Climate Change Institute, University of Maine, USA. Accessed on June 21, 2023. 2016 was the warmest year on record - it seems likely that 2013 might break that record.

average surface temperatures of Earth's oceans are now the highest on record; ocean surface temperatures off the Atlantic coast were as much as 13.8°C (24.8°F) warmer than the average from 1981-2011.[11] The three hottest days in recorded human history were July 3-5, 2023.

» The World Resources Institute estimates that we will need to produce *56% more* crop calories to feed 10 billion people in 2050 compared to 2010 to avoid a *global food gap* that will disproportionately impact vulnerable societies. Since the best agricultural land is already in use around the world, we will have to bridge this gap by becoming enormously more productive, all while reducing the greenhouse gas contributions of food systems.[12]

» A 2015 U.S. Intelligence Community Assessment judged that:

> *"the overall risk of food insecurity in many countries of strategic importance to the United States will increase during the next 10 years because of production, transport, and market disruptions to local food availability, declining purchasing power, and counter-productive government policies. Demographic shifts and constraints on key inputs will compound this risk. In some countries, declining food security will almost certainly contribute to social disruptions or large-scale political instability or conflict, amplifying global concerns about the availability of food."*[13]

The 2023 Annual Threat Assessment of the U.S. Intelligence Community estimates that:

> *"In every region of the world, challenges from climate change, demographic trends, human and health security, and economic disruptions caused by energy and food insecurity and technology proliferation will combine and interact in specific and unique ways to trigger events ranging from political instability, to terrorist threats, to mass migration, and potential humanitarian emergencies."*[14]

Combined with ongoing confrontations with China and Russia, the Intelligence Community believes that these shared global challenges will intersect and interact in unpredictable ways that could impact our ability to respond.

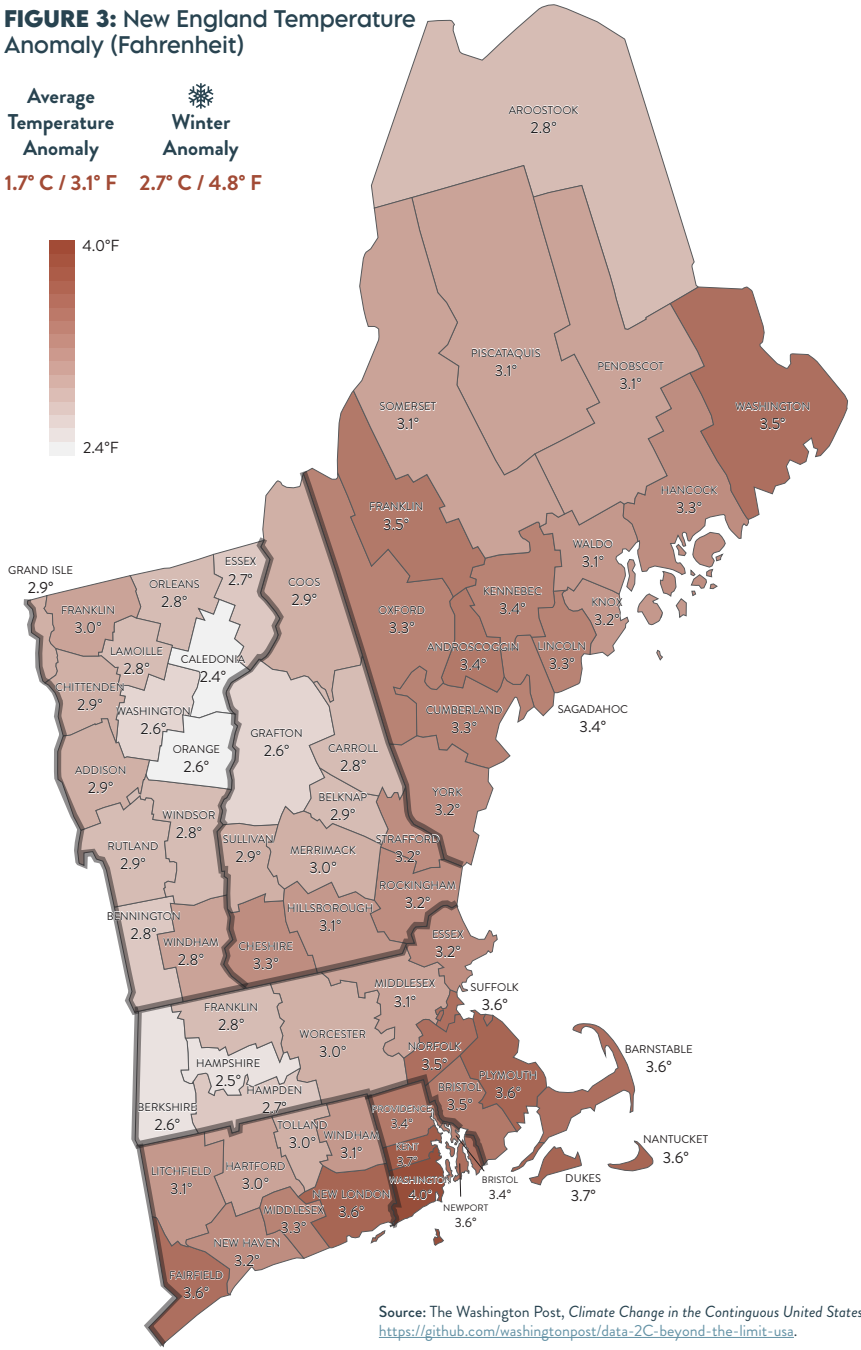
» The sixth United Nations Intergovernmental Panel on Climate Change Synthesis Report (IPCC) estimates that Earth will cross the critical warming threshold of 1.5° Celsius (2.7° Fahrenheit) above preindustrial levels in the *early 2030s*. Average temperatures have already increased by 1.1° Celsius (2.0° Fahrenheit) above preindustrial levels with widespread observed changes:

> *"Human-caused climate change is already affecting many weather and climate extremes in every region across the globe. This has led to widespread adverse impacts on food and water security, human health and on economies and society and related losses and damages to nature and people. Vulnerable communities who have historically contributed the least to current climate change are disproportionately affected."*[15]

A *Washington Post* analysis of multiple temperature data sets found numerous locations around the planet have already warmed by *at least 2°C (3.6°F)* over the past century, including many counties in New England (Figure 3). The largest temperature anomalies in New England occur during winter, when regional average temperatures are 2.7°C/4.8°F warmer than they were a century ago.[16]

Since "***There is a rapidly closing window of opportunity to secure a liveable and sustainable future for all***," (emphasis added) the IPCC strongly encourages "Deep, rapid and sustained mitigation and accelerated implementation of adaptation actions in this decade."[17]

**FIGURE 3:** New England Temperature Anomaly (Fahrenheit)




**Source:** The Washington Post, *Climate Change in the Continuous United States*, https://github.com/washingtonpost/data-2C-beyond-the-limit-usa.

» The Fourth National Climate Assessment (2018), an evaluation of climate change impacts across the U.S., warns:

> *"Rising temperatures, extreme heat, drought, wildfire on rangelands, and heavy downpours are expected to increasingly disrupt agricultural productivity in the United States. Expected increases in challenges to livestock health, declines in crop yields and quality, and changes in extreme events in the United States and abroad threaten rural livelihoods, sustainable food security, and price stability."*[18]

The draft Fifth National Climate Assessment (2023) is more blunt:

> *"**The things Americans value most are at risk** (emphasis added). More intense extreme events and long-term climate changes make it harder to maintain safe homes and healthy families, reliable public services, a sustainable economy, thriving ecosystems, and strong communities."*[19]

The *Agriculture, Food Systems, and Rural Communities* chapter of the Fifth National Assessment predicts:

> *"Large and recurring disruptions in food production, storage, processing, and transportation are expected to significantly impact the US food supply chain. Instabilities to food and production systems are expected to increase with climate change as increasingly frequent and severe extreme events impact human health, prosperity, and social well-being. These disruptions are projected to make food less accessible, more expensive, and create economic hardship, particularly for the socially disadvantaged and those in rural settings."*[20]

» A May 2023 study found that more than 600 million people already live outside of the "human climate niche"—two zones where the majority of people and animals live with mean annual temperatures of about 13°C (55.4°F) and 27°C (80.6°F) —due to 1.2°C (2.2°F) in global average surface temperature warming. Projected warming of 2.7°C (4.8°F) would put *2.4 billion people—mostly in Asia and Africa—outside of the human climate niche.*[21]

» A May 2023 analysis of the 1,972 largest lakes on the planet found statistically significant storage declines for 53% of lakes from 1992 to 2020. About 2 billion people live in basins with large water bodies that are experiencing storage losses. The authors state that the net volume loss in natural lakes is mostly attributable to climate change.[22]

» The Russian invasion of Ukraine highlights how disruptive events ripple through long-distance global food supply-chains: many African and Middle Eastern countries depend on wheat imports from Ukraine. The Food and Agriculture Organization of the United Nations warns that acute food insecurity has increased, impacting up to *205 million* people in 45 countries, particularly in Africa.[23]

» A Harvard Law School and New York University study on the risk of zoonotic diseases from our country's animal industries, including livestock raised for food, found that "we are left with the uneasy but unavoidable conclusion that, at present, the United States has no comprehensive strategy to mitigate zoonotic risk."[24] This is despite the COVID-19 pandemic, the fact that about 60% of all known infectious diseases are spread from animals to humans, and "more emerging infectious diseases originated in the United States than in any other country in the world during the second half of the 20th century."

The opinion writer David Wallace-Wells recently posed the question: "What do you call the arrival of events that have been predicted but, when predicted, were described as distressing or even terrifying? The question now governs an awful lot of our experience of the warming world, which confronts us routinely with events we may have known to expect but for which nevertheless we find ourselves often woefully underprepared — politically, socially, emotionally, and with inadequate built and human infrastructure."[25]

If—*when*—major food production regions around the planet experience recurring and cumulative challenges, will we continue to be woefully underprepared? Or will we take up the clarion call of people like José Andrés, chef and founder of World Central Kitchen, who have argued for the creation of a national security adviser for food, a secretary of food, and a National Food Agency?[26]

Where do the six New England states currently stand in terms of our food supply? Our analysis in Volume 2 demonstrates that New England has high regional self-reliance—the amount of food we produce compared to how much food we consume—for certain species of seafood, potatoes, blueberries, cranberries, dairy products, and a few other products, but **relatively low regional self-reliance for most other food products.**

As a practical matter, while we can identify sources and amounts of domestic and international food production, interstate trade of food is not tracked in a meaningful way. We rarely know how much or what kind of food was imported to or exported from a sub-national region. We can make assumptions based on where significant amounts of food are produced and analyze New England's vulnerability to changes in those regions. For example, in the United States, most domestic fruits, vegetables, and nuts are grown in California's Central Valley (a significant amount of dairy products are also produced in California), while most domestic grains and livestock are grown and raised in the Midwest. The scale of these two regions is enormous: The 12 Midwestern states accounted for nearly 36% of U.S. farms in 2017, 37% of land in agriculture, and about 45% of sales (Table 1). The average Midwestern farm is larger than the average U.S. farm (579 acres compared to 441 acres), and average sales per Midwestern farm

**TABLE 1:** Comparing New England Agriculture to US and Major Agricultural Regions, 2017

| | Farms | % of US Farms | Average Size of Farms (acres) | % of Average US Farm Size | Land in Agriculture (acres) | % of US Land in Agriculture | Agricultural Sales | % of US Agricultural Sales | Average Sales | % of US Average Sales |
|---|---|---|---|---|---|---|---|---|---|---|
| **US** | **2,042,220** | **100.00%** | **441** | **100.00%** | **900,217,576** | **100.00%** | **$410,241,113,651** | **100.00%** | **$190,245** | **100.00%** |
| **Midwest** | **731,018** | **35.80%** | **579** | **131.2%** | **337,218,515** | **37.46%** | **$183,416,643,723** | **44.71%** | **$253,758** | **133.38%** |
| **Central Valley** | **35,198** | **1.72%** | **399** | **90.6%** | **12,932,201** | **1.44%** | **$30,630,751,982** | **7.47%** | **$721,323** | **379.15%** |
| **New England** | **32,336** | **1.58%** | **107** | **24.26%** | **3,856,499** | **0.43%** | **$2,902,690,218** | **0.71%** | **$79,054** | **41.55%** |
| Connecticut | 5,521 | 0.27% | 69 | 15.65% | 381,539 | 0.04% | $612,542,373 | 0.15% | $105,074 | 55.23% |
| Maine | 7,600 | 0.37% | 172 | 39.00% | 1,307,613 | 0.15% | $704,245,176 | 0.17% | $87,758 | 46.13% |
| Massachusetts | 7,241 | 0.35% | 68 | 15.42% | 491,653 | 0.05% | $501,746,786 | 0.12% | $65,624 | 34.49% |
| New Hampshire | 4,123 | 0.20% | 103 | 23.36% | 425,393 | 0.05% | $198,291,685 | 0.05% | $45,548 | 23.94% |
| Rhode Island | 1,043 | 0.05% | 55 | 12.47% | 56,864 | 0.01% | $61,240,088 | 0.01% | $55,607 | 29.23% |
| Vermont | 6,808 | 0.33% | 175 | 39.68% | 1,193,437 | 0.13% | $824,624,111 | 0.20% | $114,713 | 60.30% |

**Source:** USDA 2017 Census of Agriculture, https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_State_Level/. The Midwest is made up of 12 states: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. The Central Valley of California includes 19 counties: Butte, Colusa, Glenn, Fresno, Kern, Kings, Madera, Merced, Placer, San Joaquin, Sacramento, Shasta, Solano, Stanislaus, Sutter, Tehama, Tulare, Yolo, and Yuba.

are more than $60,000 higher than the national average ($253,758 compared to $190,245).

While the Central Valley essentially takes up the entire vertical center of California, it only accounts for 1.4% of land in agriculture in the country and average farm size in the Central Valley is only 91% of the national average. However, Central Valley farms have the highest average sales of any region of the country because of the high value of the crops they produce (as well as dairy production): $721,323 compared to $190,245.

**The six New England states, in comparison, make up only 1.6% of U.S. farms, 0.4% of land in agriculture, and 0.7% of agricultural sales.** The size of the average New England farm is equal to only 24% of the national average (107 acres compared to 441 acres), and average sales are equal to only about 42% of the national average. Within New England, Vermont and Maine have larger average farm sizes, more land in agriculture, and higher sales than Connecticut, Massachusetts, New Hampshire and Rhode Island.

In 2020, the Atlantic region, which includes New England, accounted for 14% of domestic seafood landings by volume, and 40% by value, the highest total of any region. New England alone accounted for about 26% of the value of U.S. seafood landings and the port of New Bedford, Massachusetts was the top in the nation for value of landings at $377 million (mostly due to the value of lobster). New England's seafood sector commercially harvests more than 150 species. Total landings have declined over the last decade from a period high of 691 million pounds in 2012 to 479 million pounds in 2020.[27] The observed decline has been primarily driven by a decrease in Atlantic herring catch due to historic overfishing, changing environmental conditions, and new regulations. The Atlantic region also accounted for 40% of the value of U.S. aquaculture production (within New England this mostly includes the value of salmon in Maine and oysters in Massachusetts and Rhode Island).[28]

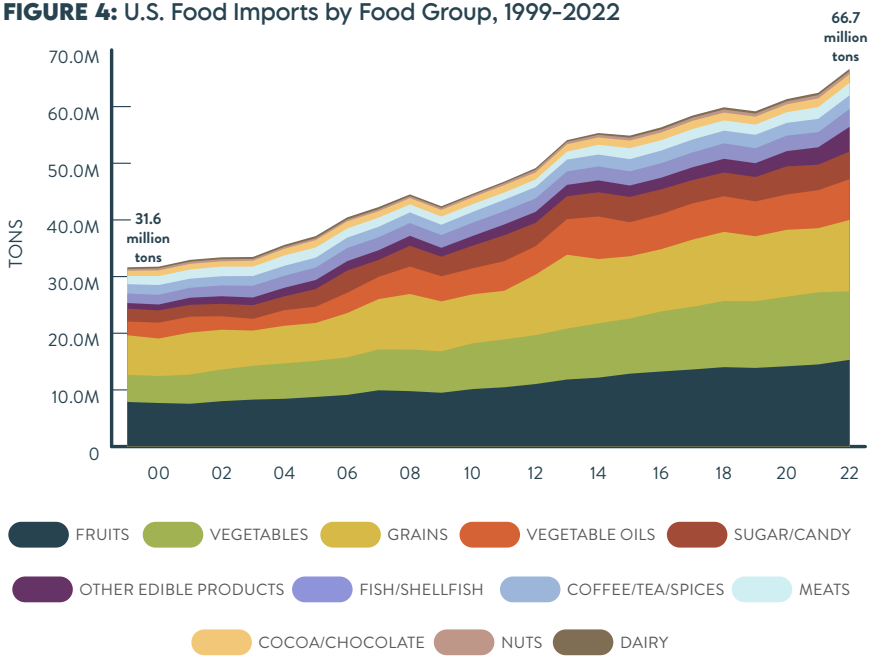
Photo credit: Vermont Agency of Agriculture, Food and Markets

New England farms are small by national standards. Dairy farms in Vermont tend to be bigger than the average New England farm and generate higher per farm sales.

U.S. food and beverage exports and imports have dramatically increased since 1995 due to improved economic conditions in many countries and trade agreements. In 2022, the value of U.S. exports reached $196 billion. East Asian countries received 34.7% ($68 billion) of exports, followed by Canada and Mexico at 29.0% ($57 billion). An average of 20% of U.S. agricultural, food, and beverage products are exported, including significant percentages of grains, oilseeds, fruits, nuts, and meat products. In 2022, the value of imports reached $198 billion. Fruits, vegetables, and grains accounted for 60% of the volume of food imports in 2022 (Figure 4). Together, Mexico and Canada accounted for 35% of the value of food imports.

Evidence suggests that the two dominant food-producing regions in the United States—the Midwest and California's Central Valley—are both in a state of "palpable and accelerating decline" due to increased temperatures, drought, and water stress brought on by lack of snowfall, rainfall, and depletion of groundwater supplies.[29] In Mexico, the top source of imported fruits and vegetables to the U.S., climate change could significantly limit agricultural production, including corn, tomatoes, avocados,[30] and Sriracha. While a warming climate

**FIGURE 4:** U.S. Food Imports by Food Group, 1999-2022




Source: USDA, US Food Imports, https://www.ers.usda.gov/data-products/u-s-food-imports/.

may provide opportunities for some regions of Canada, an increased frequency and intensity of extreme events is expected to bring significant food production challenges.[31]

As the Midwest, Central Valley, Mexico, Canada, and other major food production regions experience and adapt to a changing planet, should the six New England states do more to build a more reliable, safe, and abundant food supply? As warming temperatures and more extreme rainfall events impact New England, should we invest more time, resources, public support, and political will to build our shared future and safeguard against risks? It's now or never. As outlined in 4 Volumes of this report, a regional approach to food system resilience that secured at least 30% of food servings by 2030 in New England would require:

- Significant cultural and behavioral transitions toward healthier eating patterns
- Significant investment in expanding land in agriculture, as well as investment in equipment, technology, infrastructure, storage, and other tools for farming and fishing
- Significant investment in increasing the number of farmers, farmworkers, and fishermen in the region, including expanding the diversity of New England's farmers and fishermen
- Significant investment in increasing access to healthy, regional food for all New Englanders

System-level change is by its very nature complex, and no one organization, entity or state can change it alone. System-level change requires collaboration, highly networked multi-stakeholder alignment, transparency, continuous communication and strategic action that is properly resourced and built upon trusted relationships.

A couple of examples shared below highlight the clarifying power of emergencies to marshall significant resources and create new tools for addressing problems. Other examples indicate that fairly rapid changes could take place with a common agenda and high leverage investments. We also highlight how easy it is for warnings to go unheeded.

## The Dust Bowl

Photo credit: USDA

Buried machinery in in Dallas, South Dakota.

In perhaps the most well-known test of America's food system—the Dust Bowl of the 1930s—multi-year droughts combined with hubris and mismanagement, leading to massive soil erosion, dust storms, farmland destruction and farm abandonments, migration, and widespread trauma across the Great Plains. In response to "the nation's worst prolonged environmental disaster,"[32] our federal government greatly expanded participation in land managment and soil conservation through tree planting, purchase of marginal lands, investment in infrastructure (e.g., irrigation), support for institutional research and extension services, support for new farming practices, and much more. Conservation tillage, no-till farming, rotational cropping, and other practices to minimize surface disturbance are still recommended today as "climate-smart" practices.

The federal government also became more involved in supporting regional agricultural economies and "relief" programs through farm income stabilization, loans, support for resettlement, food aid, employment-creation programs, and more. While, in some ways, the Great Plains never recovered, and historians debate the long-term effectiveness of these government interventions, it is clear that **significant national resources and support can be mobilized during emergencies.**[33]

### Planning for Injustice

The history of our country is marked by explicit, intentional, *planned* efforts to deprive Indigenous, Black, Hawaiian, Hispanic/Latino, Asian, and other non-White Americans from opportunities and resources. Our federal and state governments—aided by businesses and community groups—have demonstrated that they can devote significant time and resources over centuries to exploit Indigenous, Black, Hawaiian, Hispanic/Latino, Asian and other Americans and deny them resources and opportunities to achieve the American Dream. If this effort had been expended on planning and building a more just, sustainable, and resilient country, we might all be more prepared to weather coming storms.

Our food systems are *unjust*, built from violence, stolen land, underpaid work, discrimination, and unequal access to healthy food:

- Federal Indigenous policy facilitated genocide and encouraged removal, reservations, and assimilation. Food traditions formed over generations were dismantled and Indigenous peoples today have food insecurity rates double that of White Americans.[34]
- Slavery, Jim Crow, redlining, the "Great Land Robbery," and relentless discrimination have impacted the ability of Black Americans to fully participate in food systems.[35]
- The Hawaiian ahupua'a sustainable resource management system, running from mountain to ocean, was dismantled by European and American colonists. Today, Native Hawaiians have disproportionately high rates of diet-related diseases.[36]
- Despite constituting the majority of farmworkers in the country and a significant number of food system workers—keeping America fed, in other words—Hispanic/Latino Americans are "always a step away from derision, detention, and deportation."[37]
- Despite significant contributions to U.S. agriculture, cuisine, and retailing, Asian Americans have faced chronic discrimination and lack of recognition for their contributions to our food system, indicating "how difficult it is to overcome the marginalized image of Asian Americans as perpetual foreigners."[38]

## Wild Capture Fisheries

In contrast to agriculture, **wild capture fisheries represent a common-pool resource in which harvesting activities are performed by privately owned vessels but managed by a constellation of government fisheries management entities with extensive input from scientists and stake-holders.** Wild capture fisheries stand apart from both terrestrial and aquaculture production systems in that production volumes are largely outside the direct control of harvesters and operate within a multi-trophic level food web, such that different harvesting strategies imply biomass production tradeoffs among species (although these are not always taken into account in fisheries management).

Harvest activities target a wide range of trophic levels, from primary consumers to top predators. Trophic level in marine systems is a shifting condition determined not only by species but also by size and phase of life (e.g., egg, larvae, juvenile, adult), with most marine species occupying several different trophic niches within their lifetime. As a result of complex trophic interlinkages, steps taken to increase the harvest of one species may have the effect of decreasing the available harvest of others, and vice versa, sometimes causing multi-species ripple effects.

Entities with governance responsibility over seafood landed in New England include local shellfish commissions, state fisheries agencies, interstate coordination bodies like the Atlantic States Marine Fisheries Commission, federal agencies like the National Marine Fisheries Service, and regional federal fisheries management councils like the New England Fishery Management Council and the Mid-Atlantic Fishery Management Council.

These entities manage fisheries by setting species-specific harvest limits, size limits, specifications on allowable fishing gear, open and closed areas, and other controls on harvest and fishing effort. Their actions represent a mediating layer between ecological production and harvested landings that does not exist in terrestrial systems or aquaculture. Moreover, the harvest activities governed by these bodies influence dynamics of ecological production via direct and indirect ecological feedback loops. Consequently, a focus on the role of fisheries management is relevant to identifying opportunities for increasing regional self-reliance for wild capture fisheries.

Photo credit: Rhode Island Food Policy Council

A little more than 3,100 people are employed in Rhode Island's seafood and fisheries sector. More than 100 species are caught or harvested by Rhode Island fishermen, but 14 species account for the majority of pounds and sales, particularly shortfin and longfin squid.

## The COVID-19 Pandemic

Over the past three years, the COVID-19 pandemic has brought wrenching changes to the way we live. To date, nearly 7 million people on Earth, including over 1.1 million Americans and about 48,000 New Englanders have died, an irreplaceable and unfathomable loss. Total cumulative data indicates that Black, Hispanic/Latino, Indigenous, Native Hawaiian, and Pacific Islander Americans experienced higher rates of COVID-19 cases and deaths than White Americans, although the gap has recently narrowed.[39]

Many saw the pandemic as a dress rehearsal for how we will collectively respond to the far-reaching consequences of climate change- a test that we failed in the first year of the pandemic due to lack of effective leadership at the federal level, failure to act early and decisively, and underinvestment in planning and preparedness. The pandemic also "unfolded despite the United States' enormous wealth and unparalleled medical and scientific capacity."[40] At the same time, **federal support of public-private partnerships to develop and distribute vaccines and massive federal spending to help families, businesses—including food system businesses—and local and state governments have protected many Americans from even worse consequences.**

Short- and long-term analyses of food system disruptions due to the pandemic are emerging. In the short term, the temporary closure of restaurants, schools, colleges, and other food service venues spiked unemployment—particularly for restaurant workers. It also altered consumer demand by:

1. Shifting purchases to grocery stores
2. Shifting the composition of purchases at grocery stores (e.g., milk is sold in different types of packaging for food services than it is for home consumption)
3. Changing their behaviors in ways that impacted demand (e.g., a surge in home baking or some stockpiling behavior)
4. Switching to online shopping and home delivery from major grocery, restaurant, and fast food chains
5. Shifting some food purchases to locally and regional produced food via Community Supported Agriculture (CSA), home delivery, and other direct to consumer channels.[41]

While "Lean manufacturing and just-in-time production, distribution, and storage strategies have resulted in a low-cost food system," the temporary closing of the hospitality industry meant that the "sudden and dramatic shifts in the volume and form of food demanded by consumers" could not be met easily or quickly by our industrial food system.[42] This resulted in some well-publicized cases of milk dumping, crops rotting in fields, and livestock euthanasia, but, as a practical matter, supplies of meat, grains, produce, and dairy products did not dramatically change and conditions have now returned to "near normal."[43]

In the long-term, there is concern that the COVID-19 pandemic will have ultimately led to *more* market concentration, as larger food system businesses able to withstand the economic turmoil are now in a position to acquire businesses that allow them to diversify their product offerings. For example, Yelp found that over 90,000 restaurants permanently closed in 2020,[44] and major chains are buying up available commercial real estate.[45] As students return to school and workers go back to work, it also remains to be seen if the "pivot" to local food producers via CSA shares, home delivery,

food hubs, meal kits, and other options becomes normalized, or if convenient, fast options maintain primacy.[46]

The COVID-19 pandemic also spiked *food insecurity*, underscoring how inequalities based on race, ethnicity, geography, education level, and gender run like fault lines through our country. Emerging data on rates of food insecurity indicate that levels are still elevated, likely due to a combination of the elimination of many COVID response programs and inflation.

## The Netherlands

A more proactive example of planning for the future of food has been unfolding in the Netherlands over the past 25 years. Haunted by memories of a famine created by the Nazis during World War II, the Dutch made a national commitment to *produce twice as much food using half as many resources*. Today, *the Netherlands is the second largest food exporter in the world* after the United States, even though our landmass is 270 times larger. The Dutch had a goal and a forward looking government. They coordinated activities and investments between world-class research institutes, universities, and public-private partnerships. They pioneered cell-cultured meat, indoor farming, vertical farming, seed technology, robotics, and more.[47]

To make a few comparisons: The Netherlands and the six New England states have roughly the same population, 17 million compared to 15.1 million. But, with only 22% of New England's land area (10.2 million acres compared to 45.8 million), the Dutch generated $108.4 billion just in agricultural *exports* in 2021, while New England generated $4.1 billion in *total* agriculture and fisheries sales in 2017 (the latest available year of data). Is it possible, culturally appropriate, or desirable for New England to become New *Holland*? No, but the Dutch demonstrated that **a common agenda based on national aspirations could lead to major transformations in our food system in a short timeframe with investments in infrastructure, logistics and distribution networks, technology, research and development, and sustainable practices, including reduced resource use.**

## Reimagining Native Food Economies

The harrowing history of treatment of Indigenous peoples in this country—genocide, removal from ancestral lands, reservation confinement, child abductions, lack of recognition, lack of reparations—underscores the challenges that Tribal Nations face today. Despite this history, Indigenous peoples operate the second largest amount of land in agriculture (58.7 million acres) after White Americans (850 million acres). This resource, the Indigenous food and agriculture sector, is "the single most underappreciated resource for sustainable, rural, and rural economic development in our Nation," according to a detailed vision developed by the Native American Agriculture Fund (NAAF).[48]

"For too long," NAAF writes, "Native producers, communities, Tribes, and regions have not had the infrastructure necessary to create a resilient and thriving regional food system. A regional food system grounded in Native culture, that provides economic opportunities and diversification for Tribes and producers to feed their communities is necessary." They say that, although the federal government spends billion of dollars on USDA nutrition programs to feed Indigenous peoples, they do not support the nutritional needs of communities and bypass "the very Native farmers and ranchers that produce food within those communities." NAAF outlines a 10-year vision to develop ten regional food hubs, including a Northeast Hub, at a total cost of $3.4 billion. Each regional hub would include:

- Processing facilities for meat, fruits, vegetables, grains, poultry, and dairy products
- Warehouse and storage facilities
- Logistics and distribution infrastructure
- Finance, credit, and business services for Native producers
- Support for resource management plans, regenerative grazing, carbon sequestration, and other climate smart practices.

*Reimagining Native Food Economies* provides itemized costs for every element of building their Regional Hub model in 10 parts of the country.

## Hub Brick and Mortar Costs

**Meat Processing** — Cost Per Hub: **$10,000,000** — Total Cost: **$100,000,000**

70% of Tribal producers raise cattle. Investing in meat processing is the most critical aspect for advancing Native American agriculture.

The Regional Hub Meat Processing Center will be:
- Federally inspected to ensure the highest food safety protocols
- Process multiple species like bison, elk, sheep, and pork

**Fruits, Vegetables, Specialty Crops and Grain** — **$5,000,000** — **$50,000,000**

The Regional Hubs will purchase, aggregate, package and distribute fruits and vegetables to Tribal communities in rural and remote areas. Grains like corn, wheat and soybeans also require proper storage and processing. In addition, milling infrastructure will be located at the hubs to ensure grain producers have access to critical infrastructure.

The Regional Hub Fruit, Vegetables, Specialty Crops and Grain Infrastructure will include:
- Grain elevators, milling equipment and packaging equipment
- Wash and Pack facilities for fruits and vegetables
- Packaging equipment and supplies

**Fisheries** — **$10,000,000** — **$100,000,000**

Fishing is a way of life for many Tribes located near bodies of water. Fish processing infrastructure is a critical link in ensuring that Tribal communities who practice agriculture through fishing are supported. The funding would be distributed to the region to address its specific fishing needs.

Regional Fisheries Infrastructure will include:
- Refrigerated storage
- Filleting stations and ozone
- Shellfish storage

**Poultry, Eggs and Dairy** — **$5,000,000** — **$50,000,000**

Each regional hub should also include a poultry, egg, and dairy processing facility. Each facility should be federally inspected for poultry slaughter as well as provide further processing for dairy and eggs.

Regional Poultry, Eggs and Dairy Infrastructure will include:
- Poultry slaughter facilities
- Cold storage

**Warehouse and Storage** — **$3,000,000** — **$30,000,000**

Each regional hub would need proper warehouse capacity that is appropriate for the needs of that region. This storage must include cold storage as well as shelf-stable storage.

Warehouse Storage infrastructure will:
- Serve as the main storage for the distribution of all food to regional communities
- Include cold storage for perishable goods and ample shelf stable storage

**Food Waste Diversion** — Cost Per Hub: **$2,000,000** — Total Cost: **$20,000,000**

Reducing food waste not only increases efficiency but also addresses food insecurity while eliminating wasteful spending. Food waste diversion streams at the hubs will ensure food is prioritized appropriately for distribution for human consumption first, then for animal consumption and then lastly for composting. This will drawdown greenhouse gas emissions while also ensuring people are fed.

Food Waste Diversion Infrastructure will:
- Require advanced logistics to track food freshness for human consumption
- Reduce producer costs by providing animal feed
- Create a composting program to divert waste from landfills

**Packaging** — **$1,000,000** — **$10,000,000**

Each Regional Food Hub should be equipped with packaging equipment to ensure that all food that passes through the regional food hub can be packed to ensure it safely arrives at its final destination. Packaging equipment would be able to serve the unique needs of that region. Smart packaging will allow producers and the Hubs to reduce waste and provide solutions for both wholesale and retail markets.

**Logistics Infrastructure** — **For all Hubs** — **$3,000,000**

The hubs cannot run smoothly without the proper logistical infrastructure to support them. This one-time initial expense will build a logistical infrastructure for all hubs to use. Hubs will not only communicate with sub hubs in their region but will also communicate with Hubs across the country to distribute food most efficiently.

Logistics Infrastructure will:
- Utilize Blockchain technology to ensure all food is accounted for and distributed appropriately
- Direct Trucking and Distribution efforts
- Address food security issues by providing food when and where it is most needed
- Work directly with producers on timing harvests and deliveries
- Limit food waste by ensuring that food is delivered before it has expired

**Trucking** — **$1,500,000** — **$15,000,000**

The Regional Hub Model requires distribution from the larger regional hubs to the smaller, more localized sub hubs. Each Tribe within the 10 regions will need a small fleet of trucking vehicles that can facilitate distribution and coordination of food movement within sub hub locations and to the regional hub, for the delivery of foods both from the community to the regional food trade hub and within smaller Tribal community clusters.

**Ancillary Costs** — **$1,000,000** — **$10,000,000**

The Regional Hubs will constitute large campuses housing multiple food processing, distribution, and packaging efforts.

Ancillary Infrastructure includes:
- Roads, sidewalks
- Loading docks
- Staffing rooms and restrooms

**Total Brick and Mortar for Regional Hub**

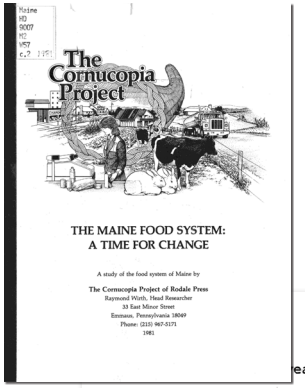
| Cost Per Hub | Total Cost |
|---|---|
| **$38,500,000** | **$388,000,000** |

## New England's Local Food Movement

The local, or alternative, food movement is not one unified movement, but rather an umbrella that contains advocacy for relocalizing food supply chains, food justice, organic farming, fair trade, community wealth building models (e.g., cooperatives and employee ownership), and more. In the past several decades, the local food movement has also reflected systems-level planning initiatives organized by cities, counties, regions, and states.

In the *1980s*, for example, the Cornucupia Project of Rodale Press produced a series of food system reports for a number of states, including Maine and Vermont. Although the language to describe the existential threat of climate change was not yet widespread, these reports used language that sounds very familiar today to describe threats to agriculture, fisheries, and food systems: "relatively little is being done...the same problems are occurring across the country and world...an age of isolation has ended." **As a practical matter, these early reports did not lead to the kinds of policy changes, investments, and interventions imagined necessary to prepare for a challenging future.**

More recently, food policy councils have proliferated across the country. A food policy council is an organized group of stakeholders, either sanctioned by a government body or independent of government, that works to address food systems issues and needs at the local (city/municipality or county), state, regional, or tribal nations levels.[49] Over 300 food policy councils now exist across the country, and policy priorities tend to be most focused on healthy food access, anti-hunger policies, support for food production, and economic development opportunities across food systems.




A *1981* report about Maine's food system highlights lack of action on problems that were considered concerning more than 40 years ago.

ears, much has been said about the critical problems of Maine agriculture and of the Maine economy in general. Reports have been written and recommendations have been made. However, relatively little is being done. We may be moving in some of the right directions, but when we consider ourselves in the context of the rapidly changing global food situation, we certainly are not moving quickly enough.

The problems in Maine are very real, and they are compounded by the fact that the same problems are occurring across the country and around the world. Every day, while the U.S. population grows by 5,000, the nation loses the productive equivalent of 25 square miles of agricultural land to erosion and farmland development. In addition, repeated, heavy applications of chemicals and continuous single-cropping are destroying the fertility of our soil. The supply of fertilizer minerals is rapidly depleting.

Our entire food system is powered by non-renewable fuels. Processing, packaging and transporting food use 60 percent more energy than all the farms that produce our food.[1] Dependence on long-distance food transport makes supplies tenuous in many areas. Farm debts are at record levels and rising astronomically; they've shot up 650 percent in the last 20 years.[2] Irrigated farmlands in the West, which produce a large share of the nation's foodstuffs, are threatened by declining water tables and increasing salt build-up. Last year's drought caused major losses in our corn, soybean, sorghum and peanut crops, and more severe weather patterns are predicted for the future.

In previous times, the connections between Maine agriculture and events occurring in the rest of the world may have been slight or "uncertain" as they are described in a recent report on Maine agriculture.[3] However, such an age of isolationism has ended. Like it or not, we are living in a single global village whose survival is dependent upon the willingness of its citizens

- 3 -

Despite the significant accomplishments of food policy councils, including stepping up to meet community needs during the COVID-19 pandemic, the majority of food policy councils are hampered by small budgets and limited staffing. A 2020 survey of 198 food policy councils found that 29% (57) of respondents had *no funding*, 34% (67) had between $1 and $10,000 in annual funding, and 11% (22) had between $10,001 and $25,000. In other words, 74% of food policy councils have budgets of *less than $25,000*, while 15% (30) have budgets between $25,001 and $100,000, and 11% (22) have budgets over $100,000. The majority, 64%, of food policy councils *do not have staff*.[50] This is a very challenging recipe for success.

In the past 10 or so years, the six New England states have taken a different and more comprehensive approach to food system planning - perhaps none more comprehensive than Vermont's Farm to Plate Initiative. Several practical—but nevertheless unique—features have made it possible for Vermont Farm to Plate to be the state's official food system plan for *more than a decade*:

- **Legislative/Administration Support:** In 2009, the Vermont Legislature passed legislation directing the Vermont Sustainable Jobs Fund (VSJF) to develop a 10-year strategic plan to strengthen Vermont's food system. Passed into law by Governor Jim Douglas (R), brought to life during Governor Peter Shumlin's (D) Administration, and maintained and supported by Governor Phil Scott (R), Vermont Farm to Plate has transcended changes in political Administrations and parties. In our review of food policy council and other food system planning initiatives, it became clear to us that efforts that do not have official or institutional support or less likely to succeed over time. In 2019, VSJF was reauthorized by the legislature to create the Vermont Agriculture and Food System Strategic Plan 2021-2030.

- **The Power of Networks:** Organizational silos are real and can reduce the effectiveness of large-scale change initiatives. In several respects, Vermont may have a built-in advantage compared to many states or regions in the country: the state has been a longtime leader in sustainable agriculture practices and support of local food, independent businesses are easily accessed in daily life, and the social fabric within Vermont's communities is largely intact. Building from many long-standing relationships—while creating new relationships—the Farm to Plate Network breaks down silos while collectively implementing the Farm to Plate Strategic Plan's goals. By harnessing the power of networks to build trust, Vermont Farm to Plate has been able to pursue new opportunities and tackle long-standing problems across the state.

- **Don't Reinvent the Wheel:** VSJF found that it was easiest to adopt an existing systems-change framework—collective impact—and maximize its effectiveness in Vermont. For example, the collective impact framework emphasizes the need for a ***strong backbone support organization*** (i.e., VSJF) that provides administrative support, logistics, research, fundraising, communications, and reporting. The Farm to Plate Strategic Plan is a ***common agenda***—a shared vision for change—built from community aspirations. The Strategic Plan contains ***high leverage and mutually reinforcing activities*** that are carried out by the Network. Network members engage in ***continuous communication and community engagement*** to build and maintain trust, and news, events, job listings, and resources are regularly shared. A ***shared measurement system*** provides regular opportunities for strategic learning and evidence of impact.

The 5 other statewide food system networks in New England have adopted a similar approach.

- The Connecticut Food System Alliance (CFSA) is working with network members to develop a state food action plan rooted in food justice to transform the Connecticut food system. This plan will serve as a roadmap for equitable food access, diverse ownership of food system assets, and sustainable, viable food production and distribution.

- The Maine Food Strategy (MFS) is a statewide initiative aimed at advancing goals identified in the 2016 Maine Food Strategy Framework. The MFS accomplishes its work by partnering with the Maine Food Convergence Project, Selling More Maine Foods, and the Maine Food Policy Alliance.

- The Massachusetts Food System Collaborative's (MFSC) work is centered on public policy campaigns and building the capacity of food system stakeholders to engage in policy advocacy. Their priorities are driven by the 2015 Massachusetts Local Food Action Plan, which presented a broad agenda for issues ranging from farmland access and protection, to farming and fishing, to public health and food access.

- The New Hampshire Food Alliance (NHFA) is a statewide network of over 150 partners that engages and connects people dedicated to growing a thriving, fair, and sustainable local food system. They work together to grow and sustain local farms, fisheries, and food businesses, secure healthy food access for all, build climate resilience, and ensure racial equity in the state.

- The Relish Rhody food strategy was established in 2017 to create a vision and "roadmap" for a more equitable, accessible, economically vibrant, and environmentally sustainable food system in Rhode Island. Led by the Director of Food Strategy and supported by the Rhode Island Food Policy Council (RIFPC) their strategic initiatives are designed to further a just and resilient food system across five integrated focus areas. They are currently working to develop their second 5-year strategic plan to guide state investment in their food system.

In 2014, Food Solutions New England (FSNE) developed A New England Food Vision to imagine what it would take to produce 50% of New England's food supply from regional sources by 2060. It found that the region *could* supply 50% of its food by focusing production on fruits, vegetables, dairy products, and grass-finished meats, while importing the majority of food grains, feed grains, oilseeds, and sweeteners. Based on a target of 2,300 calories per person per day, **4 million additional acres of land in agriculture would be required to do this** (about three times more than is currently in production).[51]

Building from *A New England Food Vision*, in 2019 the New England State Food System Planners Partnership—a collaboration between six state-level food system organizations and Food Solutions New England—launched *New England Feeding New England*, a 10-year initiative to prepare the region for system shocks such as climate-related weather events and public health emergencies. **New England Feeding New England combines the accumulated experiences and expertise of organizations in each state in order to raise awareness and marshall resources for increasing regional food production for regional consumption.**

# 3 Risks to Long-Term Food Production

Risks to long-term food production include climate change impacts on crops, livestock, aquatic species, supply chains, infrastructure, and workers; environmental degradation of agricultural resources and oceans; farmland conversion; and inequitable access to farmland and fishing grounds.

## Climate Change

Food system activities—cultivating crops and raising livestock, land use changes, energy and resource use throughout supply chains, and the generation of waste—are major drivers of climate change. Food systems generate approximately 21–37% of global greenhouse gas emissions.[52] Of particular importance: Food systems are the largest contributors of methane and nitrous oxide emissions, two gases with much higher global warming potentials than carbon dioxide.

A 2020 study found that, even if emissions from fossil fuel combustion for energy production were *immediately* stopped, the world could *miss* efforts to limit global warming to 1.5 degree Celsius (2.7 degree Fahrenheit) *due to food system activities*.[53] Unfortunately, methane and nitrous oxide emissions continue to increase globally and in the United States.

Food system activities are also particularly vulnerable to climate change. To illustrate one global example, there is concern that the world's breadbaskets will become less reliable due to climate change. About 46% of the calories of an average global diet are made up from rice, wheat, corn, and soy, and global production of these grains is concentrated in China, the U.S., India, Brazil, Argentina, Northwestern Europe, Canada, Ukraine, and Southern Russia. As temperatures increase, the likelihood of yield declines and price increases, particularly for corn, soy, and rice, is expected to rise. Wheat production may benefit from warmer temperatures, but the Russian invasion of Ukraine highlights how disruptive events ripple through long-distance global supply-chains: many African and Middle Eastern countries depend on wheat imports from Ukraine.[54] The Food and Agriculture Organization of the United Nations warns that acute food insecurity has increased, impacting up to *205 million* people in 45 countries, particularly in Africa.[55]

The Fourth National Climate Assessment (2018, the fifth assessment has not been published as of summer 2023) featured a detailed analysis of projected changes to the Northeast, which includes the

6 New England states plus New York, Pennsylvania, New Jersey, Maryland, Delaware, and West Virginia. Key messages included:

- **Loss of Seasonality:** although seasonality is key to the region's sense of place and economy, less distinct seasons, milder winters, earlier spring conditions, and more unpredictable weather are expected to impact tourism, agriculture, and forestry. For example, maple syrup production is expected to decrease as climate change impacts the range in which tree species can survive, shortens the length of the sugaring season, and aids in the expansion of invasive tree pests.

- **Ocean Under Threat:** the Atlantic Ocean supports tourism, recreation, and economic activities, including fisheries. Warmer ocean temperatures—the Northeast Continental Shelf is warming much faster than the global average—sea level rise, acidification, and increased storm frequency and intensity all threaten marine ecosystems and the communities that depend on them. For example, lobster populations have declined in southern regions of New England where temperatures have increased too much.

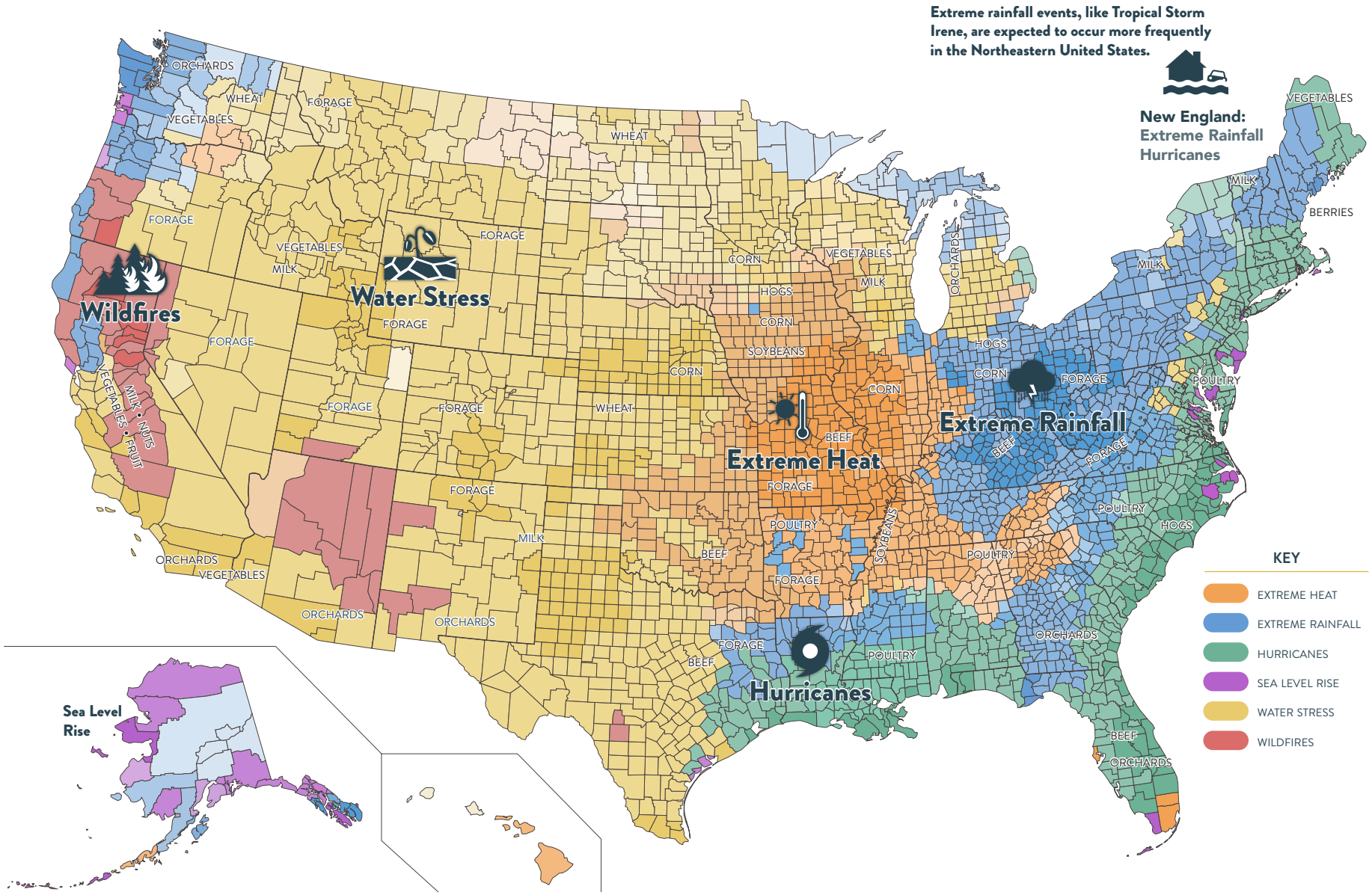
- **Risks to Cities:** the Northeastern U.S. is home to densely populated cities, including Boston and Providence, critical transportation corridors and infrastructure, and culturally and historically significant sites. Climate change impacts, including from sea level rise, flooding, and hurricanes can damage infrastructure, displace populations, strain our emergency response system, and disproportionately affect historically marginalized and low-income communities.

- **Threats to Health:** increases in heat and humidity, ground-level ozone pollution, air pollution from wildfires, mold, pollen season, vector-borne diseases (e.g., Lyme disease), and gastrointestinal illnesses from waterborne and foodborne contaminants can lead to more illness and death, particularly for already disadvantaged and immunocompromised communities. Extreme heat and other climate change impacts may have an adverse effect on mental health and well-being.[56]

Although climate change means multiple, compounding risks for all regions, an analysis prepared by *Four Twenty Seven* and the *New York Times* in 2020 highlights the most significant climate threat in each county in America (Figure 5). For example, water stress, extreme heat, and wildfires are the top risks for many counties, including major food producing counties in the Midwest and West. The greatest risks in New England are *extreme rainfall* and *hurricanes*. For example, in 2011, Tropical Storm Irene tore through the region, washing away homes, roads, infrastructure, farmland, and trees.[57] In 2012, Hurricane Sandy—the largest Atlantic storm on record as measured by diameter—inflicted damage from the Caribbean to Canada.[58] Extreme rainfall events like Tropical Storm Irene and Hurricane Sandy are expected to occur more frequently in the Northeastern United States.

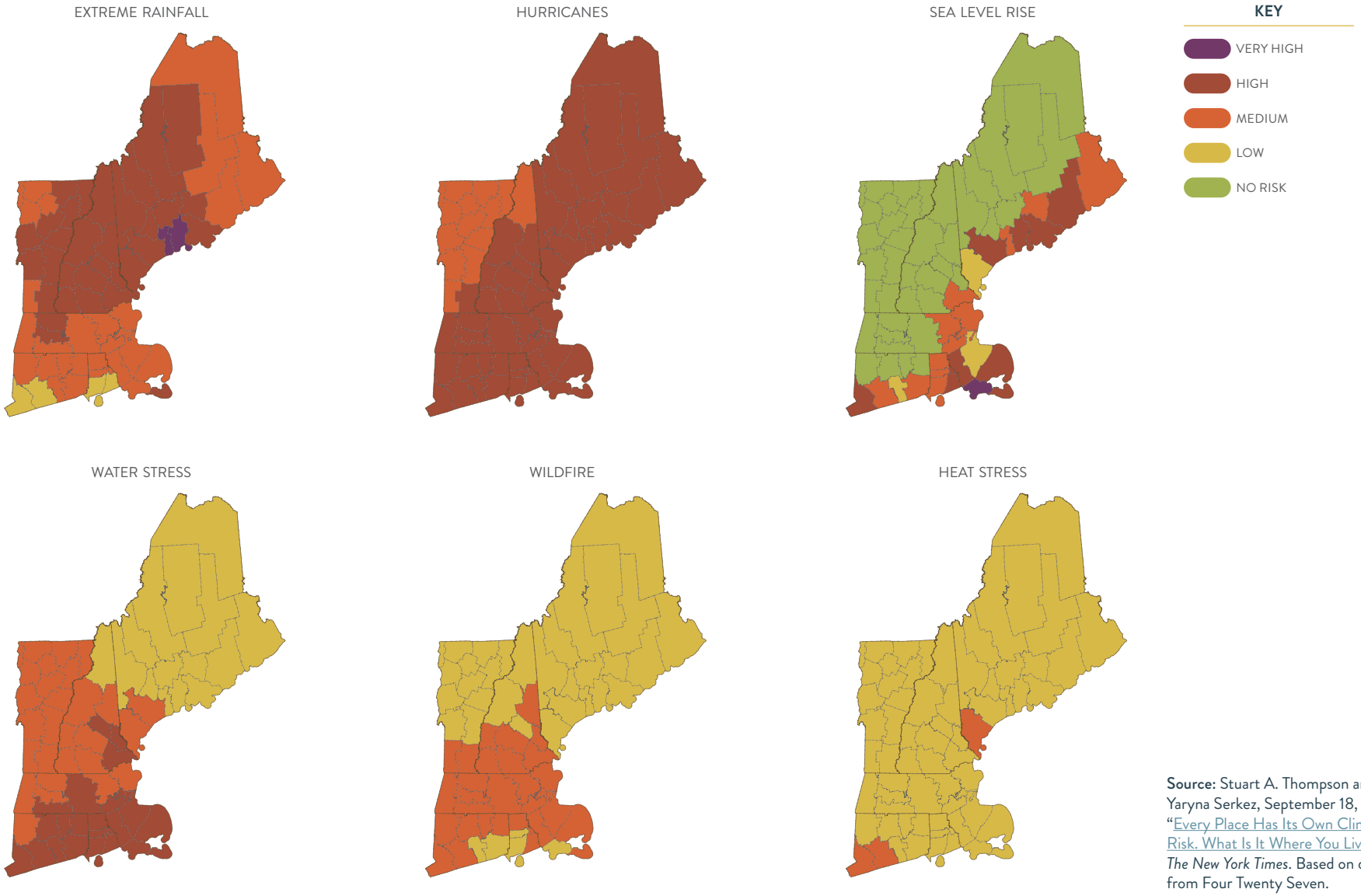
Climate risks vary between and within the 6 New England states (Figure 6). Extreme rainfall is likely to be most problematic in mountainous regions (i.e., the Green Mountains in Vermont, the White Mountains in New Hampshire and Maine, and the Berkshire Mountains in Massachusetts). Hurricanes pose a high risk to nearly every county, while sea level rise is a risk for coastal counties. Perhaps surprisingly, water stress is evaluated to be a high risk for almost all of southern New England (e.g., Rhode Island experienced extreme drought conditions as recently as August 2022). Wildfires are expected to be a medium risk across most of Massachusetts and Connecticut (although wildfires from Canada darkened northeastern skies with hazardous, particulate-filled air in summer 2023). Heat stress is evaluated to be a low risk for most New England counties.

**FIGURE 5:** Major Climate Risk by U.S. County




**Sources:** Stuart A. Thompson and Yaryna Serkez, "Every Place Has Its Own Climate Risk. What Is It Where You Live?," *The New York Times*, https://www.nytimes.com/interactive/2020/09/18/opinion/wildfire-hurricane-climate.html. Based on data from Four Twenty Seven. Major agricultural products data based on USDA Ag Atlas Maps.

**FIGURE 6:** Projected Climate Change Risks by New England County




**Source:** Stuart A. Thompson and Yaryna Serkez, September 18, 2020, "Every Place Has Its Own Climate Risk. What Is It Where You Live?," *The New York Times*. Based on data from Four Twenty Seven.

The National Oceanic and Atmospheric Administration's (NOAA) U.S. Billion-Dollar Weather and Climate Disaster database has tracked disasters where overall damages/costs reached or exceeded $1 billion. Since 1980, the United States has experienced 363 such disasters, with a cumulative cost exceeding $2.54 *trillion* and about 16,000 deaths. Severe storms—storms with wind gusts of at least 58 mph and/or hail one inch in diameter and/or a tornado—are the most common type of billion-dollar event, accounting for 48.7% (174) of such events from 1980 to 2023. Although severe storms are the most common type of billion-dollar event, they only accounted for 16.2% ($412 billion) of total costs. Tropical cyclones—hurricanes—accounted for 16.8% (60) of billion-dollar events but 52.9% (over $1.3 trillion) of total costs. For example, Hurricane Sandy (2012) was the costliest disaster in the Northeast over the past 40 years.

A total of 124 billion-dollar events occurred in the Northeast region from 1980 to 2023. The frequency of billion-dollar events has increased over the past 40 years. Data for the Northeast region—New England plus Delaware, Maryland, New Jersey, New York and Pennsylvania—shows:

- 8.9% (11 events) occurred between 1980 and 1989, an average of 1.1 events per year
- 16.1% (20 events) occurred between 1990 and 1999, an average of 2.0 events per year
- 16.9% (21 events) occurred between 2000 and 2009, an average of 2.1 events per year
- 36.3% (45 events) occurred between 2010 and 2019, an average of 4.5 events per year
- 25.8% (32 events) occurred *just* between 2018 and 2022, an average of 6.4 events per year
- 17.7% (22 events) occurred *just* between 2020 and 2022, an average of 7.3 events per year

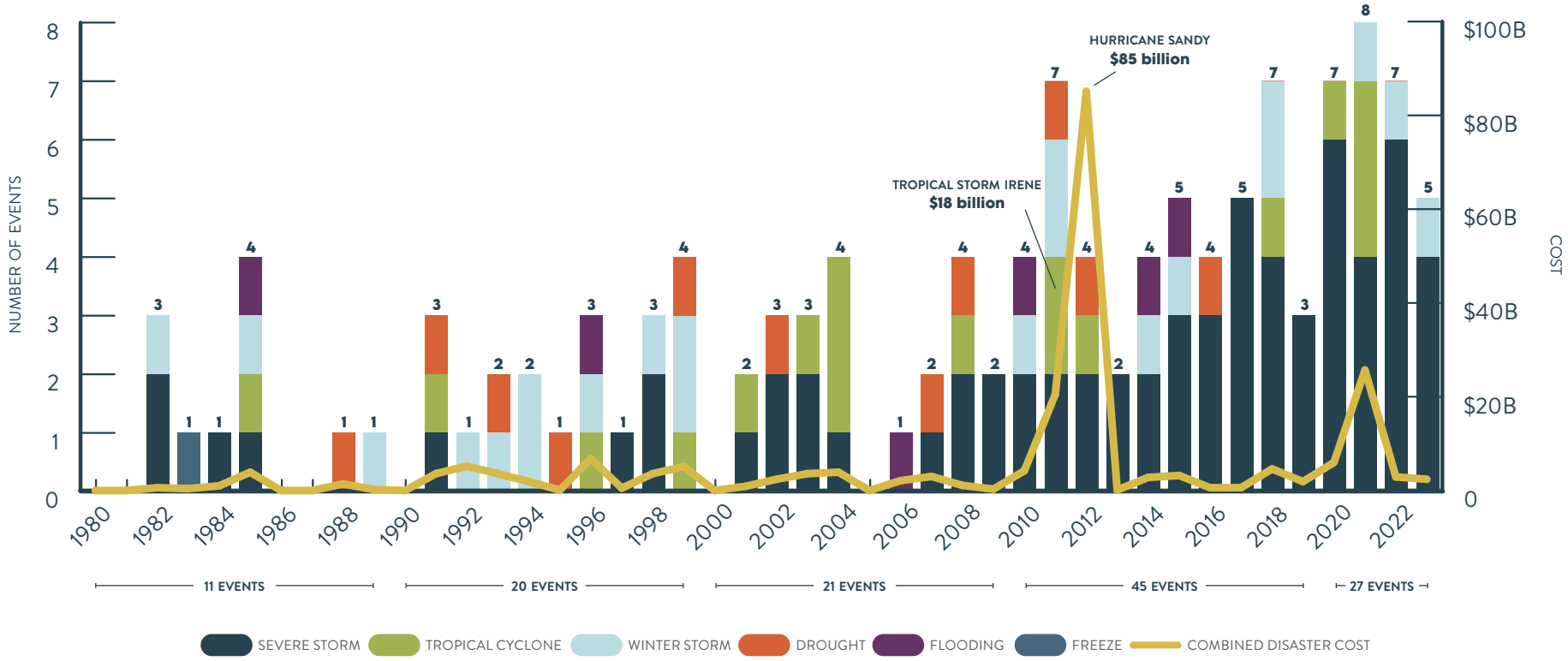
Across the Northeast, not only has the frequency of billion-dollar events increased, but the types of climate disasters has changed. As predicted, the frequency of severe storms has increased (Figure 7). The total cumulative costs of all disasters to date is $216 billion. Severe storms accounted for 54% (67 events, 48 of which have happened just since 2010) of events, and 9.5% ($20.4 billion) of total costs. Winter storms are the next most common billion-dollar event in the Northeast, with 21 events (16.9%) accounting for 15.7% ($33.8 billion) of total costs. In fact, the Northeast region accounted for 21 out of 22 total winter storm billion-dollar events in the country. Hurricanes accounted for 14.5% (18 events) of events, but 68.1% ($147.1 billion) of total costs.

In New England, an increase in extreme weather—particularly extreme rainfall, but also water stress due to droughts—has already impacted agricultural activities. Some research suggests that food production in the region would *benefit* from a longer growing season. However, evidence also suggests that excess moisture is already a leading cause of crop loss in New England - a major challenge if the region commits to meeting a 30% regional self-reliance goal by 2030, which would require another 590,000 acres in agriculture. Projected increases in precipitation amount, intensity, and persistence are expected to impact food production activities:

> *Increased precipitation can result in soil compaction, delays in planting, and reductions in the number of days when fields are workable. If the trend in the frequency of heavy rainfall prior to the last frost continues, overly wet fields could potentially prevent Northeast farmers from taking full advantage of an earlier spring. Increased soil erosion and agricultural runoff—including manure, fertilizer, and pesticides—are linked to excess nutrient loading of water bodies as well as possible food safety or public health issues from food and waterborne infections. Warmer winters are likely to increase livestock productivity in the Northeast but are expected to also increase pressure from weeds and pests, demand for pesticides,and the risk of human health effects from increased chemical exposures.*[59]

Warming oceans have also impacted commercial fisheries in New England by changing the availability and quantity of species, reducing

**FIGURE 7:** Northeast Climate Region Billion-Dollar Disaster Events, 1980-2023

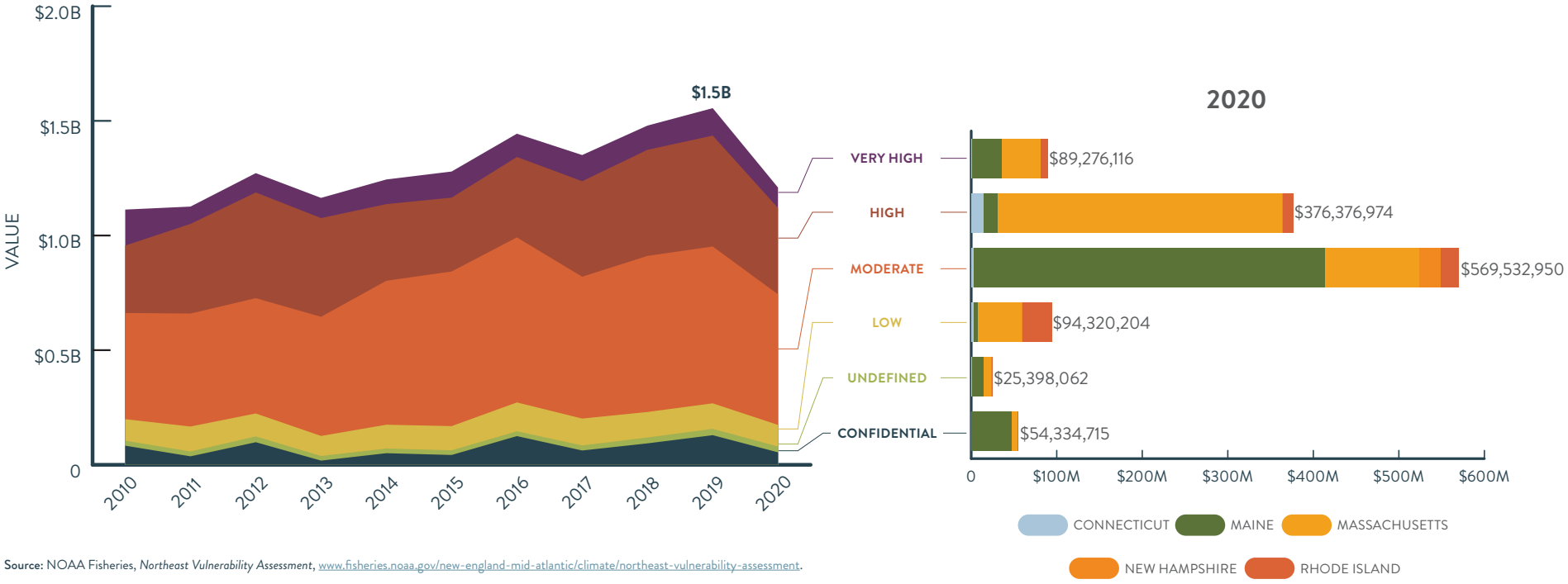



Source: NOAA National Centers for Environmental Information (NCEI), 2023, *U.S. Billion-Dollar Weather and Climate Disasters*, https://www.ncei.noaa.gov/access/billions/.

employment, and inducing new management challenges.[60] In the last two decades, New England fisheries have experienced multiple temperature-driven changes. The climate signal can be seen in the northward distributional shifts or expansions of many species historically associated with the Mid-Atlantic coast but now abundant off Southern New England, such as black sea bass, summer flounder, and scup.[61] It is evident in the divergent fates of Gulf of Maine lobster, which have experienced a fivefold increase in population,[62] and Southern New England lobster, which has experienced precipitous declines.[63] The prolonged failure of species at the southern end of their ranges, such as Gulf of Maine cod[64] and Southern New England winter flounder,[65] is also evident - despite decades of strict management measures aimed at rebuilding these stocks in an effort to rebound to desired levels. Trends like these are expected to continue.[66]

**An estimated 85% of current seafood production (2020) in New England is derived from species that are moderately (n = 21), highly (n = 19), or very highly vulnerable to climate change (n = 20)** based on NOAA Fisheries' assessment of fish species vulnerability (Figure 8). Vulnerability in this case is defined as a change in a species' productivity and/or abundance associated with a changing climate,

**FIGURE 8:** Climate Vulnerability of New England Catch and Distribution of Catch by New England State




Source: NOAA Fisheries, *Northeast Vulnerability Assessment*, www.fisheries.noaa.gov/new-england-mid-atlantic/climate/northeast-vulnerability-assessment.

including both climate change and decadal climate variability.[67] In contrast, only 8% of seafood production is derived from species with low climate vulnerability (n = 22). The remaining 7% could not be estimated because harvest data is confidential or the climate vulnerability for a species has not been evaluated. In 2020, Massachusetts alone landed nearly $400 millions worth of product that has high or very high climate vulnerability. While this data does not reveal the net impact of climate change on total ecological production or offer clarity on how species composition of this production may change, it does hint at the overall significance of the climate issue for wild capture fisheries in New England.

Significant investments in mitigation and adaptation to climate change are required for all aspects of society, including food production. Each New England state has a "climate action plan" or council which outlines goals and suggests strategies (i.e., the Vermont Climate Action Plan, the Massachusetts Clean Energy and Climate Plan for 2050, the Rhode Island 2021 Act on Climate, Maine Won't Wait, the Connecticut Governor's Council on Climate Change, and the New Hampshire Climate Action Plan). These plans appropriately target energy, transportation, and buildings, and they showcase progress on, for example, increased renewable electricity generation. They also include an interesting mix of strategies for food production. For example, Connecticut's Governor's Council on Climate Change includes recommendations for strengthening land use planning tools for agriculture, improving soil health practices through technical assistance and training, and preparing farms for climate change using federal and state programs, including risk management and crop insurance tools.

Nongovernmental initiatives are also active in the region. For example, the USDA Northeast Climate Hub provides research and analysis, tools, management actions, and demonstrations to assist farmers with climate-smart or regenerative agriculture practices (both concepts refer to a suite of practices that yield multiple benefits, including carbon sequestration, erosion control, and building healthy soil).

However, as trends continue to move in the wrong direction, it is clear that current responses to climate change are inadequate globally, nationally, regionally, and locally. At this point, it may be necessary to imagine a regional collective impact network that organizes technical assistance, financing, infrastructure, education, and other mitigation and adaptation strategies by crop and livestock production system (including indoor production) and offers these services consistently within each state. The new Northeast USDA Regional Food Business Center, to be operated by the National Association of State Departments of Agriculture, may be a good hub to offer these services.

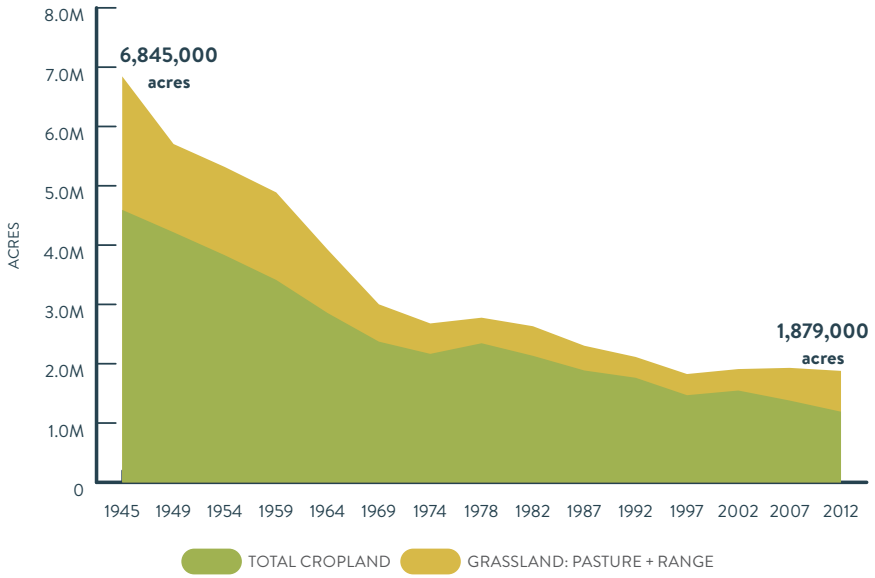
As described in the Volume 2 Supplement: Increasing Regional Self-Reliance Through Seafood, wild capture fisheries represent a common-pool resource where harvesting activities are performed by the private sector but managed by a constellation of government fisheries management entities. Within this system there are multiple possible leverage points where regional food planners and their partners in fisheries management could potentially intervene to increase regional self-reliance for wild seafood, including:

- Increase ecological production through habitat protection, restoration, and enhancement
- Increase ecological production through stock enhancement
- Increase landings by reducing regulatory discards and addressing "choke" species
- Develop fishing, processing, and marketing techniques for underutilized species
- Better align consumption with production through consumer education, processing, and marketing.

## Access to Land, Waterfront, and Water

According to the USDA's Major Land Uses series—"the longest running, most comprehensive accounting of all major uses of public and private land in the United States"—**the six New England states lost the *most* cropland and grassland of any region in the country from 1945 to 2012: nearly 5 million acres (a 73% decrease!) (Figure 9).** The region with the next highest percent decrease, the Northeast (Delaware, Maryland, New Jersey, New York, and Pennsylvania), experienced a 46% decrease (-13 million acres). In a region where *just 4.7%* of the land area is in active agricultural use, every single acre counts towards a safe and resilient future in New England.

**FIGURE 9:** Agricultural Land Use in New England, 1945-2012




**Source:** USDA Major Land Uses. Data for land in agriculture from the 2017 Census of Agriculture has been published (1,739,416 acres), but 2017 estimates for the Major Land Uses database have *not* been published. Since Census of Agriculture estimates for 2012 are slightly different than the Major Land Uses database estimates for 2012, we also anticipate a discrepancy in 2017 estimates. We expect the downward trend to continue when Major Land Uses data for 2017 is published.

Although the conversion of farmland to non-agricultural uses has waned somewhat since the 1980s and 1990s, development and competition from other land uses still threatens the agricultural land base in New England. Between 2001-2016, the American Farmland Trust (AFT) estimated that 105,000 acres of agricultural land in the region was converted to highly developed urban use or was impacted by low-density residential land uses. Roughly half of this converted land was among the region's best in terms of soil quality and suitability for food crop production.[68]

New England's population is projected to grow from **15.3 million in 2020 to 15.6 million by 2030**, an increase of over 300,000 people. Massachusetts (+156,463) and New Hampshire (+121,720) are projected to account for about 89% of that population growth, while Vermont, Connecticut, and Maine are projected to experience modest gains, and the population of Rhode Island is projected to *decrease* slightly. This projection may change as 1) remote work due to the COVID-19 pandemic becomes more possible, and 2) climate migration from regions already experiencing adverse conditions—and other push-pull factors—makes the New England region more attractive to live in for first and second home owners.[69]

For example, the American Community Survey estimated that *about 20%* of New Englanders worked from home in 2021: Massachusetts (23.7%), Vermont (19.6%), Connecticut (19.5%), New Hampshire (19.3%), Maine (17.7%), and Rhode Island (17.5%). Second homes already make up a relatively high percentage of all housing units in three New England states: Maine (15.2%), Vermont (14.9%), and New Hampshire (11.0%). The combination of the COVID-19 pandemic and second home owners escaping to New England—and well-off people buying land, homes, and farms in rural areas as investment or second or third home properties—has exacerbated long-standing tensions between locals and second home owners.[70] Land pressures and prices have become more acute since the start of the COVID-19 pandemic and, if recent trends in land use conversion continue to play out in the decades to come, New England's farm land base will face serious challenges for food security and economic resiliency.

A 2022 AFT analysis articulated three pathways for imagining land use changes from 2016 to 2040: *Business as Usual* (i.e., historical trends continue), *Runaway Sprawl* (i.e., new development is very inefficient), and *Better Built Cities* (i.e., new development is denser). Under the *Business as Usual* scenario, the United States is projected to convert 18.4 million acres of agricultural land to more-developed uses by 2040, while *Runaway Sprawl* would result in a conversion of 24.4 million acres, and *Better Built Cities* would end up converting 10.9 million acres.[71]

Within New England, a *Business as Usual* scenario would result in a conversion of 267,100 acres (Table 2 - page 32, Figure 10, page 33), with Massachusetts accounting for the biggest decrease (-73,800 acres), followed by Connecticut (-55,000 acres), Maine (-53,400 acres), and Vermont (-41,200 acres). A *Runaway Sprawl* scenario would result in a loss of 349,500 acres, while a *Better Built Cities* scenario would lead to a loss of 163,700 acres. As a reminder, as outlined in Volume 2, meeting a goal of 30% regional self-reliance by 2030 would require ***more than 588,000 additional acres in agriculture.***

- As of 2017, Massachusetts had the third most amount of land in agriculture in New England: 491,653 acres (Note that this value includes woodland and farmsteads). A loss of 73,800 acres represents a 15% decrease, a loss of 89,400 acres represents a 18.1% decrease, while a loss of 50,100 represents a 10.2% decrease. Worcester, Plymouth, and Bristol counties are projected to experience the biggest decreases (Figure 11, page 34). Maps for the other states are presented in separate State Reports.

**TABLE 2:** Projected Conversion of Farmland from 2016 to 2040 in New England (Acres)

| Land Uses | New England | CT | ME | MA | NH | RI | VT |
|---|---|---|---|---|---|---|---|
| **Business as Usual Scenario** | | | | | | | |
| **TOTAL** | **-267,100** | **-55,000** | **-53,400** | **-73,800** | **-35,600** | **-8,100** | **-41,200** |
| Cropland | -108,200 | -19,900 | -29,300 | -26,300 | -12,300 | -2,100 | -18,300 |
| Pastureland | -52,700 | -11,000 | -6,500 | -14,400 | -7,200 | -3,300 | -10,300 |
| Rangeland | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Woodland | -106,200 | -24,100 | -17,700 | -33,100 | -16,100 | -2,700 | -12,600 |
| **Runaway Sprawl Scenario** | | | | | | | |
| **TOTAL** | **-349,500** | **-72,700** | **-72,500** | **-89,400** | **-43,200** | **-9,900** | **-61,800** |
| **Better Built Cities Scenario** | | | | | | | |
| **TOTAL** | **-163,700** | **-35,800** | **-28,400** | **-50,100** | **-22,400** | **-5,500** | **-21,500** |

Source: American Farmland Trust, *Farms Under Threat 2040*, https://development2040.farmland.org/.

- Connecticut had the fifth most amount of land in agriculture in New England: 381,539 acres. A loss of 55,000 acres represents a 14.4% decrease, a loss of 72,700 acres represents a 19.0% decrease, a loss of 35,800 acres represents a 9.4% decrease. Hartford, Windham, and New London counties are projected to experience the biggest decreases.

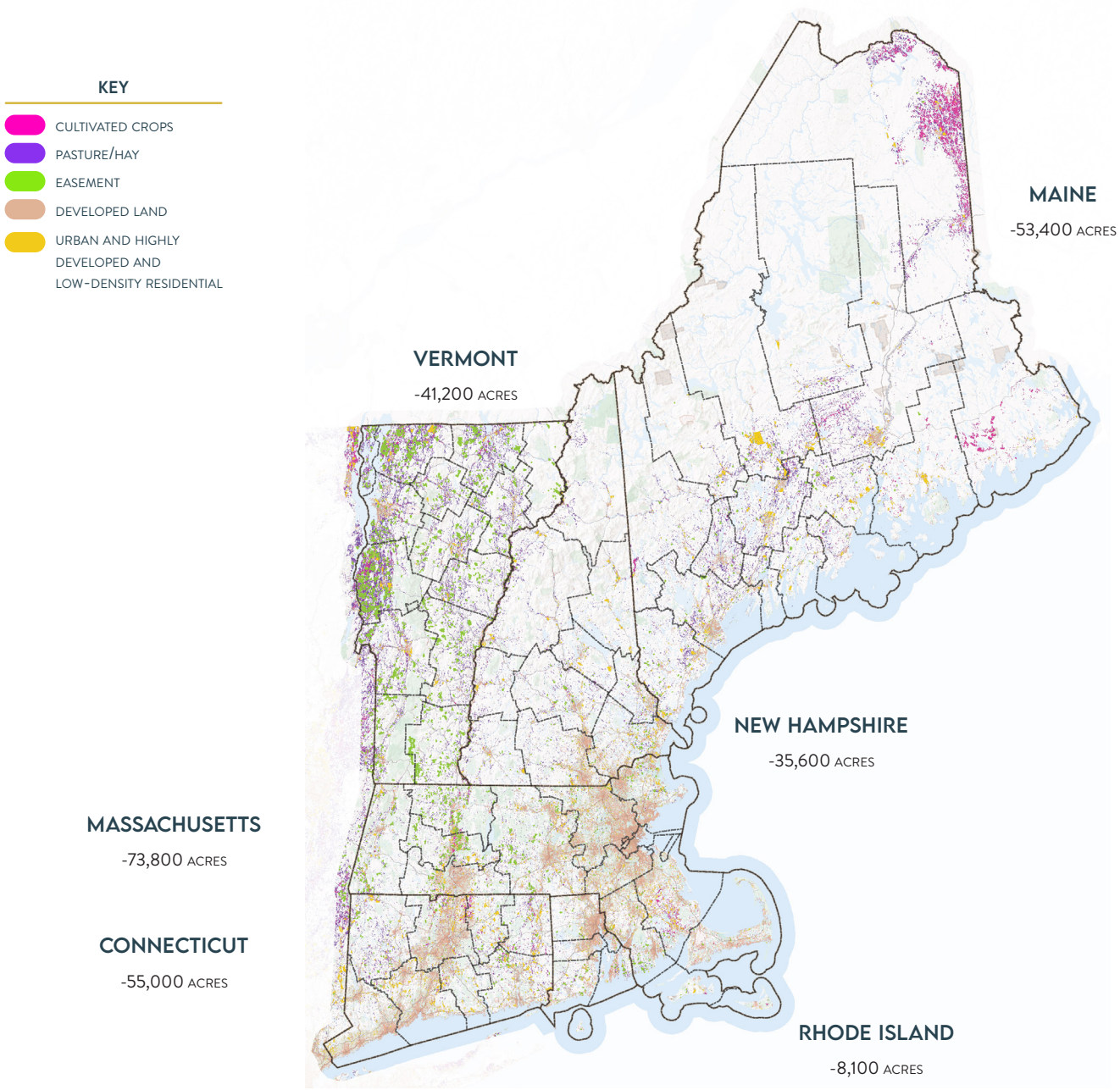
- Maine had the most amount of land in agriculture in New England: 1,307,613 acres. A loss of 53,400 acres represents a 4.1% decrease, a loss of 72,500 acres represents a 5.5% decrease, a loss of 28,400 acres represents a 2.2% decrease. Somerset, Aroostook, and Cumberland counties are projected to experience the biggest decreases.

- Vermont had the second most amount of land in agriculture in New England: 1,193,437 acres. A loss of 41,200 acres represents a 3.4% decrease, a loss of 61,800 acres represents a 5.2% decrease, a loss of 21,500 acres represents a 1.8% decrease. Addison, Franklin, and Rutland counties are projected to experience the biggest decreases.

- New Hampshire had the fourth most amount of land in agriculture in New England: 425,393 acres. A loss of 35,600 acres represents a 8.4% decrease, a loss of 43,200 acres represents a 10.1% decrease, a loss of 22,400 acres represents a 5.3% decrease. Hillsborough, Rockingham, and Grafton counties are projected to experience the biggest decreases.

- Rhode Island had the least amount of land in agriculture in New England: 56,864 acres. A loss of 8,100 acres represents a 14.2% decrease, a loss of 9,900 acres represents a 17.4% decrease, a loss of 5,500 acres represents a 9.7% decrease. Providence, Washington, and Newport counties are projected to experience the biggest decreases.[72]

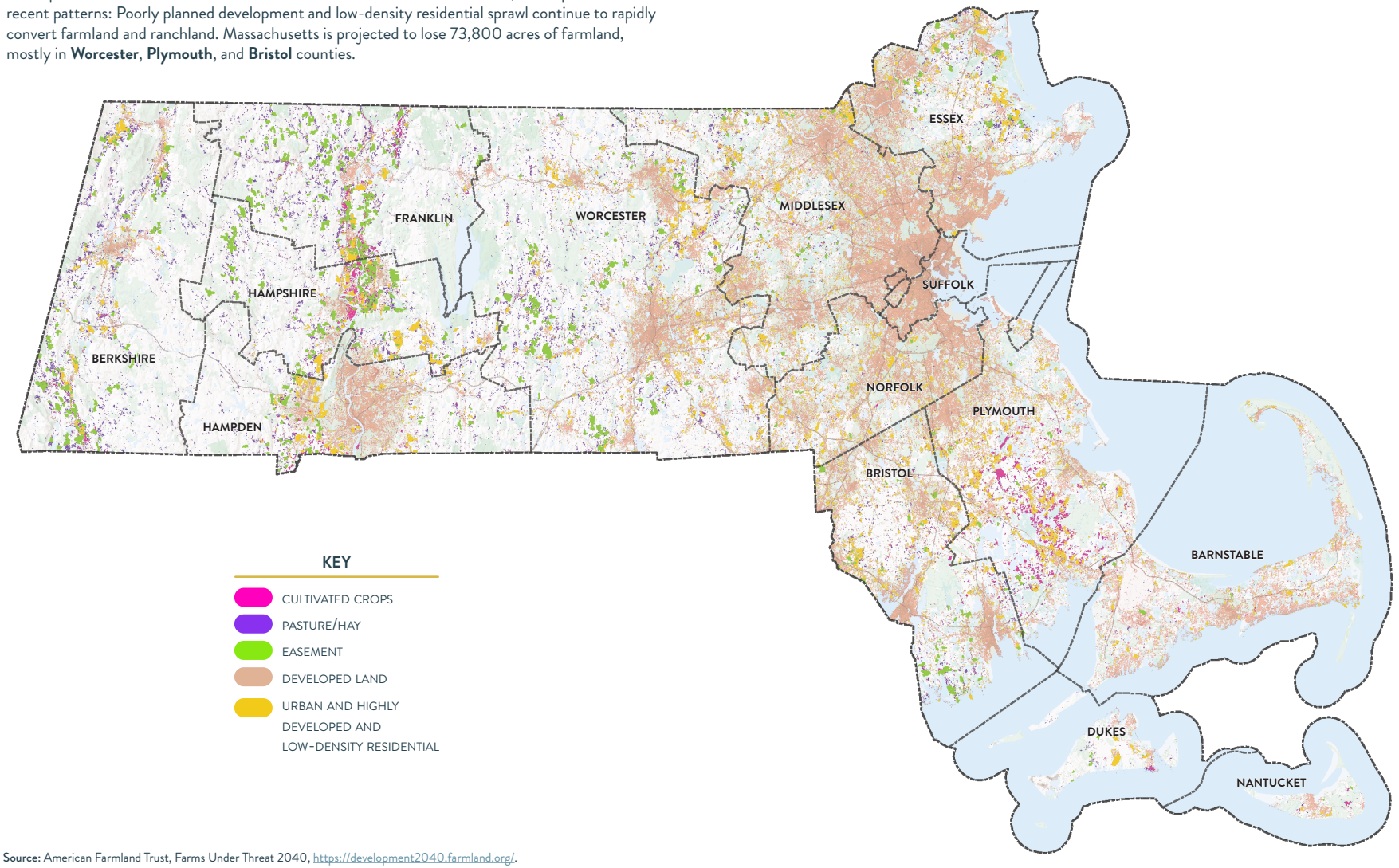
**FIGURE 10:** Projected Agricultural Land Conversion in New England, Business As Usual Scenario, 2016-2040




**Source:** American Farmland Trust, Farms Under Threat 2040, https://development2040.farmland.org/.

**FIGURE 11:** Projected Agricultural Land Conversion in Massachusetts, Business as Usual Scenario, 2016-2040

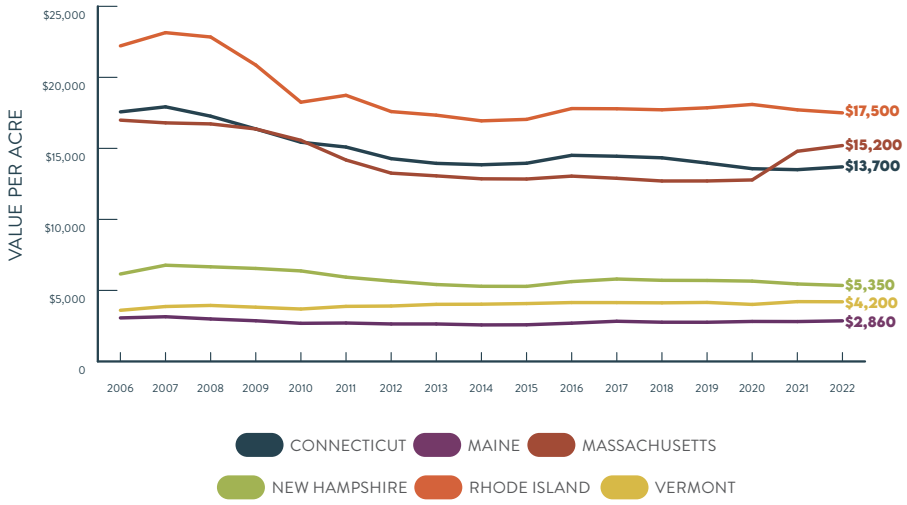
The **American Farmland Trust *Farms Under Threat 2040*** report created three scenarios of development between 2016 and 2040. Under a "Business as Usual" scenario, development follows recent patterns: Poorly planned development and low-density residential sprawl continue to rapidly convert farmland and ranchland. Massachusetts is projected to lose 73,800 acres of farmland, mostly in **Worcester**, **Plymouth**, and **Bristol** counties.




**Source:** American Farmland Trust, Farms Under Threat 2040, https://development2040.farmland.org/.

Soaring land values due to residential development and second home ownership make it increasingly difficult for farmers to compete with other land uses and prevent farmland loss. **New England has some of the highest farm real estate values in the country, especially in Southern New England:** Rhode Island has *the highest* farm land values of any state in the country ($17,500 per acre in 2022), Massachusetts is ranked third ($15,200), and Connecticut is ranked fourth ($13,700) (Figure 12).[73] High land costs negatively impact land access for all farmers but are particularly challenging for the region's new and diverse farming population.

**FIGURE 12:** New England Farm Land Values




**Source:** USDA National Agricultural Statistics Service, August 2022, Land Values 2022 Summary, https://www.nass.usda.gov/Publications/Todays_Reports/reports/land0822.pdf. Reported in 2022 dollars.

Seafood production is constrained by similar factors. Around the region, working waterfronts face competition and increasing costs as a result of gentrification, population growth, development, and expansion of the tourism industry.[74] Some wharves and docks are in need of infrastructure improvements[75] and many are highly vulnerable to sea level rise.[76] Pressures are especially acute in small ports and privately held wharves, where dockage is not specifically assigned to commercial vessels and changes in ownership can occur.[77] Publicly owned and managed ports may be more secure in their tenure but are still affected by real estate pressures and debates about the best use of these locations for the public benefit.[78] Working waterfront infrastructure for fisheries and aquaculture not only includes dockage or moorage where boats can be tied when not in use, but also adequate parking, gear storage, cold storage, availability of ice, boat yards, fuel docks, and seafood dealers where harvesters and growers can deliver their catch. Many of these infrastructure assets are disappearing or consolidating in ports around the region, and maintaining them will be critical to the future resilience of New England's seafood system.[79]

In wild capture fisheries, state and federal fishing licenses and permits represent another form of access that can be hard to come by. Transferable licenses/permits can be extremely costly, while those that are not transferable are sometimes subject to very long waiting lists, as in the case of Maine lobster licenses.[80] Since federal (and some state) permits are species-specific, these factors can prevent established fishermen from diversifying their businesses to include new fisheries and can act as a barrier to business ownership for new fishermen or for crews attempting to transition to ownership.

While spatial limitations on the ocean have not historically been a limiting factor for seafood, as they are for terrestrial food, this may be beginning to change as human use of the seascape expands and diversifies. For example, the development of expansive offshore wind farms is anticipated to impose new constraints on the spatial distribution of wild capture fishing activities, since some types of fishing gear may not be operable within wind farms and the presence of turbines may potentially affect fishing vessels' ability to transit through wind energy areas.[81] Different usage levels of wind farm areas may be possible in Southern New England, where turbines will utilize fixed foundations, and the Gulf of Maine, where turbines will utilize

floating foundations. Meanwhile, aquaculture growers contend with competition from recreational water use and commercial fisheries.

As with climate change, land use trends are unfortunately moving in the wrong direction. Reaching 30% regional self-reliance requires investments to:

- Keep existing farmland and fisheries in production
- Intensify use of agricultural land
- Increase productive potential by improving yields, closing yield gaps, and/or expanding the area of agricultural land
- Maintaining output of dairy and fisheries while expanding fruits, vegetables, grains, meat, and eggs
- Maintaining wharfs, docks, landings, and seafood processing infrastructure.

Farmland conservation via "purchase of agricultural conservation easement" programs (PACE)—legal documents that permanently limit development—are the most common tool offered by land trusts and some government programs in New England to protect farmland. AFT's Agricultural Land Protection Scorecard rates Vermont, Connecticut, Rhode Island, and Massachusetts as among the best states for policies and programs that address farmland loss (criteria include PACE programs, land use planning, property tax relief for farmland, agricultural districts, "Farm Link" programs, and state leasing programs). One challenge is that the demand for funding to purchase conservation easements exceeds available sources. Service providers and stakeholders are exploring alternative land ownership and access models that include long-term leases, leasing public land, lease-to-own, cooperative ownership models, and alternative sources of capital.

Under the umbrella of "Working Waterfronts," service providers and stakeholders have also explored cooperatives, covenants that ensure the property remains a working waterfront, and infrastructure improvements to protect wharfs and other waterfront property. For example, Maine's Working Waterfront Access Protection Program has bought the development rights to 27 wharfs, ensuring they will stay working waterfronts in perpetuity. However, a report on the future of Maine's working waterfronts suggests that the variety of funding mechanisms to protect waterfront access in the state is not commensurate with the economic impact of fisheries. Further, "Without a comprehensive, statewide plan to protect Maine's working waterfront and access to it, Maine will never move beyond its current approach." The report recommends:

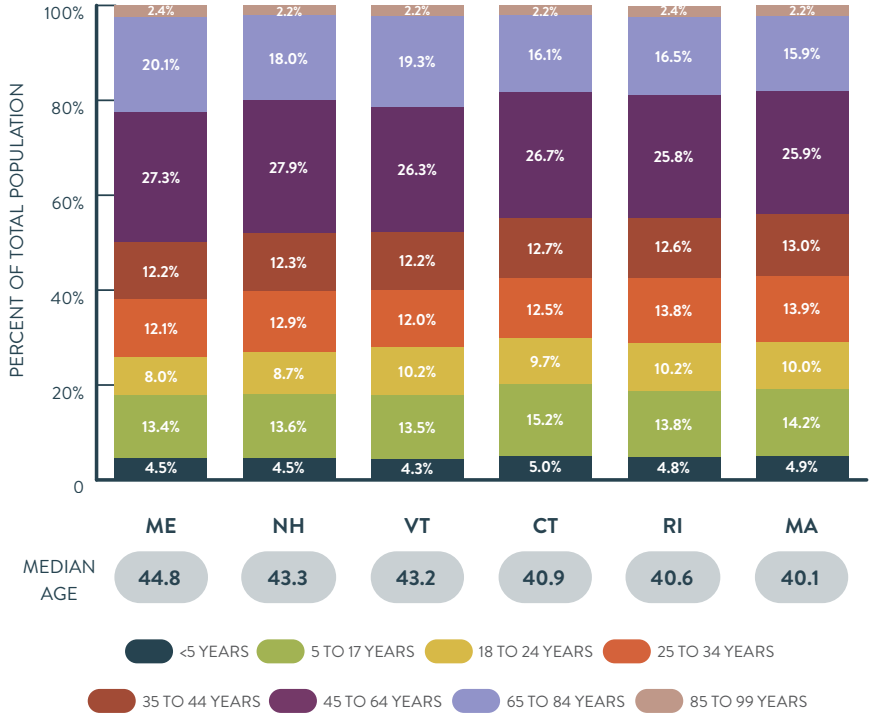
- Long term, systemic interventions, including a common agenda for protecting the state's working waterfront
- A backbone support organization that is looking holistically at the future of working waterfronts
- Technical assistance and institutional support to help coordinate complex challenges, including identifying the coastal communities most at risk.[82]

## Aging of Food Producers

America is aging - the Census Bureau reports that the median age in the country was 38.9 years old in 2022. The median age in Maine, *44.8*, was the oldest in the country, and each New England state was above the U.S. median age. In fact, **New England, particularly the northern states, has the highest percentage of adults over the age of 45 of any region in the country** (Figure 13). While this demographic transition will have societywide consequences (including significant educational, economic, and health care consequences), agriculture and fisheries are already dealing with a shrinking and aging workforce:

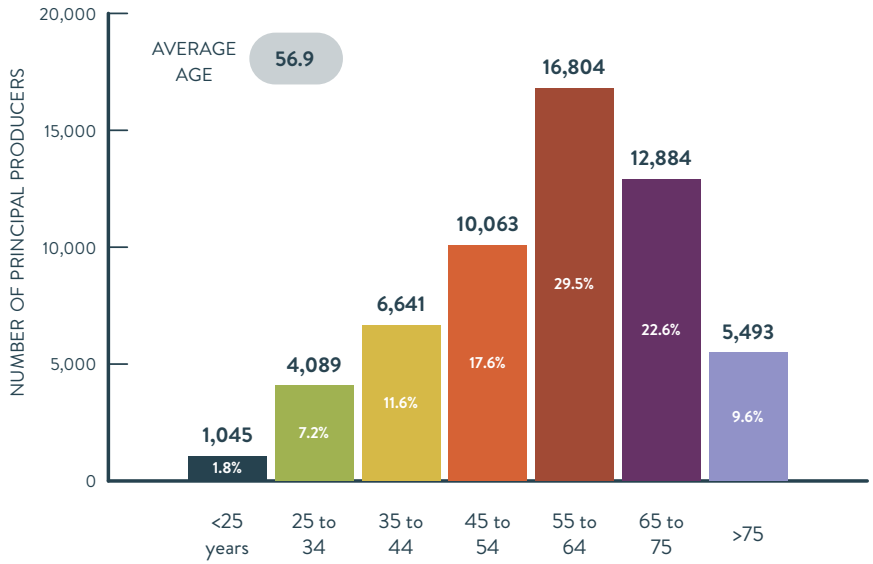
- The 1945 Census of Agriculture estimated that the six New England states had about 150,000 farms. By 2017, the number of farms decreased 78%, to 32,000.
- In 1945, there were 150,311 "farm operators" in New England. By 2017, the number of all "producers" decreased 62%, to 57,019.
- In 1945, there were 32,252 hired farm workers, not counting a significant number of family members that worked on farms. By 2017, the number of hired farm workers decreased 81%, to 6,156.
- In 2017, about 62% of New England "primary producers"—the producer who made the most decisions for the farm—were over the age of 55, while about 21% were under 45 (Figure 14). **The average age of New England principal producers was 56.9.** On average, New England counties have increased their proportion of producers over 65 by at least 50%, and some have more than doubled their older farming population since 2002. This is especially prevalent in the rural regions of New Hampshire, eastern Maine, and eastern Massachusetts.
- In 2017, the *primary occupation* of 57% (32,731) of producers in New England was off farm. As a practical matter, farming in the U.S. became enormously more productive over the 20th century—due to advances in technology, equipment, chemicals, and more—and American society changed in now familiar ways as people moved off the farm. A side effect is

**FIGURE 13:** New England Age Demographics, 2022




Source: United States Census Bureau, State Population by Characteristics: 2020-2022, https://www.census.gov/data/tables/time-series/demo/popest/2020s-state-detail.html.

**FIGURE 14:** New England Farmer Age Demographics, 2017




Source: USDA 2017 Census of Agriculture, https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_State_Level/.

> that there is now a smaller pool of experienced, knowledgeable producers at a moment when we are arguing that food production needs to scale up.

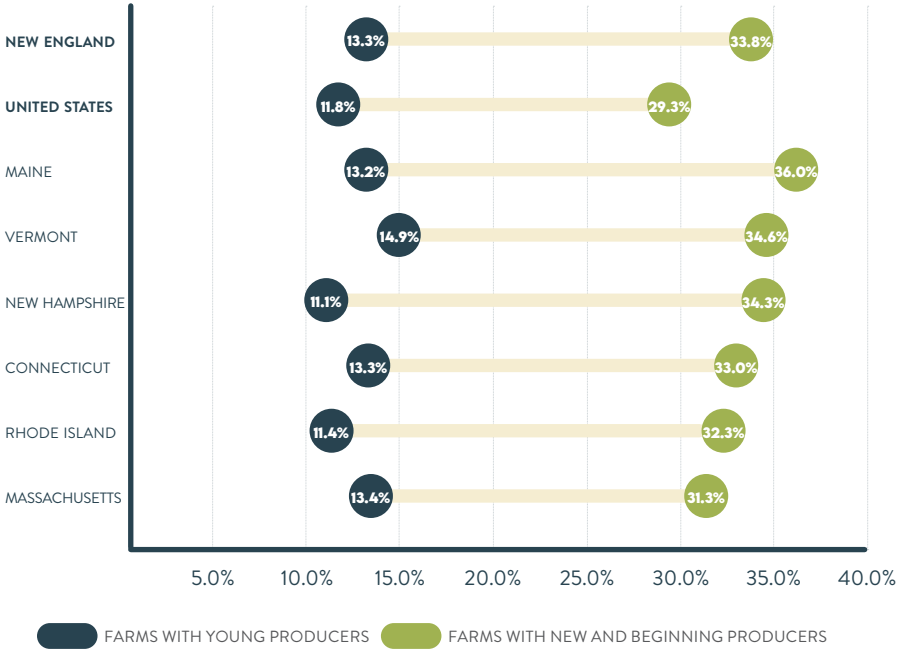
Similar trends exist in wild capture fisheries. Participants in wild capture fisheries focus groups, conducted during research for Volume 2, stated that the traditional model for business succession is breaking down in New England fisheries. For example, the average age of Point Judith (Rhode Island) fishermen increased from 33.9 to 45.2 between 1977 and 2013-14 (with a jump from 43.7 to 45.2 from 2009-10 to 2013-14) and average age of New Bedford (Massachusetts) fishermen increased from 35.1 to 46.1 between 1977 and 2013-14 (with a jump from 44.2 to 46.1 from 2009-10 to 2013-14).[83]

A recent project by the Northeast Fisheries Science Center suggests that "graying of the fleet" results from a combined trend of fewer people entering the industry and conditions that make it hard for young people to stay in the industry and advance their careers over time. Barriers to entry and advancement include start-up costs, lack of available licenses, and the challenge of learning the skills necessary to be a fisherman, which is particularly acute for entrants who do not come from fishing families. Simultaneously, there is evidence that fewer young people are seeking to enter the industry, possibly as a result of a discouraging regulatory environment, financial considerations, lack of interest in manual labor, lack of awareness about fishing as a career option, and a societal bias against blue collar work.[84]

During a variety of agricultural food production focus groups conducted for Volume 2, participants noted that in many families there is not an adult child who plans to continue farming. However, focus group participants emphasized that there are plenty of young people who would like to get involved in the agricultural workforce, but face barriers to entry including access to land, capital, and credit as well as lack of training programs. **The inability of the older generation to exit farming and of the next generation to enter farming—the farm transition gap—constitutes one of the greatest challenges for farming in New England.** Without significant intervention, lack of successors for New England's farmers may result in "a significant decrease in the amount of land in active agricultural use, land lying fallow for years or developed for other uses, and a setback of the amount of food produced" in the region.[85]

The good news is that New England is home to many programs and services for succession planning and farmland access, including Land for Good, New England Farmland Finder, Farmland Transfer Network of New England, and state-specific assistance like the Vermont Farm & Forest Viability Program. Despite the advanced ages of the majority of New England farmers, there is some evidence of new

**FIGURE 15:** Percent of New England Farms with a Young, New, or Beginning Producer, 2017




Source: USDA 2017 Census of Agriculture, https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_State_Level/.

cohorts of farmers. The USDA has two classifications for describing the next generation of farmers: "young producers" are producers who are 35 years of age or younger, and "new and beginning producers" are producers operating on any operation for 10 years or less. In 2017, 11.8% of farms in the United States had young producers, while 29.3% had new and beginning producers. **New England had slightly higher percentages of young (13.3%) and new and beginning (33.8%) producers than national averages** (Figure 15). Within New England, Vermont, Rhode Island, Connecticut, and Maine had a higher percentage of young producers than the national average, while every New England state had higher percentages of new and beginning producers. **Prioritizing and expanding business and technical assistance to support these young, new, and beginning producers is critical to meeting the 30% by 2030 goal.**

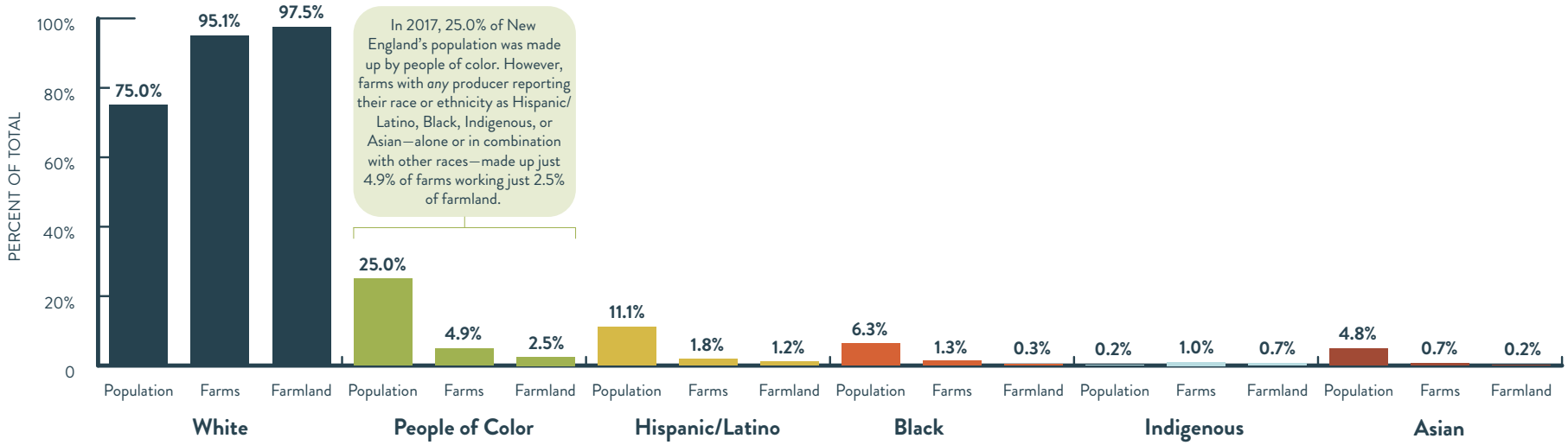
## Unequal Access to Farmland

New England is markedly Whiter than the U.S. average—61.1% of Americans were White in 2020, compared to 71.3% of New Englanders—but the region became more diverse from 2010 to 2020. The White population decreased by nearly 681,000, from 79.4% of New England's population, to 71.3%. The number of Hispanic/Latino New Englanders increased from 1.2 million to 1.8 million, that is, from 8.4% of the population to 11.9%. The number of New Englanders of two or more races dramatically increased, from 71,000 (0.5% of the population) to 656,000 (4.3% of the population). The number of Asian New Englanders increased by over 200,000, from 3.8% of the population to 5.1%. The number of Black New Englanders increased by 120,000, from 5.6% of the population to 6.1%. The Indigenous population of New England stayed approximately the same: 29,000-31,000 people. Overall, New Englanders of color increased from about 2.9 million to 4.3 million and now account for 28.7% of the population.

Comparing race and ethnicity data from the 2017 Census of Agriculture with the region's *2017* population, we see that White New Englanders made up 75% of the region's population, but 95% of farms had a White producer (i.e., farmer), and White producers worked on over 97% of existing land in agriculture. In comparison, Black, Indigenous, Hispanic/Latino, and Asian New Englanders (no other categories are included in the Census of Agriculture), accounted for 25% of the region's population but only about 5% of farms had a producer of color and these farms operated only 2.5% of land in agriculture (Figure 16).

» In 2017, Hispanic/Latino New Englanders made up 11% of the population, but only 1.8% of farms had a Hispanic producer, and Hispanic producers worked on 1.2% of land in agriculture.

**FIGURE 16:** New England Farms and Farmland by Any Producer Reporting Race/Ethnicity, 2017




**Source:** US Census Bureau, American Community Survey, https://data.census.gov/table?q=hispanic+race&t=Race+and+Ethnicity&g=040XX00US09,23,25,33,44,50&y=2017&tid=ACSDT1Y2017.B03002. USDA 2017 Census of Agriculture, Table 59. Hispanic, Latino, or Spanish Origin Producers - Selected Farm Characteristics and Table 61. Selected Farm Characteristics by Race.

- In 2017, Black New Englanders made up 6% of the population, but only 1.3% of farms had a Black producer, and Black producers worked on 0.3% of land in agriculture.
- Indigenous New Englanders made up 0.2% of the population, 1.0% of farms had an Indigenous producer, and Indigenous producers worked on 0.7% of land in agriculture.
- Asian New Englanders made up 4.8% of the population, 0.7% of farms had an Asian producer, and Asian producers worked on 0.2% of land in agriculture.

Food sovereignty refers to the ability of communities to determine the quantity and quality of the food that they consume by controlling how their food is produced and distributed. These abilities, including re-introducing traditional processes of food production, are strongly limited when Black, Indigenous, Hispanic/Latino, Asian, and other New Englanders face steeper challenges accessing land, capital, and credit than White producers. Urban agriculture and community gardens—often supported by city governments like Boston's Office of Food Justice—are common throughout New England's more diverse cities. While there may be potential for growing high-value crops on small pieces of land near urban centers (including indoor production), **a regional approach must prioritize health, wealth, leadership, and power for Black, Indigenous, Hispanic, Asian and other New Englanders, including opportunities for *land ownership* throughout the region.** A process for actively training, recruiting, supporting, and investing in Black, Indigenous, Hispanic/Latino, Asian, and other New England producers in Vermont and Maine—the top two food producing states in the region—should be pursued.

# 4 Challenges to Farm, Fishery, and Food Business Viability

The growth of the local food movement has been more than matched by the vast scale of market concentration—essentially monopolies—in the food system overall. The infamous quote of Earl Butz, Secretary of Agriculture in the Nixon Administration, to "get big or get out" has come to fruition. The majority of farms, fishermen, and food businesses in New England are comparatively small and account for a small percentage of sales. For example, farms with sales of less than $25,000 per year accounted for 78% (25,192 farms) of New England farms but only 4% ($112,300,000) of total agricultural sales. These small businesses co-exist and compete with multinational corporations from across the planet that have enormous power and resources, not the least of which are scales of production that drive prices down and crowd out competitors.

Photo credit: New Hampshire Food Alliance

Genuine Local is New Hampshire's only specialty food production accelerator - a shared-use commercial kitchen for small producers.

## Market Concentration

Eye-opening research on the concentration of ownership, wealth, and power among food system businesses shows that, starting in the 1980s, an acceleration in mergers and acquisitions among food system businesses has meant that just a few companies dominate almost all aspects of food production, processing, manufacturing, distribution, and retailing.[86]

For example, the USDA Economic Research Service estimates that grocery store market concentration has dramatically increased from 1990 to 2019: the top 4 grocery stores and supercenters—Walmart,

Kroger, Albertsons, and Ahold Delhaize—accounted for about 15% of total sales in 1990 and 34% of total sales in 2019.[87] **Within New England, these top 4 chains—Ahold Delhaize (Stop and Shop, Hannaford), Albertsons (Shaw's and Star Market), and Walmart—have at least 699 stores (Kroger currently has no stores in New England).** However, the most prolific type of food retailer in America and New England are dollar stores: Dollar Tree/Family Dollar and Dollar General operate at least 914 stores in New England.

The total number of grocery stores in the United States increased 7% (from 47,000 to 51,000) from 2005 to 2015. The number of independent, non-chain stores (i.e., stores with fewer than 4 locations) also increased during this time period, albeit at a much slower pace. The number of independent stores declined in 1,116 counties (36%) and increased in only 915 counties (29%). The net effect, the USDA Economic Research Service found, was that **the share of independent stores declined in 41% of all counties, including every county in Connecticut and most counties in Massachusetts.**[88] Independent stores are often more likely to stock local and regional food products, and the loss of these stores may impact our ability to reach our 30% by 2030 goal.

Even though large corporate food retail entities and supercenters seem to have a strong grip on New England, numerous independent and family-owned small/midsize supermarket chains, as well as food co-ops, represent an important commercial segment within the region. For instance, firmly rooted midsize supermarket chains, such as Big Y and Market Basket, originate within the region. Big Y, founded in 1936 in Chicopee (MA), has some 59 stores in Massachusetts and Connecticut. Market Basket, founded in Lowell (MA) in 1917, has 80 stores in New England, although none in Connecticut and Vermont.

Small supermarket chains, such as Roche Bros. (MA), Stew Leonard's (CT), Caraluzzi's (CT), and Highland Park Market (CT), are part of the food retail fabric of the region, mainly in suburban areas and small towns of Massachusetts and Connecticut. Small ethnic food retail chains like Patel Brothers and the Aurora Grocery Group, of Indian- and Dominican-descent, respectively, have supermarkets in Connecticut and Massachusetts.

Reduced competition enables firms to exercise market power, and can lead to fewer choices—especially locally or regionally sourced choices—and higher prices for consumers. This happens because these companies use their dominant positions to reduce quality, increase prices, decrease innovation, and erect barriers of entry to new entrants. Market concentration is also very pronounced in the types of food products available in grocery stores: when consumers look at the grocery shelves, they may see dozens of brands owned by a few companies (Table 3). Those companies also have tools to access premium in-store real estate. Plus, they can use their market power to exclude new brands. With increased consolidation, there is less overall shelf space in a store for new brands to put their products.

Another issue for local foods accessing grocery stores are stocking fees and free-fills. These are fees, free products, or premiums that brands must pay or provide to grocery stores to get access to shelf space or high value locations like end caps. Dominant and established brands have budgets for these fees. Start-ups and smaller firms have less capital available, which limits their placement in retail. For brands to compete successfully, they need a lot of capital, which creates another barrier for smaller or new food brands that have less access to capital and are often provided with worse terms than larger firms with more resources.

Market concentration is evident in the scale and ubiquity of full-service restaurants, like Olive Garden and Applebee's, and limited-service (i.e., fast food) restaurants like McDonald's and Starbucks. Combined, the 20 top-grossing chains for both types of restaurants have over 143,000 locations nationwide, and sales of over $225 billion. During the COVID-19 pandemic, independent restaurants

**TABLE 3:** Market Share of Selected Grocery Items

| Grocery Item (Year) | Parent Company | Market Share |
|---|---|---|
| Beer (2017) | **Top Companies** | **78.5%** |
| | Anheuser-Busch InBev | 41.6% |
| | Molson Coors | 24.3% |
| | Constellation Brands | 8.9% |
| | Heineken N.V. | 3.8% |
| Fresh Bread (2020) | **Top Companies** | **60.8%** |
| | Grupo Bimbo | 26.9% |
| | Flowers Foods | 24.6% |
| | Campbell Soup Company | 7.1% |
| | Lewis Bakeries | 2.1% |
| | Private Label/Store Brand | 17.0% |
| Yogurt (2019) | **Top Companies** | **74.5%** |
| | Danone | 33.0% |
| | Chobani Global Holdings | 18.4% |
| | General Mills | 17.3% |
| | Groupe Lactalis | 5.8% |
| | Private Label/Store Brand | 7.8% |
| Fresh Cut Salad (2017) | **Top Companies** | **54.2%** |
| | Cultrale-Safra | 21.7% |
| | Itochu | 14.0% |
| | Taylor Fresh Foods | 11.2% |
| | Bonduelle | 7.3% |
| | Private Label/Store Brand | 35.8% |
| Meat, Beef, and Poultry Processing (2021) | **Top Companies** | **48.8%** |
| | JBS SA | 18.7% |
| | Tyson Foods | 15.4% |
| | Cargill | 9.0% |
| | WH Group | 5.7% |

**Source:** Food & Water Watch, November 2021, *The Economic Cost of Food Monopolies: The Grocery Cartels*, https://www.foodandwatch.org/wp-content/uploads/2021/11/IB_2111_FoodMonoSeries1-SUPERMARKETS-V2FINAL.pdf.

in the country closed in record numbers—for example, Yelp found that over 90,000 restaurants permanently closed in 2020[89]—and chain restaurants have leveraged that fact by purchasing available commercial real estate.[90]

**Market concentration in retail food options at stores and restaurants limits choices for consumers and presents a challenging market channel for local and regional food producers.** While substantial progress has been made supporting local and regional food via direct sales (e.g., farmers markets), co-ops, institutional sales (e.g., farm to college), and independent grocery stores, nearly two-thirds of retail food sales are made through grocery stores, supercenters, and restaurants, including fast food. It will be challenging to meet goals of 30% by 2030 or 50% by 2060 without these two channels, but it has been historically difficult to stock local or regional products at grocery stores, restaurants, or fast food chains. In the absence of aggressive federal anti-trust enforcement, we need to explore how to translate progress made by smaller markets to these larger markets.

In some segments of the wild capture fishery system, there has also been a recent trend towards consolidation and out-of-region ownership of fishing vessels and permits. As far as we know, this trend is limited to federal fisheries (i.e., fisheries taking place outside the 3-mile state waters limit), in which permits are assigned to the vessel rather than the individual and the vessel owner need not be on board, enabling businesses to accumulate multiple vessels and permits and have vessels run by hired captains. Some federal regulations make it increasingly difficult for smaller fishing operations to operate profitability (especially when combined with flat prices for many species) and have driven consolidation around larger fishing operations that can take advantage of economies of scale.[91] Consolidation in the New England groundfish fishery garnered national attention in 2016 when New Bedford's Carlos Rafael, who at one point had amassed over 40 vessels, 80% of New England's groundfish quota, and a large portion of the region's scallop permits,

was imprisoned on charges of conspiring to mislabel fish.[92] Recent years have seen high-profile purchases of New England-owned vessels and companies by foreign-owned entities.[93]

However, in the absence of strong federal antitrust enforcement, the six New England states need as many creative strategies as possible to address market concentration and facilitate success at all scales, including:

- Facilitating access to land and building expertise for Black, Indigenous, Hispanic, Asian, and other regional farmers, fishermen, and food business entrepreneurs.
- Creating and expanding peer-to-peer learning and networking opportunities for regional farmers, fishermen, and food business entrepreneurs (e.g., reSET in Hartford, Connecticut).
- Supporting as many "community wealth building" models as possible for farms, fisheries, restaurants, stores, and food processors/manufacturers. Community wealth building models—including cooperatives, community land trusts, employee stock ownership, and equitable food oriented development—"foster collaborative, inclusive, and local control over businesses, housing, and land use decisions."[94] For example, one of New England's marquee brands—King Arthur Baking Company—is employee owned.
- Expanding technical assistance/best management practices and financing for climate-smart/regenerative agriculture - a suite of practices that yield multiple benefits, including carbon sequestration, erosion control, and conservation practices that build healthy soil. This includes exploring indoor production and transitioning existing greenhouses away from floriculture toward food production.

Photo credit: Rhode Island Food Policy Council

The Southside Community Land Trust offers low-cost leases, equipment, and technical assistance to train farmers at Urban Edge Farm in Cranston, Rhode Island.

- Supporting and coordinating agritourism and culinary tourism options. Agritourism refers to activities that have deep connections to agricultural production and/or the marketing of a farm's products. Culinary tourism refers to learning about, exploring, appreciating, and consuming food as a major purpose for tourism. Both ag and culinary tourism emphasize the unique cultures, food traditions, and landscapes of specific places.
- Continuing to identify niche markets. For example, changes in consumer purchasing behaviors have expanded the market for organics, led to declining soda sales, a preference for cage-free eggs, and an elimination of artificial colors and flavors in some products. Taking advantage of these—and other—trends is a sensible approach to the scale of production in New England.

## Agricultural Scale Challenges

Research conducted for Volume 3 shows that employment and sales growth was evident in many New England food system industries, including food and beverage product manufacturing, distribution, stores, and food services in New England from 2007 to 2017. **The *exception* was in farms and fisheries, where employment was essentially flat and sales were down during this period.** Small and midsize farmers and fishermen face significant economic pressures, including low cash receipts and increasing expenses. We can examine agricultural scale challenges through sales (Figure 17), gross cash farm income (Figure 18), and net farm income (Figure 19) data from the Census of Agriculture. Each source of information paints a consistent picture of a scale asymmetry endemic to farming across the country and in New England. For example, **sales data for 2017 indicates that about 78% of farms in New England had sales of less than $25,000. A little more than 3% of New England farms accounted for 69% of total agricultural sales.**

The most common type of agricultural activity in New England — that is, as classified by the North American Industry Classification System (NAICS)— is hay and other crop production, a category that mostly includes hay and maple syrup production (Figure 17). Within this category, hay accounted for 72.5% of farms and 53.2% of sales, while maple syrup accounted for 27.5% of these farms and 46.8% of sales. Together, hay and other crops farms accounted for 25.0% of farms and 8.1% of total sales, with Vermont accounting for 30.1% of farms and 51.3% of sales in this category. Within this category, 81.9% (6,618) of farms had sales of less than $25,000.

Photo credit: Vermont Agency of Agriculture, Food and Markets

Hay production in Vermont is the most common type of agricultural activity in New England.

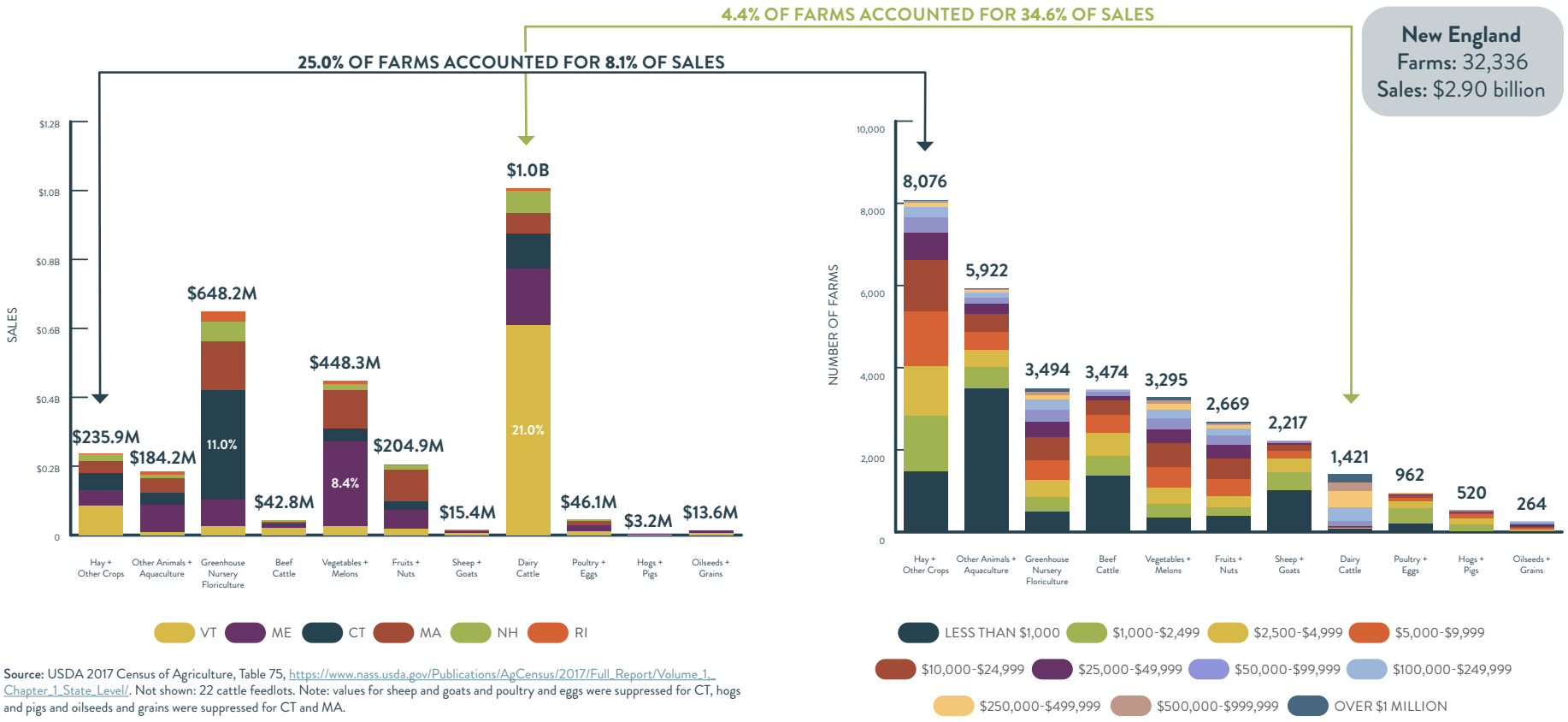
The next largest category of activities, aquaculture and other animal production (which includes apiculture and raising horses), accounted for 18.3% of farms and 6.3% of sales. Aquaculture activities accounted for 18.6% of this category of farms and 83.9% of sales. Farms that raised other animals accounted for 81.4% of farms in this category and 16.1% of sales. Maine accounted for 22.9% of farms in this category and 46.1% of sales. Within this category, 89.4% (5,295 farms) of farms had sales of less than $25,000.

**The category with the third largest number of farms, nursery, greenhouse, floriculture, and sod, includes very little food production.** Connecticut accounted for 24.2% of farms in this category and 49.1% of sales. Within Connecticut, about 94% ($299 million) of sales in this category were for bedding/garden plants, cut flowers and greens, foliage plants, potted flowering plants, and nursery crops, with about 2% ($6.7 million) devoted to food crops grown under glass or other protection. Within this category, 66.3% (2,315) of farms had sales of less than $25,000.

Meeting the dietary guidance outlined in Volume 1 requires a substantial increase in acreage devoted to vegetables and fruits. Vegetable and melon farming accounted for 10.2% (3,295) of farms and 15.5% ($448.3 million) of sales, while farms growing fruits and tree nuts accounted for 8.3% (2,669) of farms and 7.1% ($204.9 million) of sales. Maine and Massachusetts are neck and neck for the largest number of vegetable and fruit farms (1,774 and 1,753, respectively), with Maine accounting for the majority of vegetable sales (54.6%) and Massachusetts accounting for the majority of fruit sales (44.0%) A little more than 65% (2,153) of vegetable and melon farms and 67% (1,786) of fruit and tree nut farms had sales of less than $25,000.

In contrast, **1,400 dairy farms (4.4% of total farms) accounted for about 35% of regional agricultural sales.** Vermont accounted for 50.0% of farms in this category and 60.6% of sales. Within this category, only 7.7% (110 farms) of farms had sales of less than $25,000. **Dairy production in Vermont (21.0% of total sales), greenhouse/nursery/floriculture production in Connecticut (11.0%), and vegetable production in Maine (8.4%) accounted for 40.4% of total sales.**

**FIGURE 17:** New England Farms by Value of Sales, 2017

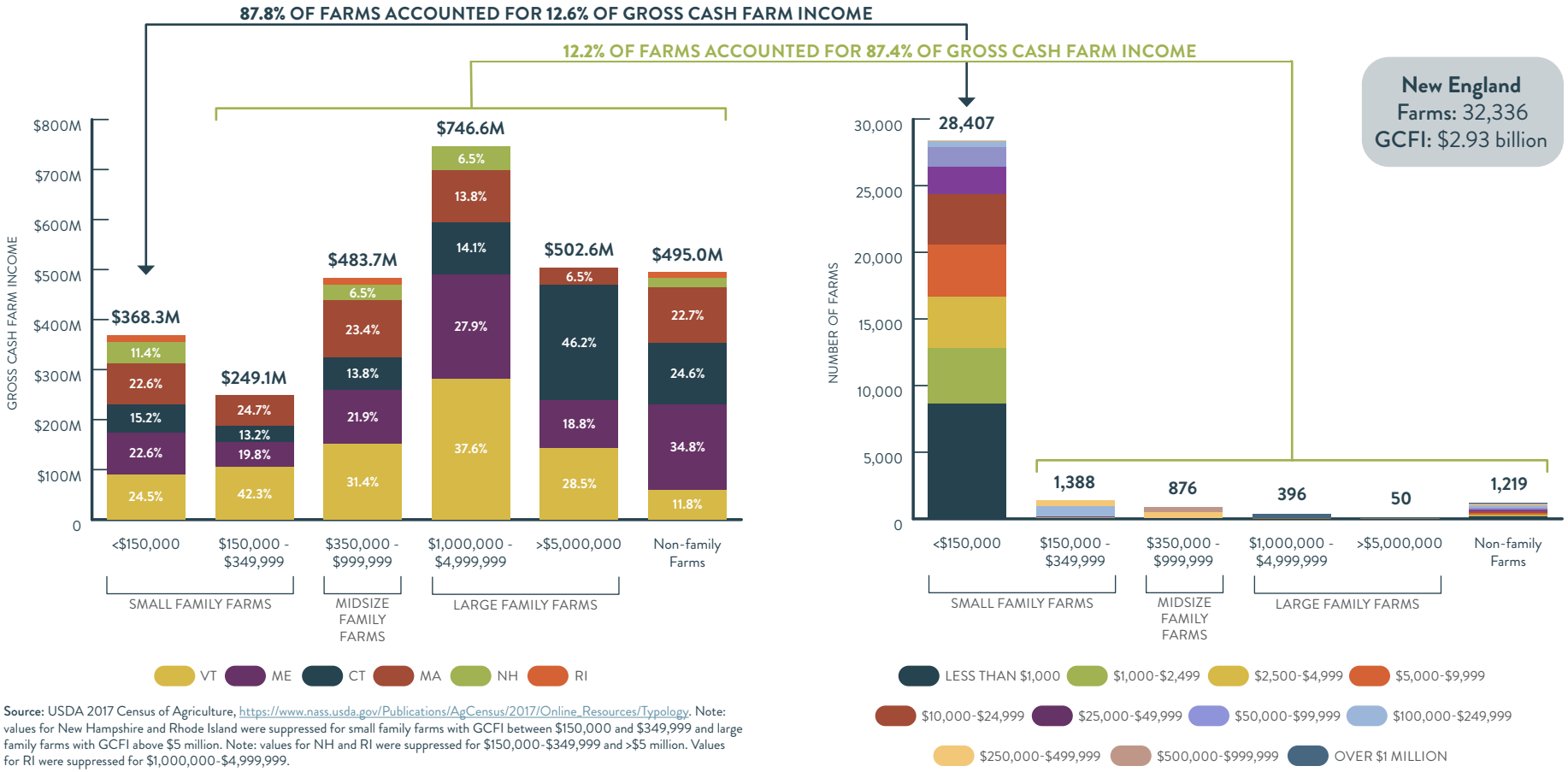



**Source:** USDA 2017 Census of Agriculture, Table 75, https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_State_Level/. Not shown: 22 cattle feedlots. Note: values for sheep and goats and poultry and eggs were suppressed for CT, hogs and pigs and oilseeds and grains were suppressed for CT and MA.

A second way to view the scale asymmetry in agriculture is the Gross Cash Farm Income (GCFI) typology, an estimate of annual income before expenses that includes cash receipts, farm-related cash income, and government farm program payments. The GCFI typology also sorts by farm ownership, identifying several scales of family and non-family farms (Figure 18). **The vast majority—87.8%—of farms in New England were small family farms with sales under $150,000 in 2017.** These farms accounted for 12.6% ($368.3 million) of total GCFI. Nationally, 67.9% of all farms had sales of less than $25,000. In New England, 77.5% of all farms had sales of less than $25,000. Of New England small family farms with sales of less than $150,000, 85.7% (24,355) of these farms had sales of *less than $25,000*. All other types of farms made up 12.2% (3,929) of farms but 87.4% ($2.5 billion) of GCFI. In fact, **just 50 large family farms with sales over $5 million generated 17.3% ($503 million) of GCFI.**

Vermont had the highest percentage of each type of family farm except for large family farms with sales over $5 million and non-family farms.

**FIGURE 18:** New England Gross Cash Farm Income Typology, 2017



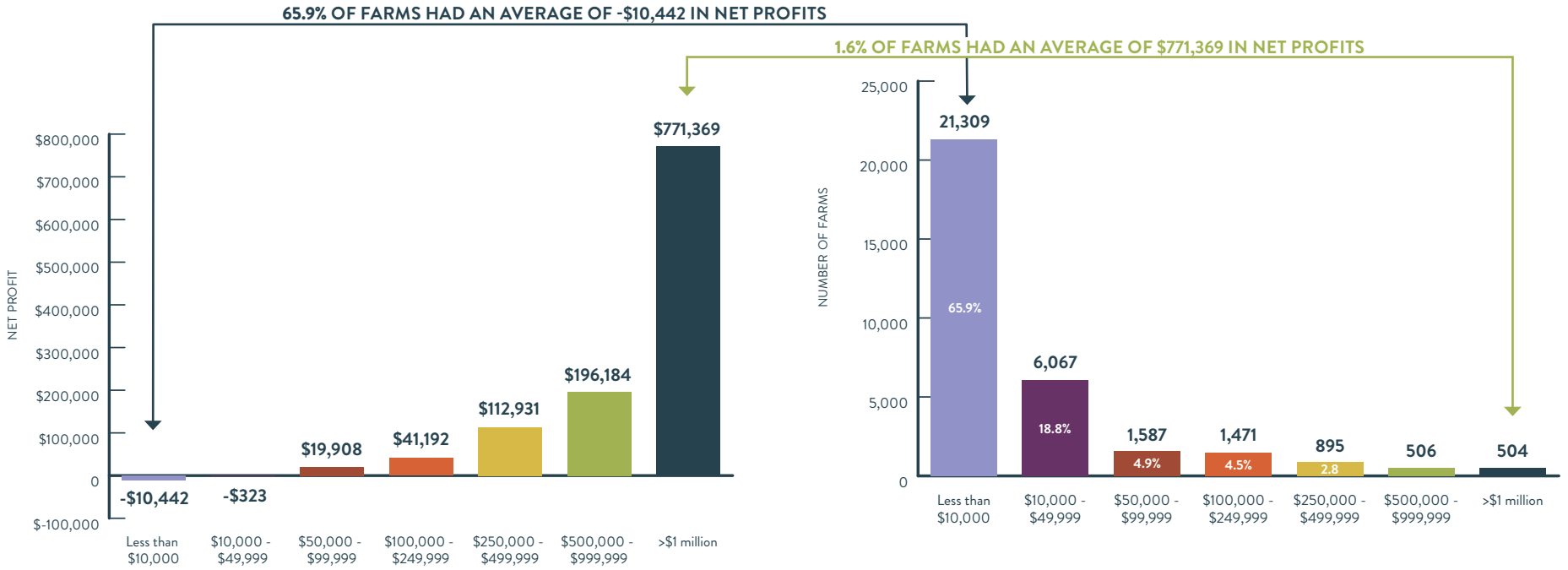

**Source:** USDA 2017 Census of Agriculture, https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Typology. Note: values for New Hampshire and Rhode Island were suppressed for small family farms with GCFI between $150,000 and $349,999 and large family farms with GCFI above $5 million. Note: values for NH and RI were suppressed for $150,000-$349,999 and >$5 million. Values for RI were suppressed for $1,000,000-$4,999,999.

A third way to view scale challenges in New England agriculture is by net profits (i.e., after expenses are accounted for). In this case, **65.9% (21,309) of New England farms had sales of less than $10,000 in 2017, yielding an average net profit of -$10,422!** In contrast, farms with sales over $250,000—5.9% (1,905) of farms—had average net profits of over $100,000. A little more than 1.5% (504) of farms had average net profits of $771,369.

Weather events, global events—including the COVID-19 pandemic and the Russian invasion of Ukraine—changes in government support payments, and many other factors can lead to fluctuations in production expenses, prices, and cash receipts. For example, the USDA Economic Research Service predicts that net cash farm income will be down in every region of the country in 2023. The bottom line is that scale matters: California and Iowa have the highest net farm incomes—gross farm income minus expenses—in the country. The six New England states rank in the bottom in the nation for net farm income: Maine (41st), Vermont (42nd), Connecticut (44th), Massachusetts (45th), New Hampshire (48th), and Rhode Island (49th).

New England scale challenges are real. Many programs, like the Vermont Farm & Forest Viability Program and the Vermont Working Lands Initiative, exist to help businesses improve financial analysis, marketing, sales, strategic planning, as well as improving work-life balance and generating income from farming. Expanding these types of programs throughout the region and encouraging, supporting, and articulating compelling cases for expanding agriculture are needed.

**FIGURE 19:** Average Net Profit Per New England Farm and Number of Farms by Economic Class, 2017




Source: USDA 2017 Census of Agriculture, https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_State_Level/.

# 5 Ongoing Exploitation of Food System Workers

Food is a major part of our economy. Food system workers grow, produce, and catch our food. They harvest, slaughter, process, mix, brew, freeze, and bake our food. They package, store, distribute, stock, sell, and deliver our food. They take our orders, prepare, cook, and serve our food. They cater our weddings, work at our favorite hangouts, and add to a lifetime of memories. They clean up our messes, wash our dishes, and dispose of our food. Every day of our lives is impacted by food system workers.

**And yet, the contributions of food system workers to our society and economy have been overlooked and undervalued.**

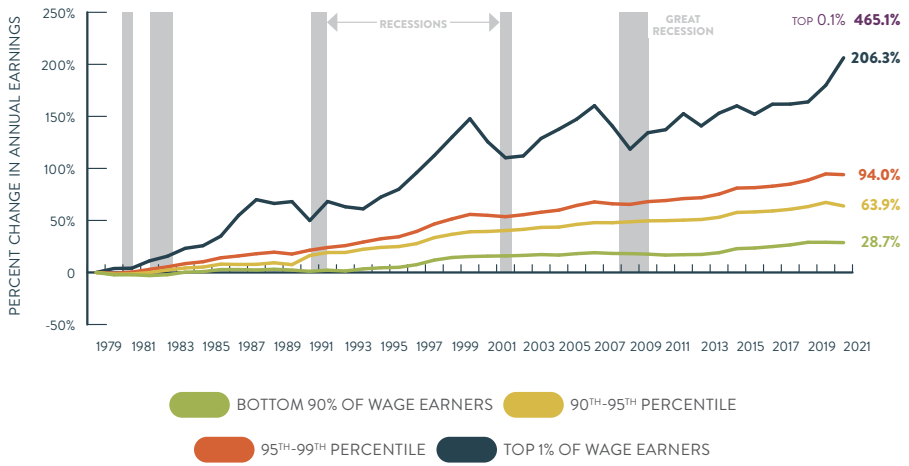
Volume 3, Economic Impact of New England's Food System highlights that total food system jobs numbered approximately 999,300 in 2017. With 9.9 million total jobs in the regional economy in 2017, **the food system represented 10% of the New England total.** Total sales amounted to $190 billion, which is equal to 11% of New England sales for all industries. Food services and drinking places (i.e., restaurants and bars) and grocery stores accounted for 76.6% (765,448 jobs) of total food system employment and 46.2% ($87.6 billion) of sales.

Wages/salaries are the most common source of income for the majority of Americans.[95] Unfortunately, across the United States—including New England—food system workers, particularly retail food workers, receive some of the *lowest* wages of any occupational category.

## Wage Stagnation and Limited Benefits

Research from the Economic Policy Institute (EPI) finds that "Rising wage inequality and slow and uneven hourly wage growth for the vast majority of workers have been defining features of the U.S. labor market for the last four decades."[96] In fact, **the earnings of the bottom 90% of U.S. wage earners grew by only 28.7% over the past 40 years, while the top 1% of wage earners saw a 206.3% increase and the top 0.1% of wage earners experienced a 465% increase** (Figure 20). In 2021, the top 1% of wage earners accumulated 22 times more than the bottom 90% of wage earners. The 90th percentile in 2021 was $57.70 per hour, which means that 90% of wage earners earned less than or equal to that value.[97]

**FIGURE 20:** U.S. Cumulative Percent Change in Real Annual Earnings, 1979-2021




**Source:** EPI analysis of Kopczuk, Saez, and Song, "Uncovering the American Dream: Inequality and Mobility in Social Security Earnings Data Since 1937" (2007) and Social Security Administration wage statistics, https://www.epi.org/publication/inequality-2021-ssa-data/.

Wage stagnation and resulting low wages have been attributed to a variety of factors, including the rise of cheap imports from China, automation, and the growing impact of "monopsony power," which refers to the ability of companies to depress wages due to lack of competition for workers.[98] Others point to federal policies that have reduced the leverage of most workers to achieve faster wage growth (e.g., lack of growth in the federal minimum wage) and financial deregulation that led to enormous growth in management compensation.[99] An increase in *informal work* (i.e., labor arrangements characterized by the lack of enforcement of existing legal or social protections), employment declines in manufacturing and production sectors, and major employment increases in service sectors are also implicated.[100]

Declining union membership is also a major contributing factor to wage stagnation. National union membership data paints a vivid picture: while *public* sector union membership (e.g., for government employees, police, and firemen), has remained over 30% for the past 40 years, private sector union membership decreased from 16.5% to 6.0% (Figure 21). Within certain food and beverage manufacturing industries, union membership decreased from over 30% to well below 20% (Figure 22). Bakery products union membership—which was later divided into retail bakeries and non-retail bakeries and tortilla manufacturers—plummeted from 43.5% to 11.0% for retail bakeries and 3.9% for non-retail bakeries (Figure 23). Union membership at grocery stores decreased from 31.1% to 16.1%, while union membership at restaurants and food services has essentially always been low (Figure 24).

EPI research found that, on average, a worker covered by a union contract earns 13.2% more than a worker with a similar education, occupation, and experience in a non-union job. Union workers are also more likely to have employer-sponsored health insurance, paid vacation, sick leave, retirement plans, and safer workplaces.[101]

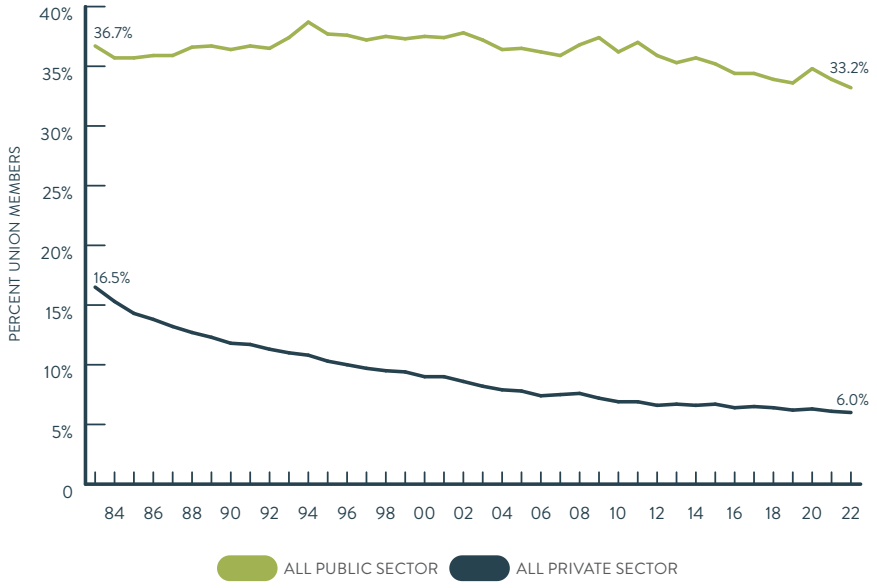
A Company Wage Tracker developed by EPI and the Shift Project identifies the percentage of workers within a variety of national chains that make *less than* a minimum wage of $15 per hour (Table 4):

**TABLE 4:** Share of Workers Earning Less than $15/Hour at Chain Stores

| Company | % | Company | % |
|---|---|---|---|
| ALDI | 36% | Applebee's | 42% |
| Burger King | 83% | Chick-fil-a | 72% |
| Dollar General | 92% | Domino's | 53% |
| Dunkin' | 68% | Hannaford | 56% |
| IHOP | 58% | McDonald's | 89% |
| Olive Garden | 38% | Pizza Hut | 75% |
| Sonic | 85% | Starbucks | 63% |
| Stop & Shop | 56% | Subway | 78% |
| Taco Bell | 81% | Target | 3% |
| Walmart | 51% | Wendy's | 87% |

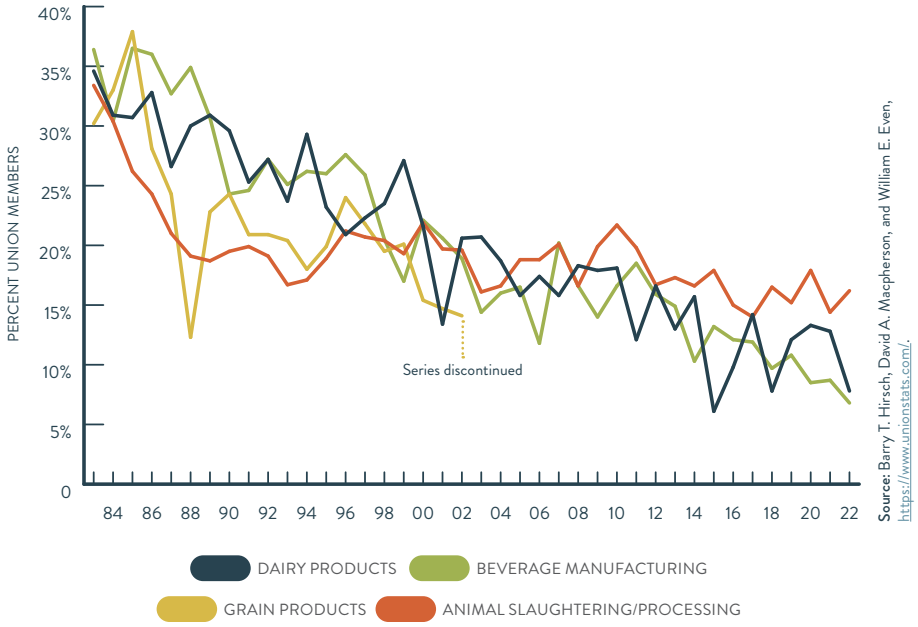
**Source:** Economic Policy Institute and the Shift Project, April 2022, *Company Wage Tracker*, https://www.epi.org/company-wage-tracker/.

**FIGURE 21:** U.S. Public and Private Sector Union Membership, 1983-2022




Source: Barry T. Hirsch, David A. Macpherson, and William E. Even, https://www.unionstats.com/.

**FIGURE 22:** U.S. Food and Beverage Manufacturing Union Membership, '83-'22




Source: Barry T. Hirsch, David A. Macpherson, and William E. Even, https://www.unionstats.com/.

**FIGURE 23:** U.S. Bakery Products Union Membership, 1983-2022

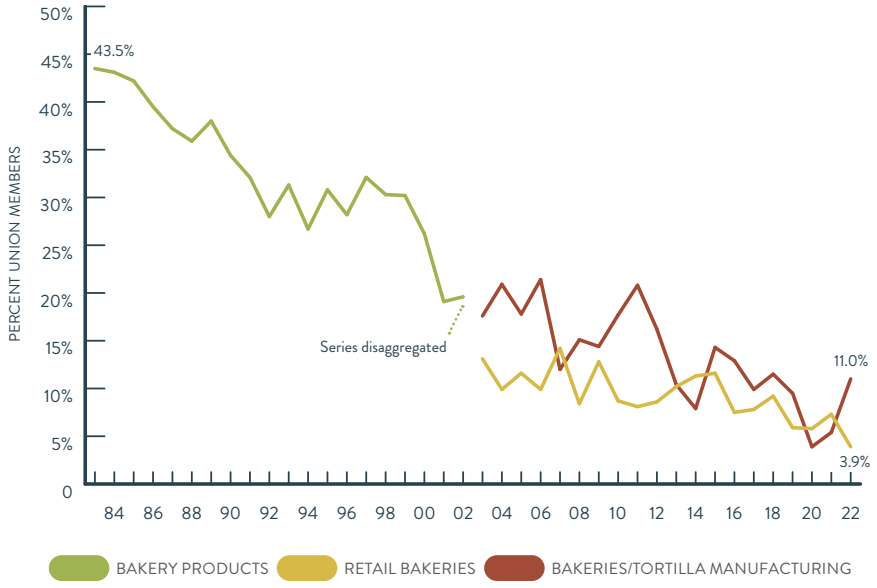
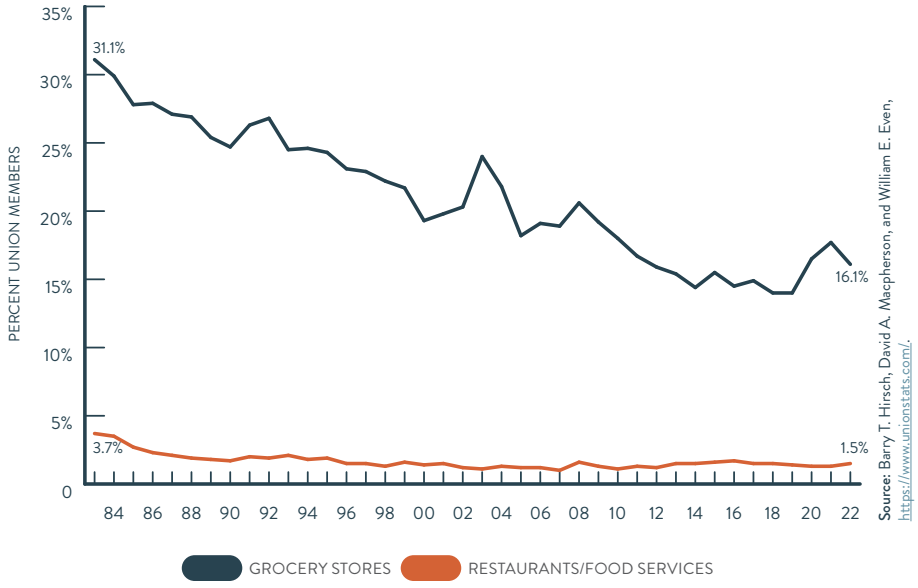



**FIGURE 24:** U.S. Food Services Union Membership, 1983-2022




Source: Barry T. Hirsch, David A. Macpherson, and William E. Even, https://www.unionstats.com/.

The U.S. Bureau of Labor Statistics Occupational Employment and Wage Statistics (OEWS) program generates wage estimates for nearly 800 occupations, including many food system jobs. For example, looking at the *major* occupational categories in Connecticut, we find that median hourly wages for "Food Preparation and Serving" ($15.37) and "Farming, Fishing, and Forestry" ($17.47) jobs are higher than the state's minimum wage ($15.00), but both categories are on the low end of wages for all major occupations, and both are below living wage criteria (Figure 25, page 52). A living wage is defined as the amount of money that a full-time worker must earn on an hourly basis to "help cover the cost of their family's minimum basic needs where they live while still being self-sufficent." Basic needs include the cost of housing, transportation, food, childcare, health care, broadband, personal items, and taxes in counties, metropolitan regions, and states.

We can also examine wages for specific food system occupations more closely and see a continuum of higher and lower paid jobs. For example, "Food Service Managers," (i.e., jobs with responsibility for the daily operation of restaurants and other food serving businesses) have the highest hourly median wage in Connecticut, while "Slaughterers and Meat Packers" (i.e., jobs that specialize in slaughtering and preparation tasks) earn the lowest food system wage (Figure 26, page 54).

Comparing wage data from 2002 to 2022 in Connecticut for a variety of food system jobs that employ a significant number of people, we see wage growth for half of the selected food system occupations and declines for the other half (Table 5). For example, the median hourly wage for Food Preparation and Serving occupations—a major category that includes chefs, supervisors, varieties of cooks, waiters/waitresses, and more—increased by about 11% over 20 years, from $13.85 to $15.37 (At an average inflation rate of 2.46% per year, the cost of goods increased 63% from 2002 to 2022). The same patterns are evident in each of the other New England states and wage details are presented in separate State Reports.

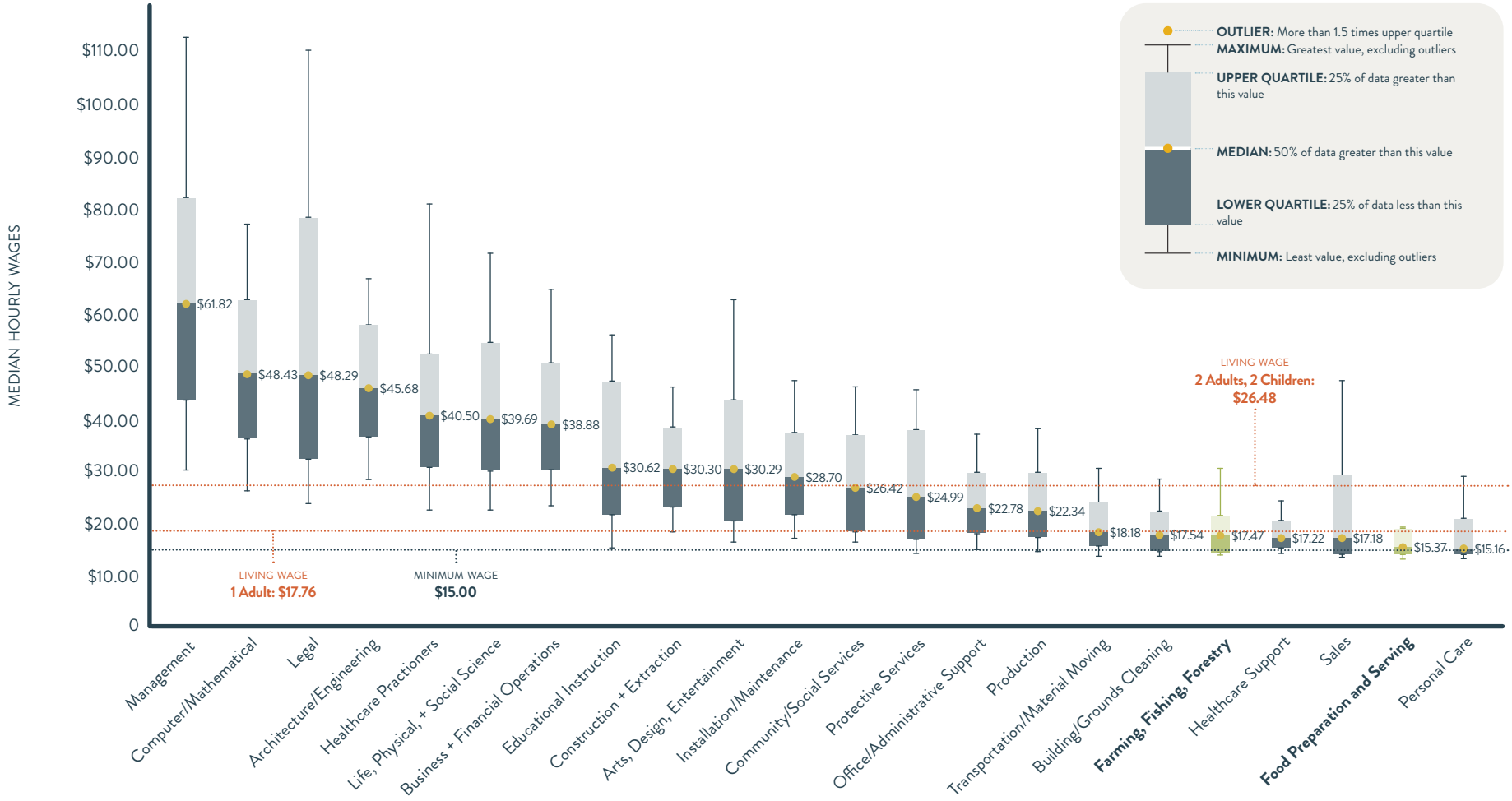
**TABLE 5:** Comparing Hourly Median Wages in Connecticut in 2002 and 2022

| Occupations | 2002 Median Hourly Wage | 2022 Median Hourly Wage | Percent Change |
|---|---|---|---|
| Food Preparation and Serving (Major) | $13.85 | $15.37 | +10.9% |
| Farming, Fishing, and Forestry (Major) | $16.29 | $17.47 | -0.2% |
| Food Service Managers | $34.88 | $34.83 | -0.2% |
| Chefs/Head Cooks | $27.06 | $28.21 | +4.2% |
| Supervisors of Food Prep Workers | $22.92 | $21.94 | -4.2 |
| Institutional/Cafeteria Cooks | $20.22 | $20.33 | +0.5% |
| Butchers/Meat Cutters | $32.13 | $18.62 | -42.0% |
| Restaurant Cooks | $18.45 | $17.37 | -5.8% |
| Bakers | $17.59 | $17.23 | -2.0% |
| Waiters/Waitresses | $11.39 | $16.52 | +45.0% |
| Fast Food Cooks | $13.52 | $15.80 | +16.9% |
| Food Prep Workers | $15.10 | $15.22 | +0.8% |
| Food Batchmakers | $17.88 | $14.68 | -17.9% |
| Bartenders | $12.38 | $14.61 | +18.0% |

**Source:** U.S. Bureau of Labor Statistics, *Occupational Employment and Wage Statistics*, https://www.bls.gov/oes/tables.htm.

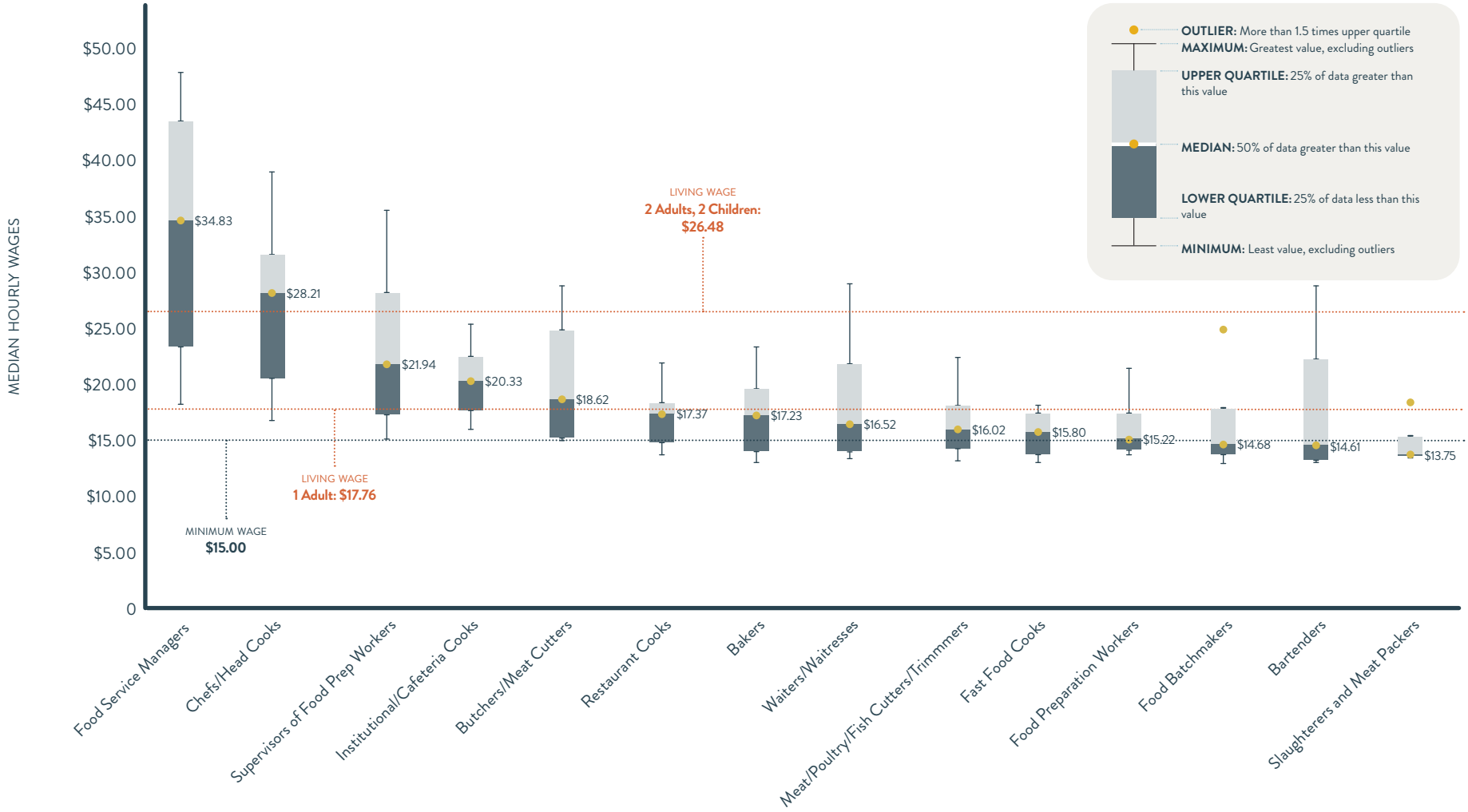
Wage stagnation over the past 40 years and low wages for food system workers limits the ability of these workers to lead healthy, comfortable lives, and pursue viable careers. Far from being *essential*, many food system workers also feel disposable because the unemployment, inconvenience, illness, and death triggered by the COVID-19 pandemic exacerbated existing challenges that they grapple with, including low wages, limited benefits, and limited workplace protections.[102]

**FIGURE 25:** Median Hourly Wages by Major Occupational Category in Connecticut, 2022




**Source:** U.S. Bureau of Labor Statistics, *Occupational Employment and Wage Statistics*, https://www.bls.gov/oes/tables.htm. MIT, *Living Wage Calculator*, https://livingwage.mit.edu/.

**FIGURE 26:** Median Hourly Wages by Selected Food System Occupations in Connecticut, 2022




**Source:** U.S. Bureau of Labor Statistics, *Occupational Employment and Wage Statistics*, https://www.bls.gov/oes/tables.htm. MIT, *Living Wage Calculator*, https://livingwage.mit.edu/.

**As a society, we pay for low wages one way or another: food system workers are disproportionately impacted by nutrition insecurity.** The U.S. Government Accountability Office (GAO) analyzed data on Medicaid and Supplemental Nutrition Assistance Program (SNAP) enrollment and benefits in 11 states. These two programs, combined with the refundable portion of the Earned Income Tax Credit, comprised almost two-thirds of federal expenditures (nearly $700 billion) distributed via 82 programs for supporting low-income individuals, families, and communities. The 21 million wage-earning adults enrolled in Medicaid or SNAP in these 11 states shared a range of common labor characteristics: about 70% of wage earners in both programs worked *full-time* hours (i.e., 35 hours or more) on a weekly basis, 90% of wage earners participating in each program worked in the private sector, and 72% worked in one of five industries, including Leisure and Hospitality (i.e., stores and restaurants).

**The GAO found that restaurants and other eating places—a category that includes sit-down restaurants, fast food franchises, and pizza shops—employed the largest percentage of working adult Medicaid enrollees in five of the six states that provided data, and employed the largest percentage of working adult SNAP recipients in seven of the nine states that provided employer data.**[103]

Improving farm, fishery, and food business viability *and* improving worker viability are two sides of the same coin: efforts to increase consumer purchasing power are key to growing the number of New Englanders who can afford local/regional food. Detailed analyses of compensation challenges have highlighted many interventions that can improve conditions for food system workers. For example:

- Increasing the minimum wage and eliminating the tipped minimum wage
- Passing comprehensive immigration reform since a significant percentage of restaurant workers are undocumented immigrants
- Passing legislation requiring employers to provide paid sick days
- Encouraging and supporting unions and workers' right to organize
- Penalizing wage theft (i.e., when employers do not pay workers for the work they have done).[104]

Photo credit: Ink + Light Creative

Food service jobs, like food preparation and serving jobs at Throwback Brewery in North Hampton, New Hampshire, are the most common type of food system job in New England.

## Occupational Segregation

**As highlighted in Volume 3, food services—which consists entirely of eating and drinking places (i.e., restaurants and bars)—is the largest food system employment category, amounting to nearly 560,000 New England jobs in 2017, or just a little more than one-half of the region's food system employment.** This category generates many jobs, but is characterized by having numerous part-time employees. Most recently, 43% of eating and drinking places jobs were part-time.[105]

Low wages disproportionately impact women, Black, and Hispanic/Latino Americans, and one of the reasons is that women, Black, and Hispanic/Latino workers are concentrated in the lowest paying segments and sections of the restaurant industry.[106] The restaurant industry is "effectively segregated by race and gender by a partition between livable-wage server and bartender positions and poverty wage busser, runner, and kitchen positions, and between limited service (fast food), full service casual, and full service fine-dining restaurants."[107] That is, women are more likely to be front-of-house workers (e.g., wait staff, cashiers, hosts) and less likely to be dishwashers, chefs/head cooks. Black Americans are disproportionately likely to be cashiers/counter attendants (the lowest paid occupation in the industry), while Hispanic/Latino Americans are disproportionately likely to be dishwashers, dining room attendants, or cooks. Additionally, according to the National Agricultural Workers Survey, about two-thirds (63%) of farmworkers in the country are from Mexico and 78% of farmworkers were Hispanic/Latino.[108] Farmworkers experience a number of challenges, including being *35 times more likely to die of heat* than other workers.[109]

### The Persistence of Wage Gaps

Significant progress has been made reducing the gender wage gap: in 1973, the median wage gap between men and women was 37.1% (i.e., a typical woman was paid 37.1% less per hour than a typical man). By 2022, the median wage gap was 16.8%.[110]

In contrast, essentially no progress was made in reducing the Black-White wage gap: in 1973, a typical Black worker was paid 22.3% less than a typical White worker. By 2022, the median wage gap was 21.5%.[111]

The median Hispanic-White wage gap actually increased from 1973 (20.3%) to 2022 (24.2%).[112]

Research conducted by Restaurant Opportunities Centers United (ROC United) found that:

- Workers point to barriers in applying for fine-dining service positions, including lack of training, social networks, childcare, transportation, interactions with the criminal justice system, and more.
- Employers point to a lack of a sufficient candidate pool of workers of color. Other research also highlights implicit biases and other forms of discrimination in hiring practices.
- Customers point to a lack of experience with servers of color. Other research highlights implicit—and explicit—bias among customers that have a preference to be served by workers of their own race/ethnicity.[113]

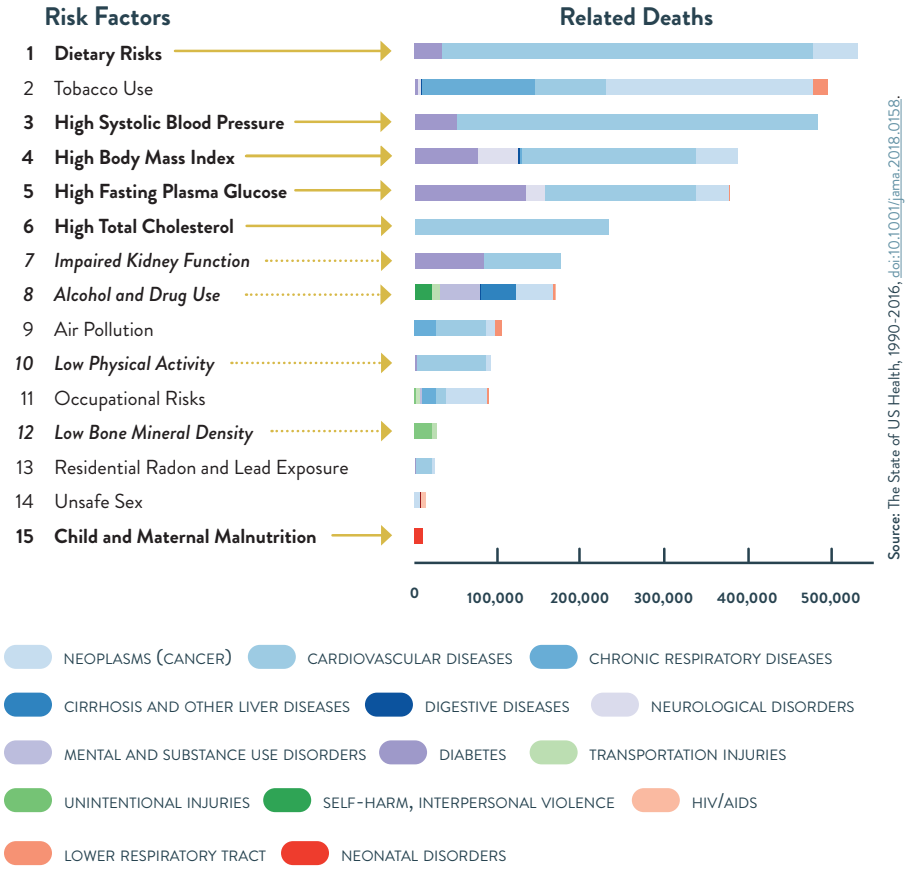
ROC United recommends that more incentives, mandates, and prohibitions are required for employers to combat bias in hiring, while workers need more skills training. At the customer level—and more broadly for all of society—we need more education, engagement, and culture change that promotes and celebrates equity, particularly as America and New England become more diverse.

# Limited Progress Reducing Diet-Related Health Problems

Diet-related health problems create many challenges for a significant number of people and the ripple effect of these challenges are far-reaching. Research from the *Journal of the American Medical Association* found that **poor diet is the leading cause of illness and death in America** and "Suboptimal intake of specific foods and nutrients was associated with a substantial proportion of deaths due to heart disease, stroke, or type 2 diabetes."[114] Dietary risks, high systolic blood pressure, high body mass index (i.e., obesity and overweight classifications), high fasting plasma glucose (i.e., diabetes or pre-diabetes), high total cholesterol, and child and maternal malnutrition are significant risk factors for premature death. Poor diet may also relate to other risk factors, including impaired kidney function, alcohol use, low physical activity, and low bone mineral density (Figure 27).[115]

Research by the Rockefeller Foundation estimated that **the true cost of food in the United States is $3.2 trillion— $1.1 trillion for the money we spend on food, and $2.1 trillion to address the *hidden* health and environmental costs of our food system.**[116] The Rockefeller Foundation estimates that direct medical costs and productivity loss associated with high body mass index were over $359 billion, while direct medical costs and productivity loss for non-communicable diseases (e.g., cardiovascular disease, diabetes, colon cancer) that can be attributed to diet were over $603 billion.

**FIGURE 27:** Risk Factors and Related Deaths in the United States, 2016




Source: The State of US Health, 1990-2016, doi:10.1001/jama.2018.0158.

## Unhealthy Food is Ubiquitous

**Why has it been so challenging to reduce diet-related health problems?** As described in Volume 1, dietary patterns in the United States are out of alignment with recommendations. The Healthy Eating Index (HEI) provides a snapshot of how well our diets align with dietary guidelines. The mean score for all Americans was 58 out of 100 in 2017-2018, up from 56 in 2005-2006, but well out of alignment with dietary guidelines. HEI scores vary by age group, with adults over 60 scoring the highest (63 points), and teenagers between the ages of 14 and 18 scoring the lowest (51 points). Our low scores can be attributed to not eating enough vegetables, fruits, whole grains, and seafood, and eating too much refined grains, meat, added sugars, and fats.

Where, what, and how much we eat fundamentally changed over the 20th century. The sociologist George Ritzer coined the phrase "the McDonaldization of society" to describe how McDonald's—which opened in 1940—literally and symbolically exemplifies the long reach of the industrialization of the global food system after World War II. McDonald's revolutionized the way we consume food by rationalizing four principles:

- **Efficiency:** McDonald's streamlined supply chains, product offerings, and the customer experience (e.g., drive thru windows).
- **Calculability:** McDonald's food products and marketing emphasize a good bargain: a lot of food can be had for a nominal amount of money.
- **Predictability:** McDonald's customers know that the food products they buy will look and taste the same in all places.
- **Control:** McDonald's controls a global supply chain, but it also controls its employees (e.g., through de-skilling) and customers (e.g., through marketing and visual cues in each restaurant).

The advantages of McDonaldization have been enormous:

- A wider range of goods and services is available to a much larger portion of the population than ever before.
- People are able to get what they want or need almost instantaneously and get it far more conveniently.
- Goods and services are of a far more uniform quality, compared to previous eras.
- People can afford things they could not previously afford.
- The most popular products of one culture are more easily diffused to other cultures.
- A McDonaldized system may bring comfort - consumers know what they are going to get.
- People may be more likely to be treated similarly, no matter their race, gender, or social class.[117]

The principles of McDonaldization have essentially been adopted by every sector of the economy, perhaps most visibly today through the reach of Amazon. But the consequences of McDonaldization have also been profound as fast food and junk food became ubiquitous: **National diet-related health trends are moving in the wrong direction and Black, Hispanic/Latino, and Indigenous Americans are dis-**

**proportionately impacted.** For example, about 42% of all adult Americans are obese, but about 50% of all Black adults and 45.6% of all Hispanic/Latino adults are obese. About 58% of all Black women are obese. Obesity increases the risk of a range of illnesses, health complications, and diseases, including high blood pressure, heart disease, stroke, type 2 diabetes, many types of cancer, depression, and COVID-19. Children with obesity are also at greater risk for certain diseases, including type 2 diabetes, high blood pressure, and depression.[118] **In New England more than 60% of adults are overweight or obese** and the percentage of adults and children with obesity and overweight classifications have increased over the past ten years.[119]

The amount of food we eat and the *composition of ingredients* in our food also changed over the 20th century: ***today, ultra-processed foods* comprise an estimated 58% of caloric intake in the United States.**[120] Ultra-processed foods—high in sugar, fat, sodium, and artificial flavors—are "hyper-palatable: Irresistible, easy to overeat, and capable of hijacking the brain's reward system and provoking powerful cravings."[121]

Ultra-processed foods, like doughnuts, hot dogs, and soda, are defined as:

> *"formulations of several ingredients which, besides salt, sugar, oils and fats, include food substances not used in culinary preparations, in particular, flavours, colours, sweeteners, emulsifiers and other additives used to imitate sensorial qualities of unprocessed or minimally processed foods and their culinary preparations or to disguise undesirable qualities of the final product."*[122]

Ultra-processed foods have also been described as "predigested" and "pre-chewed": the process of refining, pounding, heating, melting, shaping, extruding, and packing with additives creates products that are essentially predigested and easier for our bodies to absorb.[123] Ultra-processed foods are linked to higher rates of obesity, heart disease, hypertension, type 2 diabetes, colon cancer, ovarian cancer, and other cancers.[124] Ultra-processed foods can rarely be traced to their source of origin beyond a country.

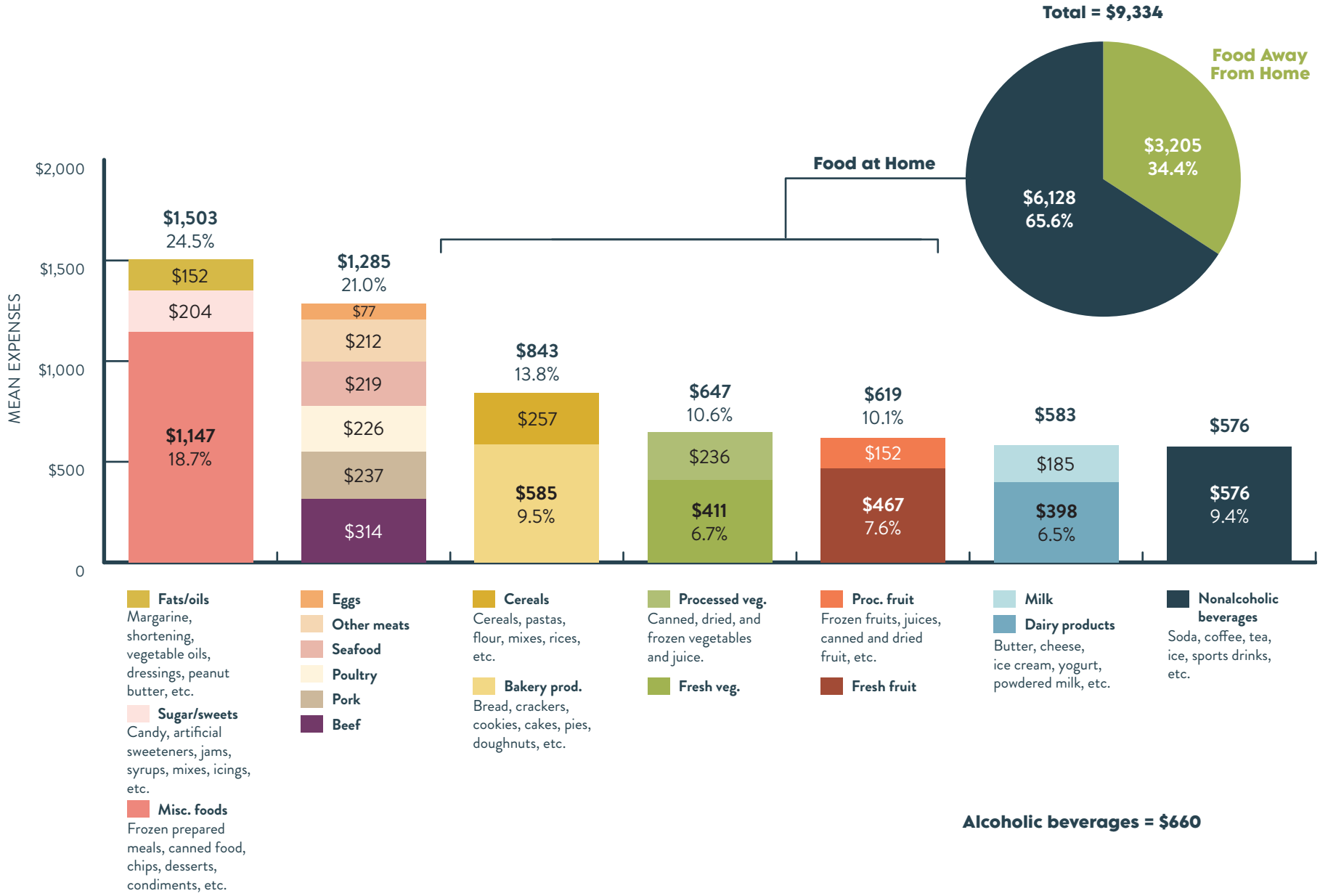
According to the Consumer Expenditure Survey—which estimates average household expenditures for U.S. consumers—ultra-processed food makes up a high percentage of food purchases. For the Northeast Region—New England plus New York, Pennsylvania, and New Jersey—*average* expenditures in 2021 were $72,678. Housing (35% of total) and transportation (14%) were the top expenditures, followed by food at $9,334 (13%).

Food purchased for consumption at home accounted for 66% ($6,128) of food expenditures and food purchased away from home (e.g., restaurants, fast food) accounted for 34% ($3,205) of sales. **Taken together, ultra-processed foods were the top food expenditure categories (Figure 28):**

- Miscellaneous foods (e.g., prepared meals, canned food chips) were the largest single category of expenditures (18.7%, $1,147), and all other food at home—which includes miscellaneous foods, sugar and sweets, and fats oils—was the largest total category (24.5%, $1,503).
- Bakery products (e.g., bread, crackers, cookies) were the second largest single category of expenditures (9.5%, $585), while cereal and bakery products were the third largest total category (13.8%, $843).
- Non-alcoholic beverages (e.g., soda, coffee, tea)—were the third largest single category of expenditures (9.4%, $576).

Some argue that "many packaged foods are enriched or fortified with vitamins and minerals, including "shortfall nutrients" that a lot of Americans don't get enough of,"[125] but the bottom line is that the ubiquity of ultra-processed food—corroborated with food intake,

**FIGURE 28:** Average Expenditures Across All Consumer Units in the Northeast, 2021




**Source:** Consumer Expenditure Survey, Annual Expenditure Means by Region of Residence. Note: "Food prepared by consumer unit on out of town trips" ($72) is not shown.

health, and consumer expenditure data—stands in the way of eating in a healthier, more resilient way.

"Food is Medicine" programs that address diet-related health risks or conditions have blossomed across the country. Food is Medicine programs are fundamentally a nexus between nutrition and health and include interventions such as:

- **Medically tailored meals:** meals that are individually tailored to health conditions (including ready-to-eat meals that can be reheated in an oven or microwave).
- **Medically tailored groceries:** includes distribution of unprepared and/or lightly processed foods for preparation of nutritionally complete meals at home.
- **Produce prescriptions:** doctor prescriptions for healthy food that are distributed via voucher or debit card that can be redeemed for produce.

Food is Medicine interventions may include food insecurity screening in health care settings for patient populations, reducing barriers for patients to access food assistance, connecting patients to short- and long-term nutrition assistance programs, and increasing the capacity of health care providers to incorporate food insecurity mitigation strategies into patient treatment plans.

Within New England, Food is Medicine interventions have taken a variety of interesting forms:

- In Connecticut, the Hartford Hospital opened a facility designed to look like a real grocery store stocked with only healthy items.
- In Maine, MaineHealth began offering a free, one-year program to support people with one or more chronic health issues who have limited access to healthy food by providing free healthy food, peer support, and menu planning with a health educator.
- In 2019, Massachusetts launched a Food is Medicine State Plan that developed recommendations to scale up access to food is medicine interventions. They envision an integrated system where 1) food and nutrition needs are identified in a health care setting; 2) health information technology supports patient connection to appropriate nutrition resources; 3) well-supported community-based nutrition organizations offer food is medicine services and programming; and 4) health care dollars provide sustainable funding streams for clinical screening and Food is Medicine services and programming.
- In New Hampshire, Dartmouth Health's Culinary Medicine Program "brings together clinical, academic and community nutrition and culinary initiatives to create a cohesive vision for the future of food as medicine." The institution offers several culinary skills classes for patients and has improved meal offerings at the Dartmouth Hitchcock Medical Center.
- The Rhode Island Healthy Eating & Active Living 2023-2028 Strategic Plan calls for expanding healthcare coverage to include produce prescriptions, home delivered meals for eligible patients, and other evidence-based approaches to improve access to nourishing foods as part of food is medicine approach.
- In Vermont, five organizations offer Health Care CSA programs that link health care clinics with farms. In 2022, 46 health care clinics and 25 farms provided support to food insecure people.

# 7 Limited Progress Reducing Food and Nutrition Insecurity

Everyone in New England—regardless of income, race, gender, location, citizenship status, or physical ability—should be able to enjoy healthy food from trusted sources. However, the ubiquity of unhealthy, ultra-processed foods goes hand-in-hand with unequal access to healthy food within our communities: from rural communities in Essex County, Vermont, to urban neighborhoods in Providence, Rhode Island, healthy food is easier to get for some people, but expensive or far away for others.

Two all-encompassing frameworks—social determinants of health and commercial determinants of health—set the stage for shaping our health, well-being, and quality of life. Social determinants of health refers to conditions of economic stability, education access and quality, health care access and quality, characteristics of neighborhood and built environment, and social and community context. Not surprisingly, variations in social determinants of health, including food/nutrition insecurity and food access challenges, disproportionately impact Black, Hispanic/Latino, Indigenous, low income, and rural New Englanders.

Commercial determinants of health refers to the responsibility of corporations—particularly corporations in four industry sectors: tobacco, ultra-processed foods, alcohol, and fossil fuels—in escalating rates of poor health, social and health inequities, and ecological degradation. While corporations undoubtedly make positive contributions to society, the political, financial, labor and employment, marketing, scientific, and supply chain practices of major corporations impact the policies and regulatory approaches of global, national, regional, and local political and economic systems in order to externalize the true costs of their operations.[126]

The common denominator for suboptimal health, well-being, and quality of life, including food and nutrition insecurity, is *poverty*, which Matthew Desmond describes as a "relentless piling on of problems" and a "tight knot of social maladies." In fact, America has more people in poverty (approximately 38 million) than any other advanced democracy in the world. If arrangements that harm the poor have endured over decades in the richest country in the history of the world, Desmond asks, doesn't that suggest that they were designed to do so? He answers: "Poverty persists because some wish and will it to":

- Black, Hispanic/Latino, Indigenous, Asian, low income people, women, undocumented immigrants, and many other categories of people are *exploited* by White Americans and corporations. Their choices and power in the labor market, housing market, and the financial market are constrained. As noted in the previous section, food system workers are some of the most exploited people in the country.

- In America, we prioritize the subsidization of affluence over the alleviation of poverty: a significant amount of money earmarked for poor people doesn't reach them, "the richest American families receive almost 40 percent more in government subsidies than the poorest American families," and we make a smaller proportional investment in alleviating poverty than other rich countries.

- Our long history of redlining and segregation continues under different guises, creating prosperous and exclusive communities for some, and public squalor for others.[127]

## Food and Nutrition Insecurity are Structural Problems

Food and nutrition insecurity are structural problems that no amount of charitable food donations can resolve. The USDA defines food security as having access, at all times, to enough food for an active, healthy life for all household members. In contrast, food insecure households are uncertain of having, or unable to acquire, enough food to meet the needs of all their members at some time during the year. This may be the result of insufficient money or other resources for food.

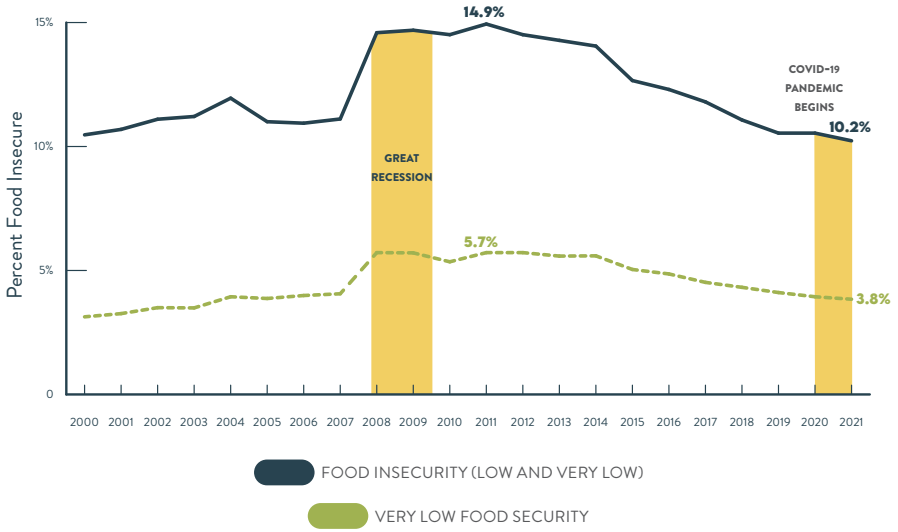
The USDA has also started to include nutrition insecurity as a complementary concept. Nutrition insecurity refers to inconsistent and inequitable access, availability, and affordability of foods and beverages that promote well-being, prevent disease, and if needed, treat disease. Food and nutrition insecurity are correlated with poverty, unemployment, our shared legacy of racism and inequality, where people live, disability status, citizenship status, the presence of children, and the intersection of these variables: single mothers are the most food insecure segment of American society.[128]

In 2021, 13.5 million (10.2%) U.S. households experienced low and very low food security (Figure 29). Households with very low food security have some household members whose eating patterns are disrupted at times during the year, with self-reported food intake below levels considered adequate.[129] The Great Recession (December 2007 through June 2009) spiked unemployment and rates of food insecurity for many years after the fact so that the United States has essentially made no progress in reducing food insecurity rates over the past 20 years.

The profile of food insecurity in the U.S. reflects the ongoing legacy of structural and systemic racism. Feeding America's website emphasizes that persistent food insecurity is the result of "discriminatory policies and systems that result in racial and gender inequities in pay/earnings and wealth. For example, Black and Hispanic families have considerably less wealth than white families. According to the Federal Reserve Board, Black families' median wealth is less than 15 percent that of white families ($24,100 vs. $188,200) and the median wealth of Hispanic families is about 20 percent that of white families ($36,100 vs. $188,200). Similarly, the National Women's Law Center reports that, among full-time, year-round workers, Native American women are typically paid only 60 cents for every dollar paid to white, non-Hispanic men. This gap in pay typically amounts to a loss of $2,055 every month or $24,656 every year."[130] Figure 30 shows big disparities in food insecurity between Black and Hispanic households and all other households.

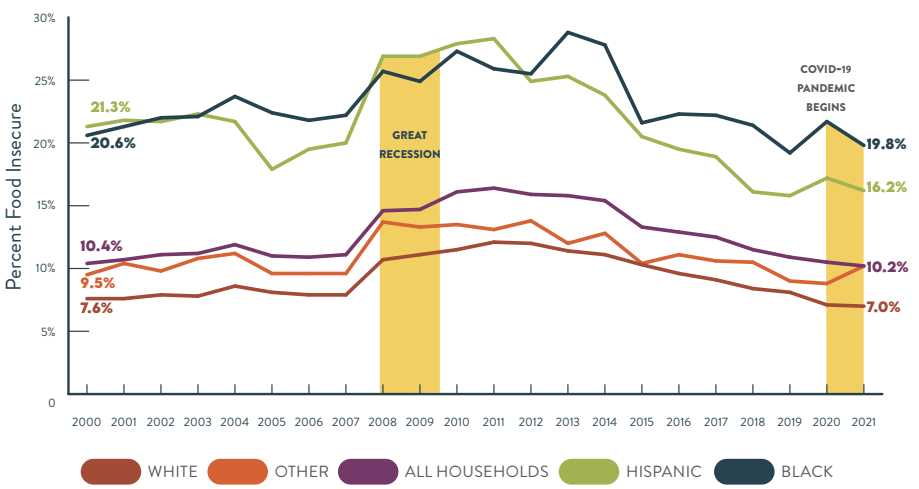
Among the New England states (Figure 31), Connecticut (9.6%) and Maine (9.5%) had the highest rates of food insecurity in 2021, followed by Massachusetts and Rhode Island (tied at 8.4%), Vermont (7.9%), and New Hampshire (5.4%).

**FIGURE 29:** Prevalence of Food Insecurity in the U.S.



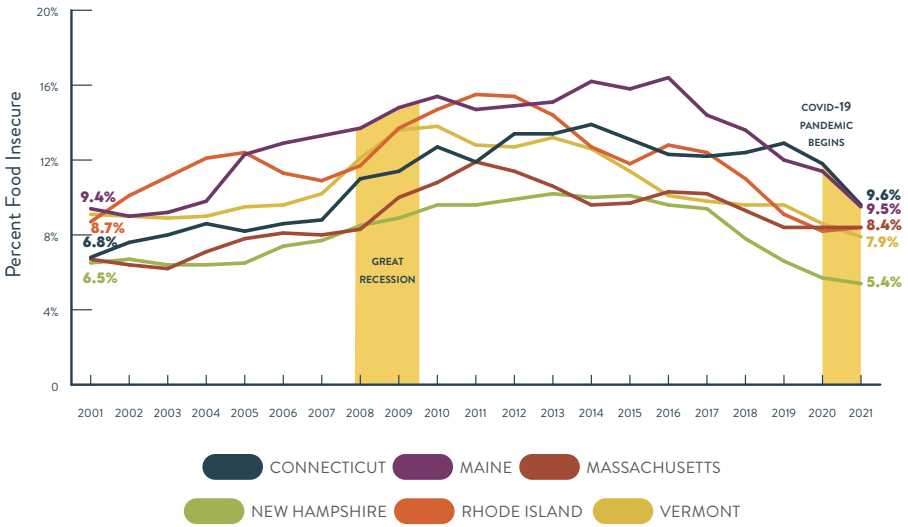

**Source:** USDA Economic Research Service, multiple years, Statistical Supplement to Household Food Security in the United States, https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/readings/#reports.

**FIGURE 30:** Prevalence of Food Insecurity in the U.S. by Race/Ethnicity



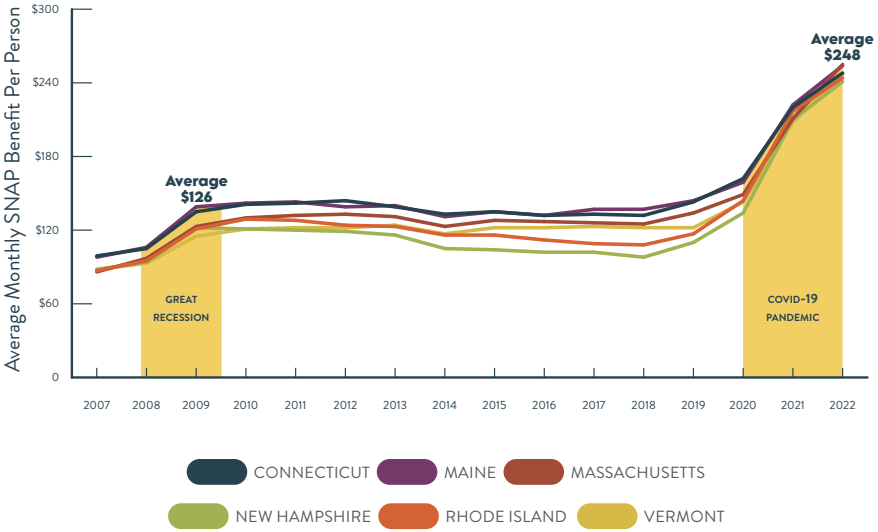

**Source:** USDA Economic Research Service, multiple years, Statistical Supplement to Household Food Security in the United States, https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/readings/#reports.

**FIGURE 31:** Prevalence of Food Insecurity in New England




**Source:** USDA Economic Research Service, multiple years, Statistical Supplement to Household Food Security in the United States, https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/readings/#reports.

**FIGURE 32:** Average Monthly SNAP Benefits Per Person




**Source:** KFF, Average Supplemental Nutrition Assistance Program (SNAP) Benefits Per Person, https://www.kff.org/other/state-indicator/avg-monthly-snap-benefits.

The COVID-19 pandemic triggered economic hardship across the country, but rates of food insecurity are not noticeably higher in 2020 and 2021. What explains this? The federal government rapidly fortified the social safety net: "In the early, panicked days of the pandemic, the United States government did something that was previously unthinkable. It transformed itself, within weeks, into something akin to a European-style welfare state."[131] The federal government is estimated to have spent about $5 trillion to mitigate the consequences of the pandemic, including more assistance for food assistance programs. The Supplemental Nutrition Assistance Program (SNAP) is by far the most important tool currently available for addressing food insecurity. The average monthly SNAP benefit increased from an average of $126 per person in New England in 2009, to $248 per person in 2022 (Figure 32). However, most of the safety net programs started or expanded during the pandemic have ended, and there is an expectation that food insecurity rates will increase in 2023.

For example, using data from the RI Life Index, the Rhode Island Community Food Bank estimated that an astounding 31% of household in Rhode Island were food insecure in 2022. This is likely due to inflation and the elimination of many COVID-19 response programs. Hispanic (46.6%) and Black (43.2%) households in Rhode Island had almost double the rate of food insecurity than White (25.9%) households in 2022.[132] In Connecticut, DataHaven and the Siena College Research Institute surveyed adults in every town and found that the percentage of Hispanic/Latino adults reporting food insecurity increased from 28% in 2018, to 34% in 2022. Black adults reporting food insecurity increased from 23% in 2018, to 25% in 2022. Meanwhile, only 10% of White adults reported food insecurity in 2018 and 11% did so in 2022.[133]

The National Food Access and COVID Research Team (NFACT) supported researchers from the Universities of Vermont and Maine who conducted a series of surveys throughout the pandemic. They found that an astounding 39% of respondents experienced some form of food insecurity during 2022.[134] From October 2020 to January 2021, the Greater Boston Food Bank, in collaboration with NFACT, surveyed over 3,000 Massachusetts adults and found that the overall food insecurity rate increased from 19% in the 12 months before the pandemic, to 30% during the pandemic. Before the pandemic, 15% of White adults were food insecure, and that increased to 24% during the pandemic. In comparison, 44% of Hispanic/Latino adults and 31% of Black adults were food insecure before the pandemic, which increased to 58% and 45%, respectively, during the pandemic.[135]

Research also finds major disparities in food access by race, income, and low-density rural areas.[136] For example, the United States has a long, deplorable history of government sanctioned racism, segregation, and inequality. Among the many policies that legally encouraged discrimination, redlining was a practice that assigned grades (e.g., D, hazardous, color-coded red) to neighborhoods based on their risks for banks and other mortgage lenders from 1935 to 1940. Boston, Providence, Hartford, New Haven, Manchester, and several other New England cities were redlined. Fast forward to 2023 and many of the redlined neighborhoods have lower household incomes, more poverty, less home ownership, less economic mobility, more food and nutrition security, more diet-related health problems, and lower food access than predominately White neighborhoods.

These types of disparities are depicted on the USDA Food Access Research Atlas. The Atlas identifies "low income/low access" (LILA) census tracts where a large proportion of the residents have low-incomes and are more than 1/2 mile from a food source for urban populations, and over 10 miles for rural populations. The Food Access Research Atlas includes proximity to supercenters (i.e., very large big box stores), supermarkets (i.e., grocery stores with 10 or more checkout lanes), and large grocery stores (i.e., grocery stores that are smaller than supermarkets), but warehouse clubs are excluded from the USDA's analysis because they are only available to people

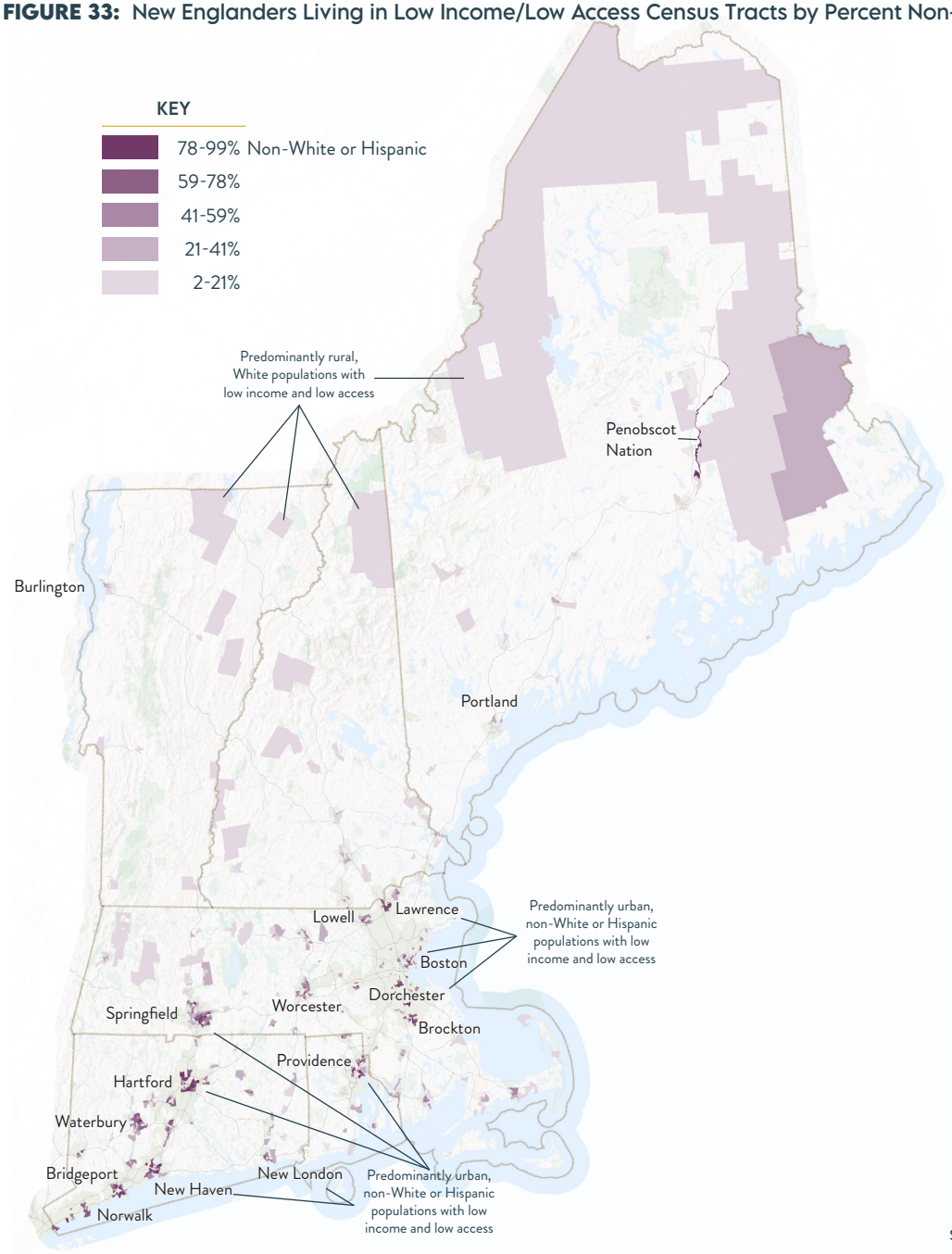
who pay an annual membership fee. Drug stores, dollar stores, and convenience stores are also excluded because ERS does not have consistent data on where these food sources are, what they carry, and when they are open.[137]

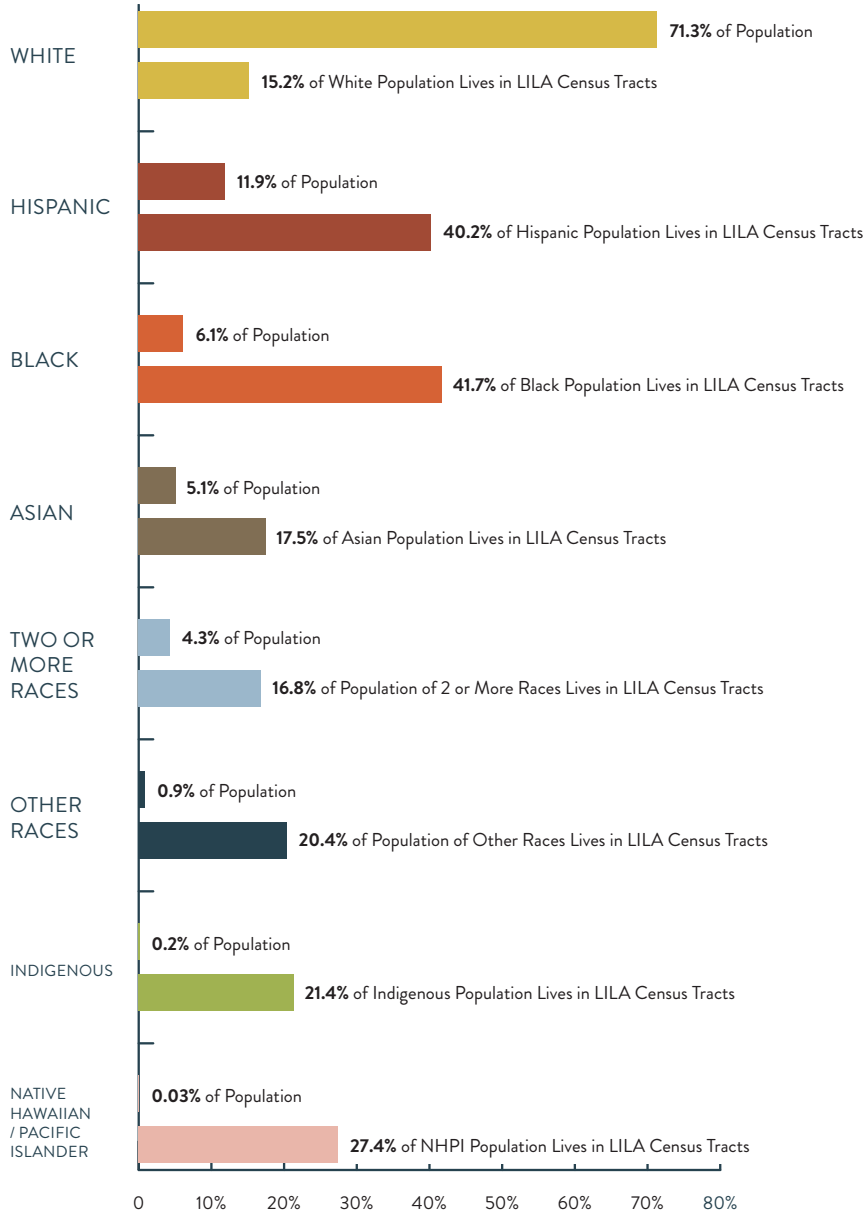
Dollar stores fill a need in communities lacking basic retail services, but research conducted by the Institute for Local Self-Reliance (ILSR) found that dollar stores commonly offer narrow selections of processed foods, with limited offerings of fresh vegetables, fruits, and meats. More to the point, ILSR suggests that the proliferation of dollar stores is "not merely a byproduct of economic distress. They're a cause of it."[138] For example, the former chief executive of Dollar Store said "The Dollar General customer is in a permanent recession, and we want to help them."[139] ILSR argues that rural and urban areas are particularly susceptible to dollar stores because 1) decades of growth by Walmart already weakened or eliminated independent stores, and 2) Dollar General and Dollar Tree saturate communities with multiple store locations, making it very challenging for independent stores to survive.

When we intersect LILA census tracts by the percent of the population that is Black, Hispanic, Indigenous, Asian, two or more races, some other race, or Native Hawaiian/Pacific Islander (i.e., by the percent that is not White) a disturbing—but not unexpected—pattern emerges (Figure 33): Nearly 20% (2.9 million) of New Englanders live in a LILA census tract. Although White New Englanders make up 71.3% of the region's population, only 15.2% of White people live in LILA census tracts. Every other category—**Hispanic, Black, Asian, Indigenous, Native Hawaiian/Pacific Islander, two or more races, some "other" race—make up 28.7% of New England's population, but *45.9%* of its population living in LILA census tracts.**

A transition toward a more resilient regional food system must overcome a long history of discriminatory practices that have disproportionately impacted non-White and low income communities, leading to higher rates of diet-related health problems, more food and nutrition insecurity, and fewer healthy food options. Fundamentally, Matthew Desmond argues, we need to "lift the floor" by rebalancing our social safety net so that more resources are reaching Americans who need them, empower the poor by reining in exploitation, and we need to invest in broad prosperity by turning away from segregation.[140]

**FIGURE 33:** New Englanders Living in Low Income/Low Access Census Tracts by Percent Non-White or Hispanic




**Sources:** USDA Food Access Research Atlas and American Community Survey, Table B03002, Hispanic or Latino Origin by Race.

# Limited Progress Reducing Wasted Food

Why do Americans waste so much food? Key reasons include a culture of waste in our country (e.g., the EPA estimates that, on a per capita basis, each American generates 4.9 pounds of municipal solid waste *every day)*, losses across supply chains, oversized servings, overstocked stores, confusing labels, a preference for "perfect produce," and missing diversion and recycling infrastructure. Black, Hispanic/Latino and low income communities are disproportionately impacted by waste infrastructure. While food is landfilled by the ton each day, millions of people simultaneously experience food insecurity.

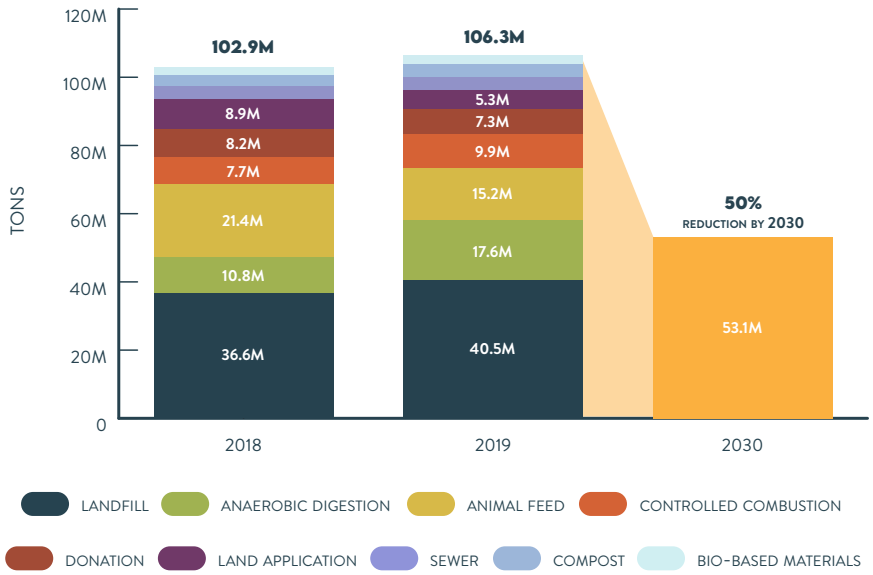
## A Culture of Waste

The U.S. Environmental Protection Agency (EPA) estimates that more than 30% of the food produced in the United States is *never eaten*. The resulting *waste* of resources—land, soil, freshwater, pesticides, fertilizers, and energy—and *generation* of environmental impacts like greenhouse gas emissions, climate change, soil degradation, and air pollution, is equal to:

- 140 million acres of agricultural land (an area larger than New York and California combined)
- 5.9 trillion gallons of freshwater (equal to the use of 50 million homes)
- 778 million pounds of pesticides
- 14 billion pounds of fertilizers (enough to grow all plant-based food produced each year in the U.S. for domestic consumption)
- 664 billion gigawatt-hours of energy (enough to power 50 million homes)
- 170 million tons of carbon dioxide equivalents (equal to the $CO_2$ emissions of 42 coal-fired power plants).[141]

The EPA estimates wasted food generation from the residential, food and beverage processing and manufacturing, retail, and food service sectors, as well as estimates of how food waste is managed. Methodological improvements mean that 2018 is the first year of more detailed estimates. In 2018, the United States generated about 103 million tons of food waste, which increased to a little over 106 million tons in 2019. The food and beverage processing and manufacturing sector generates the largest total amount of wasted food (37.7% of total in 2019), followed by the residential sector (24.9%), and restaurants (17.3%). The top "management pathway" for wasted food is landfilling (38.1% in 2019), followed by anaerobic

**FIGURE 34:** U.S. Wasted Food Management Pathways



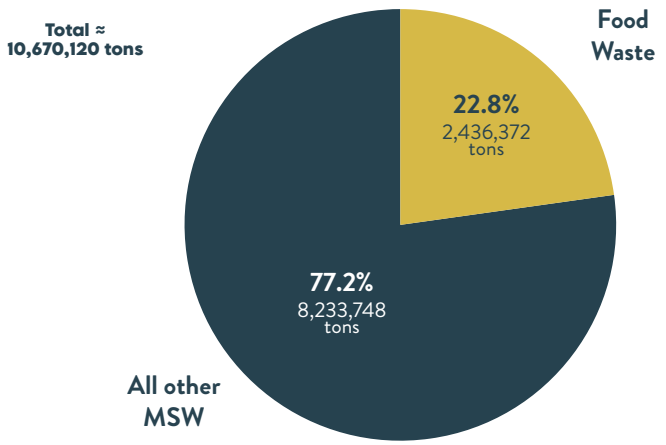

**Source:** U.S. EPA, April 2023, 2019 Waste Food Report, https://www.epa.gov/system/files/documents/2023-03/2019%20Wasted%20Food%20Report_508_opt_ec.pdf.

digestion (16.6%), animal feed (14.3%), controlled combustion (9.4%), and donation (6.9%). The remaining pathways, including composting, made up 14.7% (Figure 34). In 2015, the USDA and EPA announced the U.S. 2030 Food Loss and Waste Reduction goal - the first national goal to reduce food loss and waste by 50% by 2030.

How much food waste does each New England state generate? We estimated food waste in New England from two sources: 1) waste characterization studies conducted in each state except New Hampshire, and 2) detailed analyses conducted by ReFED, a national nonprofit working to end food loss and waste across the U.S. food system.

Waste characterization studies involve sampling residential, industrial, commercial, and institutional (ICI) waste from many sources and then identifying material types (e.g., glass, plastic, paper, food waste).

**FIGURE 35:** New England's Food Waste as Percent of Municipal Solid Waste

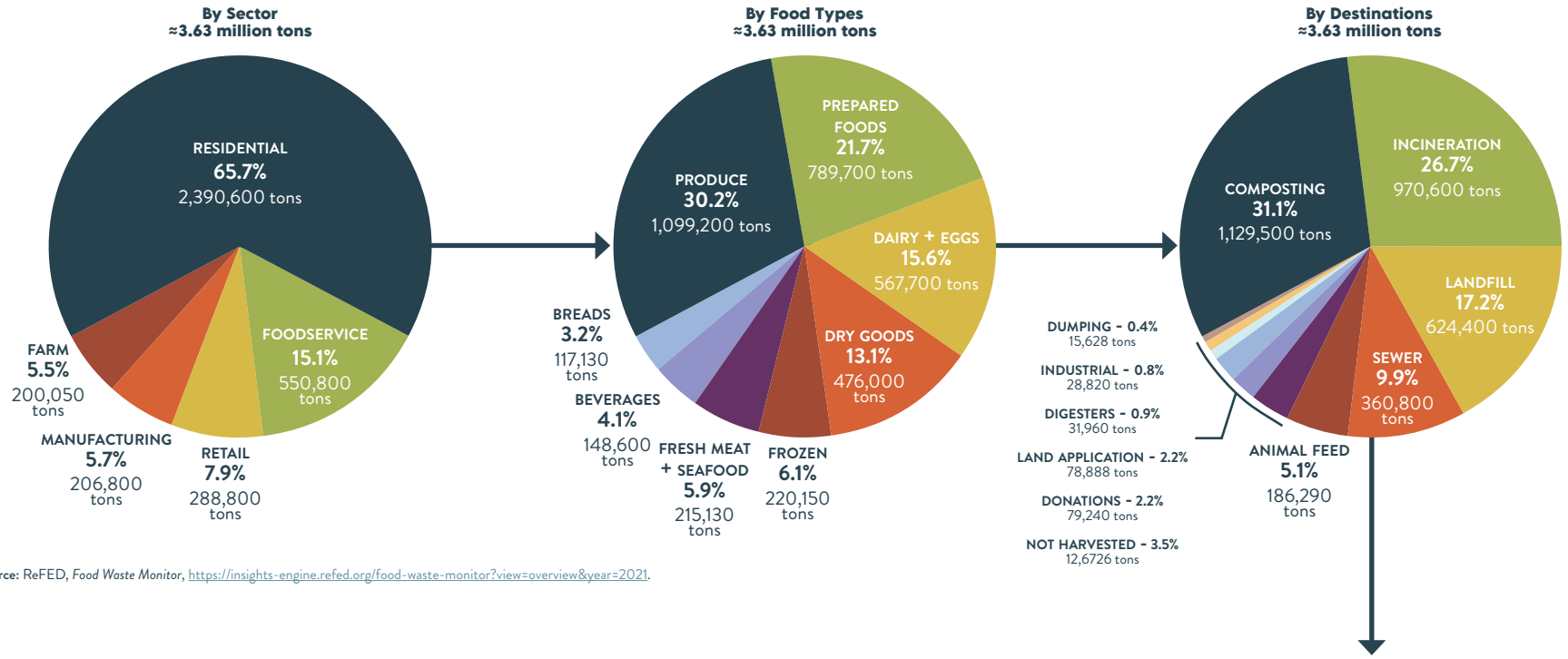



**Sources:** Waste characterization studies from each state from different years. Values for New Hampshire were approximated.

Waste characterization studies have been conducted in every New England state except New Hampshire in different years: Connecticut (2015), Maine (2011), Massachusetts (2016), Rhode Island (2015), and Vermont (2018). From these studies, we combined residential and ICI estimates by material type and state to arrive at a New England estimate. We then applied the New England percentages for each material type to the total municipal solid waste (MSW) estimate for New Hampshire in 2020 to approximate New Hampshire's contribution. **We arrived at an approximate total value of 2.4 million tons, or 22.8% of New England's MSW. This is the largest single material in the waste stream by weight (Figure 35).**

ReFED defines "surplus food" as food that goes unsold or uneaten. They estimate that 67% of the U.S. food supply is eaten, while the rest is surplus food that ends up being wasted, recycled, or rescued for human consumption. In 2021, ReFED estimated that the United States generated 91 million tons of surplus food, of which, 80 million tons of food were wasted, 9.4 million tons were recycled, and 1.8 million tons were donated.

**FIGURE 36:** New England Surplus Food Tons by Sector, Type, and Destination, 2021




Source: ReFED, *Food Waste Monitor*, https://insights-engine.refed.org/food-waste-monitor?view=overview&year=2021.

ReFED estimates are available for every state. In 2021, the six New England states were estimated to generate over 3.6 million tons of surplus food. The residential (65.7%) and food service (15.1%) sectors accounted for the majority of surplus food in New England (Figure 36). Massachusetts (45.9%) and Connecticut (20.6%) accounted for the majority of surplus food generation. Causes of surplus food in the residential sector include spoilage, inedible parts, "didn't want leftovers," a perception that the food was inedible, and date label concerns. The major reason for surplus food generation in the food service sector is plate waste, followed by overproduction, and date label concerns. Produce (30.2%), prepared foods (21.7%), and dairy and eggs (15.6%) accounted for the majority of surplus food types. The top destinations for surplus food in New England were composting, incineration, landfilling, and in the sewer system. New

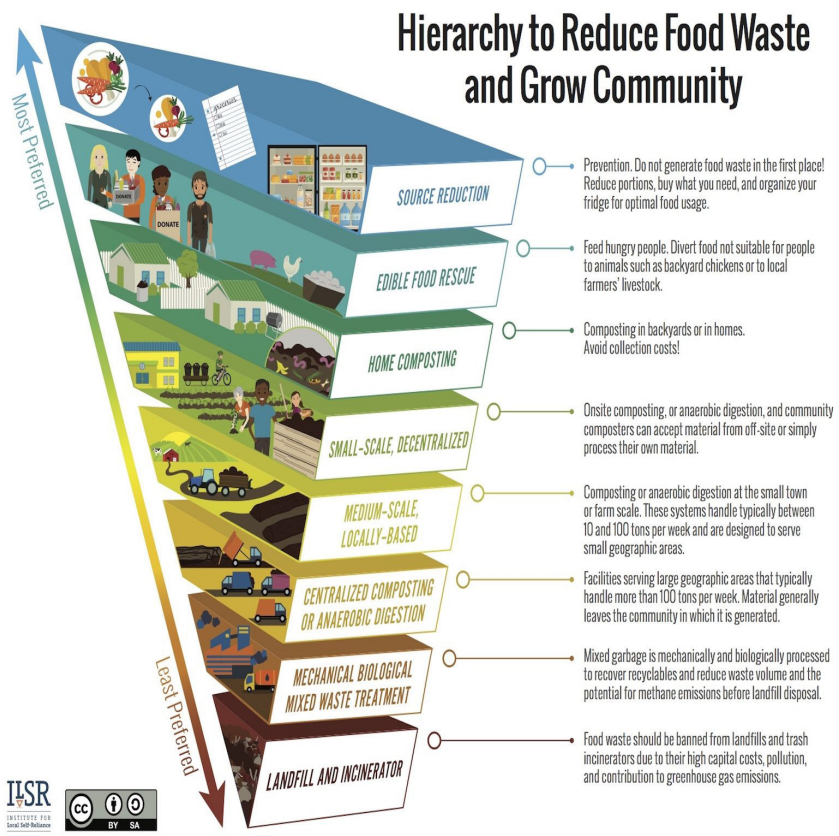
England has a much lower percentage of surplus food that is landfilled compared to the nation (17.2% compared to 35.9%), and higher percentages of surplus food that is composted (31.1% compared to 18.3%) and incinerated (26.7% compared to 4.7%) compared to the nation.

The majority of surplus food generated in New England in 2021, 60.3%, was considered "wasted" because it was incinerated, landfilled, not harvested, dumped, put in sewer systems, or applied to land. Nearly 38% of New England's surplus food was "recycled" because it was composted, fed to animals, put in an anaerobic digester to make energy, and other industrial uses. A little more than 2% of New England's surplus food was "rescued" because it was donated to food banks and pantries.

As a practical matter, some amount of food waste is unavoidable. The EPA developed a food waste hierarchy to prioritize actions that people and organizations can take to prevent and divert wasted food (Figure 37). Source reduction—preventing wasted food through portion size reduction, standardized date labels, meal kits, and many more options—is the most preferred option. Edible food rescue—recovering food from grocery stores, restaurants, and farms—for people and animals is the next preferred option, followed by composting at various scales, anaerobic digestion to generate electricity, and landfilling.

ReFED's Solutions Database identifies over 40 large-scale options for addressing food waste. Centralized composting facilities, large-scale centralized anaerobic digesters, and co-digestion at wastewater treatment plants are considered the top options for recycling wasted food. Several states have passed significant organic waste recycling laws. For example, New York's Food Donation and Food Scraps Recycling Law instructs food scraps generators producing over two tons per week of food waste to donate surplus food to the extent possible, and requires certain designated food scraps generators to divert remaining food scraps for organics processing such as

**FIGURE 37:** U.S. EPA's Food Recovery Hierarchy (ILSR Version)




This redesign of the EPA Food Recovery Hierarchy comes from the Institute for Local Self-Reliance, a national nonprofit organization working to strengthen local economies, and redirect waste into local recycling, composting, and reuse industries. It is reprinted here with permission.

composting. California's SB 1383 sets statewide targets for reducing organic waste disposal, including penalties for failure to comply. Within New England there may be room to harmonize a six-state approach to reducing food waste. For example, Vermont has a strong organic waste recycling law, but Maine and New Hampshire have no organic waste recycling laws. Massachusetts and Connecticut have the majority of food waste generators, but Vermont and Maine could possibly make the most use out of food waste turned into compost.

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