## U.S. Food System

Americans enjoy a diverse abundance of lowcost food, spending a mere $10 \%$ of disposable income on food. ${ }^{1}$ However, store prices do not reflect the external costs -economic, social, and environmental-that impact the sustainability of the food system. Considering the full life cycle of the U.S. food system illuminates the connection between consumption behaviors and production practices.


## Patterns of Use

## Agricultural Production

- Farmers account for $\mathrm{I} \%$ of the population, and the average age of farmers is leveling off in the mid-sos after a rapid increase. ${ }^{2,3}$
- Large-scale family farms account for only $2 \%$ of all farms, but $35 \%$ of production. Small-scale family farms account for only $26 \%$ of production, but represent $90 \%$ of U.S. farms. ${ }^{4}$
- Just 174 of every dollar spent on food in 2014 went back to the farm; in 1975, it was $404 .{ }^{5.6}$
- In 20I2, farmers were reliant on income sources outside the farm to make up $80 \%$ of their household income, on average. ${ }^{2}$
- In 200i-2002, $53 \%$ of the hired agricultural labor force lacked authorization to work in the United States. ${ }^{7}$
- From 1997 to 2007 , total cropland decreased from 455 million acres to 408 million acres. ${ }^{8}$
- Many parts of the U.S., including agricultural regions, are experiencing increasing groundwater depletion (withdrawal exceeds recharge rate). ${ }^{9}$ In 2013, 88.5 million acre-feet of water were used for irrigation-more than 520,000 gallons per acre; groundwater sources supplied more than half this amount. ${ }^{10}$
- Nutrient runoff from the upper agricultural regions of the Mississippi River creates a hypoxic "dead zone" in the Gulf of Mexico that averaged over 5,742 sq mi in size between 2007 to 2013 . ${ }^{11,12}$
- Although pesticide use declined I.4\% annually from 1996 to 2007, herbicide use increased significantly during the same period. ${ }^{13}$ In 2008, the U.S. agriculture sector used 516 million pounds of pesticides. ${ }^{14}$
- Decreased pesticide use is due in part to widespread deployment of genetically engineered crops. ${ }^{14}$ Less than $20 \%$ of corn and soy plants were genetically engineered in 1996; by $2015,92 \%$ of corn and $94 \%$ of soybeans were genetically modified. ${ }^{15,16}$
- In 2012, 1.67 billion tons of topsoil were lost to erosion, equal to about 190,000 tons each hour. ${ }^{17}$
- Agriculture was responsible for $8.3 \%$ of total U.S. greenhouse gas emissions in 2014. Livestock and soil management are major contributors. ${ }^{18}$


## Consumption Patterns

- In 20Io, the U.S. food supply provided 4,000 calories per person per day. ${ }^{20}$ Accounting for waste, the average American consumed 2,544 calories per day in 2010, an increase of $25 \%$ from 1970. ${ }^{21}$
- In 2013, 186 lbs of meat per person were available for consumption, up i3 lbs from $1963 .{ }^{22} 33 \%$ of grains grown are used to feed animals, down from $50 \%+$ in past years. ${ }^{23}$
- The average American consumes about 22 teaspoons of added sugars and sweeteners per day; the
American Heart Association recommends between 6 and 9 teaspoons daily for an average adult. ${ }^{21,24}$
- More than $70 \%$ of U.S. adults are overweight or obese (body mass index $25+$ ), and $17 \%$ of children age 2-19 are obese. ${ }^{25,26}$
- Diet contributes to heart disease, certain cancers, and stroke-leading causes of U.S. deaths. ${ }^{25,27}$
- An estimated $2 \mathrm{I} \%$ of the edible food available is wasted at the consumer level, $50 \%$ more than in 1970. ${ }^{28,29}$ This waste accounts for roughly $15 \%$ of the municipal solid waste stream and represents a loss of $\$ 455$ per person each year. ${ }^{29,30}$ One estimate suggests that $2 \%$ of total annual energy use in the U.S. is used to produce food that is later wasted. ${ }^{31}$

Material Flow in the U.S. Food System ${ }^{19}$


## Life Cycle Impacts

The energy used by a system is often a useful indicator of its sustainability. Food-related energy use accounts for nearly $16 \%$ of the national energy budget. ${ }^{32}$ Modern agriculture and the food system as a whole have developed a strong dependence on fossil energy; io units of (primarily) fossil energy are consumed for every unit of food energy produced. ${ }^{34}$

- On-farm production amounts to approximately $20 \%$ of the total system energy. $40 \%$ of agriculture production energy goes into making chemical fertilizers and pesticides. ${ }^{19}$
- Food processing, wholesale and retail services, and household energy consumption made up $60 \%$ of food-related energy flows in 2002. ${ }^{32}$
- Reliance on fossil fuel inputs makes the food system increasingly vulnerable to oil price fluctuations. ${ }^{19}$
- Consolidation of farms, food processing operations, and distribution warehouses often increases distance between food sources and consumers. ${ }^{19}$
- Consolidation in the food system is also concentrating management decisions into fewer hands. For example:

- Four firms control $85 \%$ of the beef packing market; $82 \%$ of soybean processing is controlled by 4 firms. ${ }^{35,36}$
- The top four food retailers sold $36 \%$ of America's food in 2013, compared to only $17 \%$ in $1993 .{ }^{37}$


## Solutions and Sustainable Alternatives

## Eat Local

Fresh produce eaten in the Midwest travels an average of more than 1,500 miles. A study by the Leopold Center showed that increasing Iowa's consumption of regionally grown fresh produce by only $10 \%$ would save more than 300,000 gallons of transportation fuel per year. ${ }^{38}$ Community Supported Agriculture (CSAs) and Farmers Markets are both great ways to support a local food system.

## Eat Less Meat

A meat-based diet ( $28 \%$ calories from animal products) uses twice as much energy to produce as a vegetarian diet. ${ }^{19}$ Meat production as it is widely practiced today also has significant environmental impacts on land use, water use and water pollution, and air emissions. ${ }^{39}$

## Eat Organic

Organic farms don't use chemicals that require large amounts of energy to produce, pollute the soil and water, and present human health impacts. Sales of organic food in 2015 were $11 \%$ higher than in 2014; organic food now accounts for nearly $5 \%$ of all food sold in the U.S. ${ }^{40}$

## Use Less Refrigeration

Home refrigeration accounts for $13 \%$ of all energy consumed by our food system. ${ }^{19}$ Today's convenience foods rely heavily on refrigeration for preservation. Consider a smaller, more efficient refrigerator and buying smaller quantities of fresh produce more frequently. Refrigerator efficiency more than doubled from 1977 to 1997, but increases in size have largely offset this improvement. ${ }^{19}$

## Reduce Waste

Much of household food waste is due to spoilage. Prevent food from going bad by buying smaller amounts; planning meals and sticking to shopping lists; and freezing, canning, or preserving extra produce. ${ }^{41}$ Many foods that are still safe are thrown out due to confusion about "sellby" and "use-by" dates. For further information on food product dating, see the USDA's Food Safety and Inspection Service.

[^0]22. USDA, ERS (2015) "Red Meat and Chicken (Retail Weight)."
23. USDA, ERS (2016) "Feed Grains - Supply and Disappearance Tables."
24. American Heart Association (2014) "Sugar 101."
25. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention (2016) "Health, United States, 2015."
26. Ogden, C., et al (2012) Prevalence of Obesity and Trends in Body Mass Index Among U.S. Children and Adolescents, 1999-2010. Journal of the American Medical Association, 307(5): 483-490.
27. Harvard T.H. Chan, School of Public Health (2016) "What Should I Eat: Vegetables and Fruits."
28. Buzby, J., et al. (2014) The Estimated Amount, Value, and Calories of Postharvest Food Losses at the Retail and Consumer Levels in the United States. EIB-121, USDA, Economic Research Service.
29. Natural Resource Defenese Council (NRDC) (2012) Wasted How America Is Losing Up to 40 Percent of Its Food from Farm to Fork to Landfill.
30. U.S. EPA (2015) Advancing Sustainable Materials Management: Facts and Figures 2013.
31. Cuellar, A. and M. Webber (2010) Wasted food, wasted energy: The embedded energy in food waste in the United States. Environmental Science \& Technology, 44(16): 6464-69.
32. Canning, P., et al. (2010) Energy Use in the U.S. Food System. USDA, ERS.
33. Population Division, U.S. Census Bureau (2002) National Population Estimates.
34. Weber, M. (2012) More Food, Less Energy. Scientific American, 2012(1) 74-79.
35. USDA, ERS (2013) "Processing \& Marketing: Manufacturing."
36. U.S. Census Bureau (2007) "Share of Value of Shipments Accounted for by the 4, 8, 20, and 50 Largest Companies for Industries." 2007 Economic Census.
37. USDA, ERS (2014) "Top 4, 8, and 20 firms' share of U.S. grocery sales, 1993-2013."
38. Leopold Center for Sustainable Agriculture (2001) Food, fuel, and Freeways: An Iowa perspective on how far food travels, fuel usage, and greenhouse gas emissions.
39. U.S. EPA (2012) "Potential Environmental Impacts of Animal Feeding Operations."
40. Organic Trade Association (2016) "U.S. Organic Sales Post New Record of $\$ 43.3$ Billion in 2015." 41. U.S. EPA (2016) "Reducing Wasted Food At Home."


[^0]:    1. U.S. Department of Agriculture (USDA), Economic Research Service (ERS) (2016) "Food CPI, Prices and Expenditures: Food Expenditures by Families and Individuals as a Share of Disposable Personal Income."
    2. USDA (2014) 2012 Census of Agriculture. United States Summary and State Data. Volume 1, Geographic Area Series, Part 51.
    3. U.S. Census Bureau (2012) "Population Estimates, Detailed Tables."
    4. USDA (2014) Structure and Finances of U.S. Farms, Family Farm Report, 2014 Edition.
    5. USDA, ERS (2016) "Food Dollar Series."
    6. Elitzak, H. (1999) Food Cost Review, 1950-97. USDA, Agricultural Economic Report 780.
    7. U.S. Department of Labor (2005) Findings from the National Agricultural Worker Survey 2001-2002.
    8. USDA, ERS (2011) "Total cropland, by region and States, United States, 1945-2007."
    9. Konikow, L. (2013) Groundwater depletion in the United States (1900-2008). U.S. Geological Survey (USGS) Scientific Investigations Report.
    10. USDA (2014) 2012 Census of Agriculture: Farm and Ranch Irrigation Survey 2013.
    11. National Oceanic and Atmospheric Administration (NOAA) (2012) "NOAA Scientists: Midwest drought brings fourth smallest Gulf of Mexico 'Dead Zone’ since 1985."
    12. NOAA (2013) "2013 Gulf of Mexico Dead Zone Size Above Average But Not Largest."
    13. Osteen, C., et al. (2012) Agricultural Resources and Environmental Indicators, 2012. USDA ERS.
    14. USDA (2014) Pesticide Use in U.S. Agriculture: 21 Selected Crops 1960-2008.
    15. USDA, ERS (2012) "Adoption of Genetically Engineered Crops in the U.S."
    16. USDA (2015) "Recent Trends in GE Adoption."
    17. USDA, National Resources Conservation Services (2015) National Resources Inventory 2012.
    18. U.S. EPA (2016) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2014.
    19. Heller, M. and G. Keoleian (2000) Life Cycle-Based Sustainability Indicators for Assessment of the U.S. Food System, The University of Michigan Center for Sustainable Systems, CSS00-04.
    20. USDA, ERS (2015) "Data Sets: Nutrient Availability."
    21. USDA, ERS (2015) "Loss-Adjusted Food Availability."
