Sustainable Food Systems:

Feeding the World Without Eating the World

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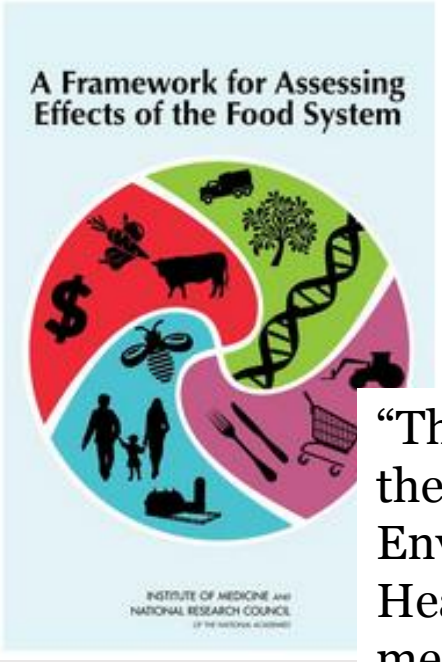
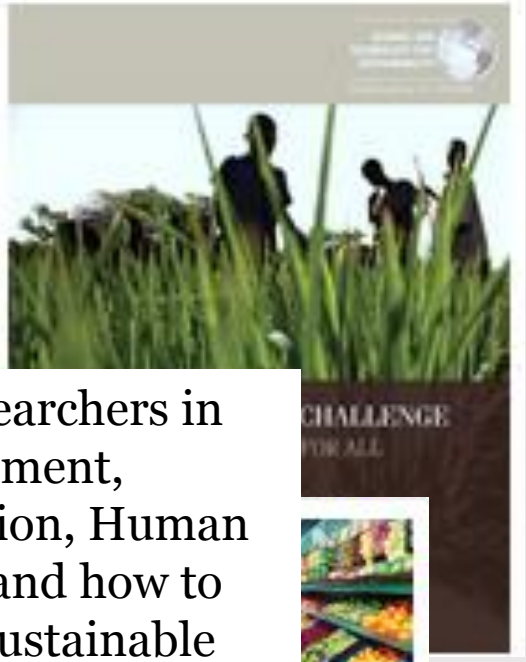
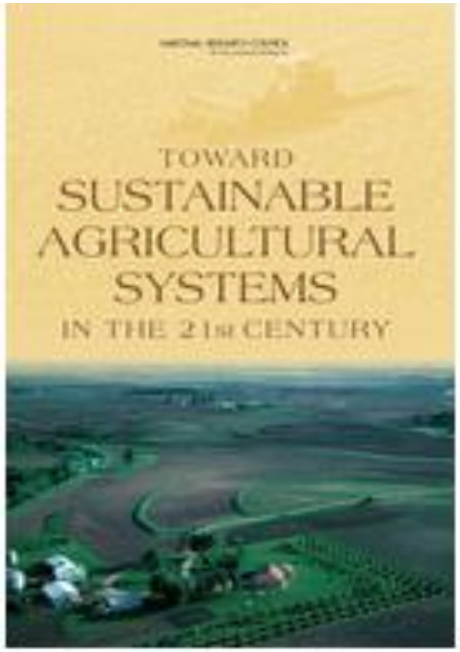
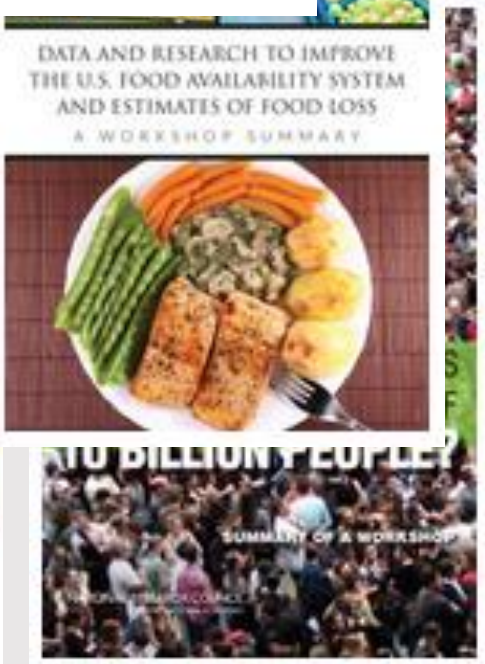




"There is an <u>urgent</u> need to bring together researchers in the areas of Agricultural Sciences and Management, Environmental and Natural Resources, Nutrition, Human Health and Animal Sciences to better understand how to meet the goals of making food systems more sustainable and to increase global food security."





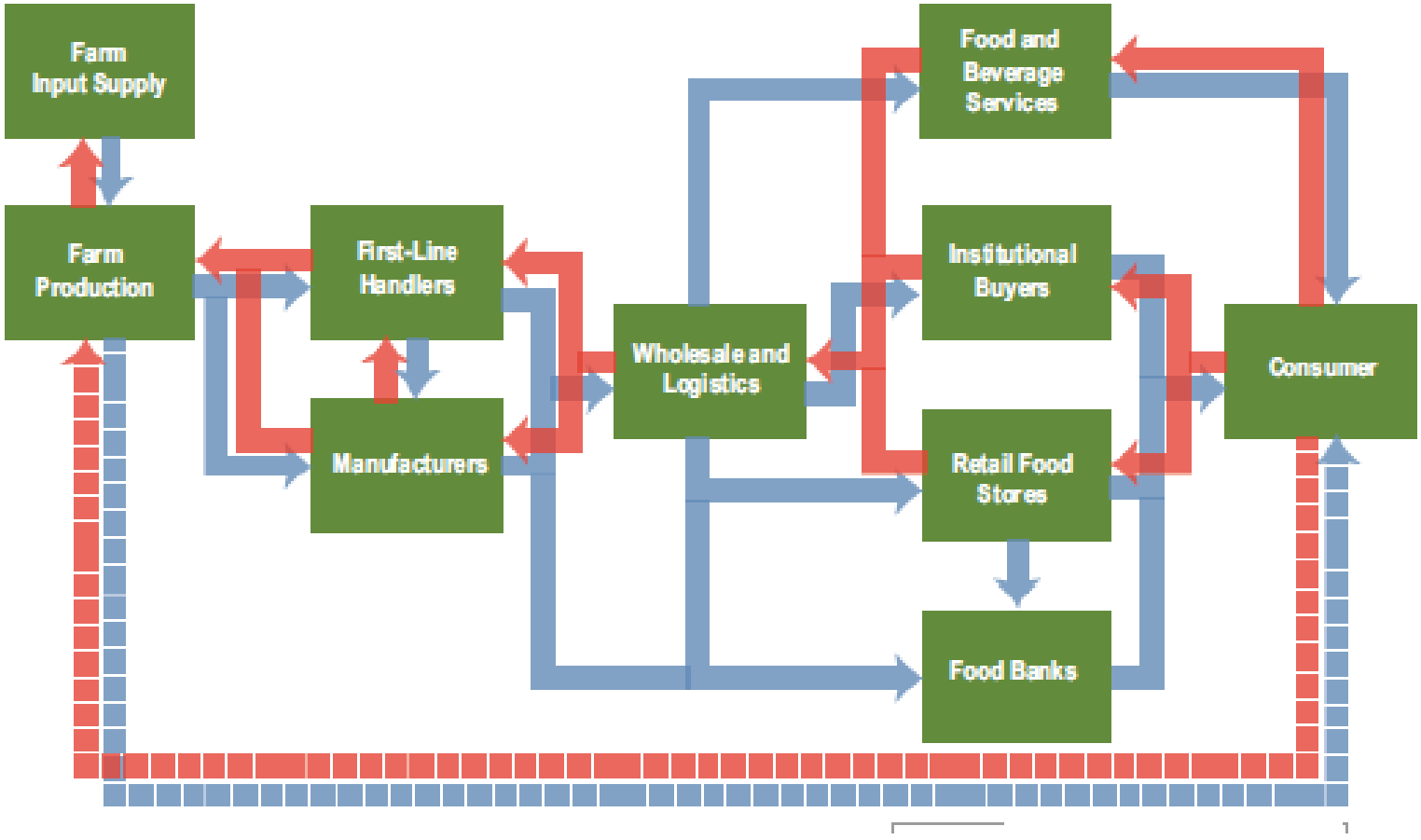


FIGURE S-1 Conceptual model of a food supply chain. Elements or actors in this supply chain in one area (e.g., region or country) also have interactions (e.g., international trade) with actors in other areas.

Source: NRC 2015. A Framework for Assessing Effects of the Food System

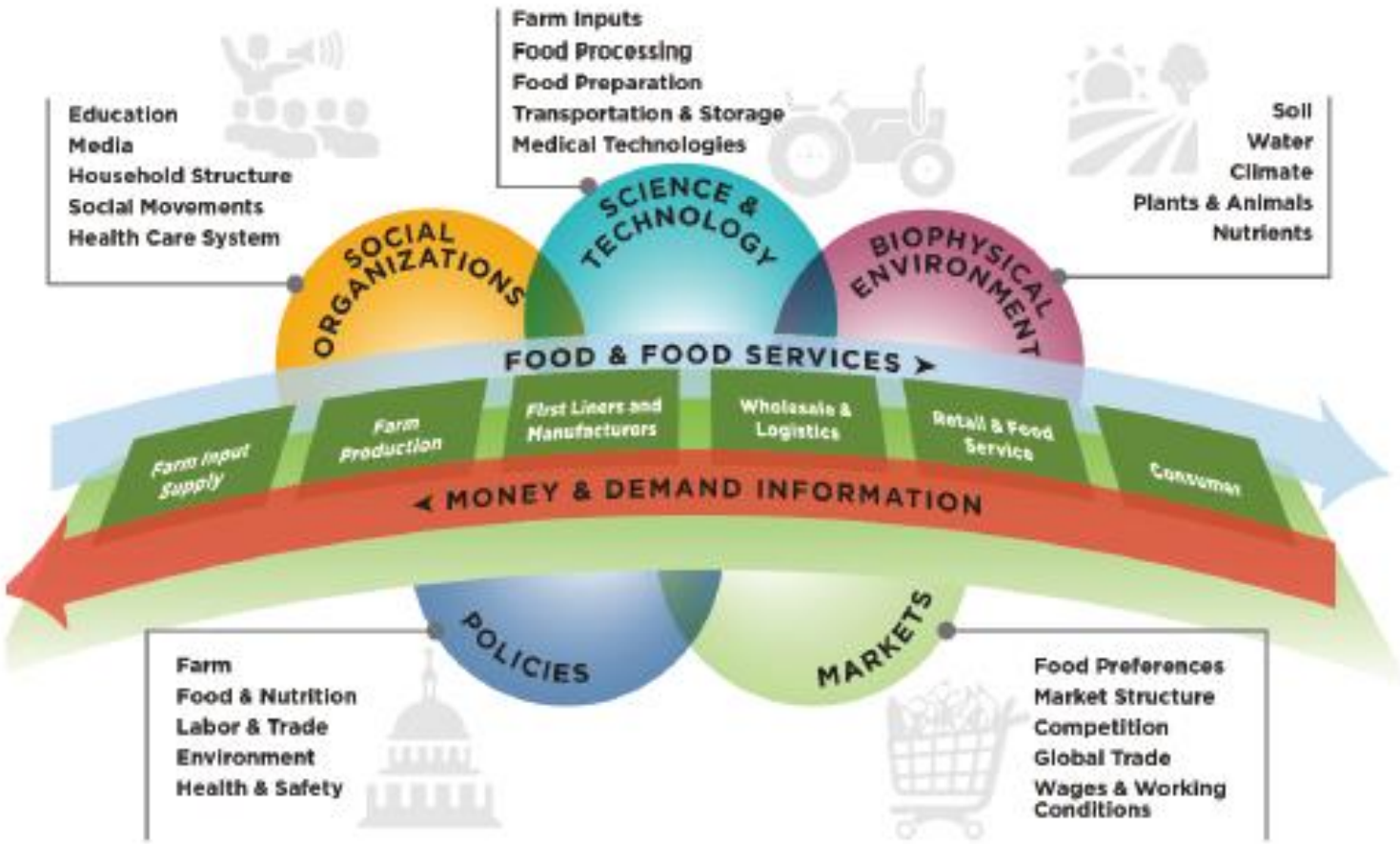
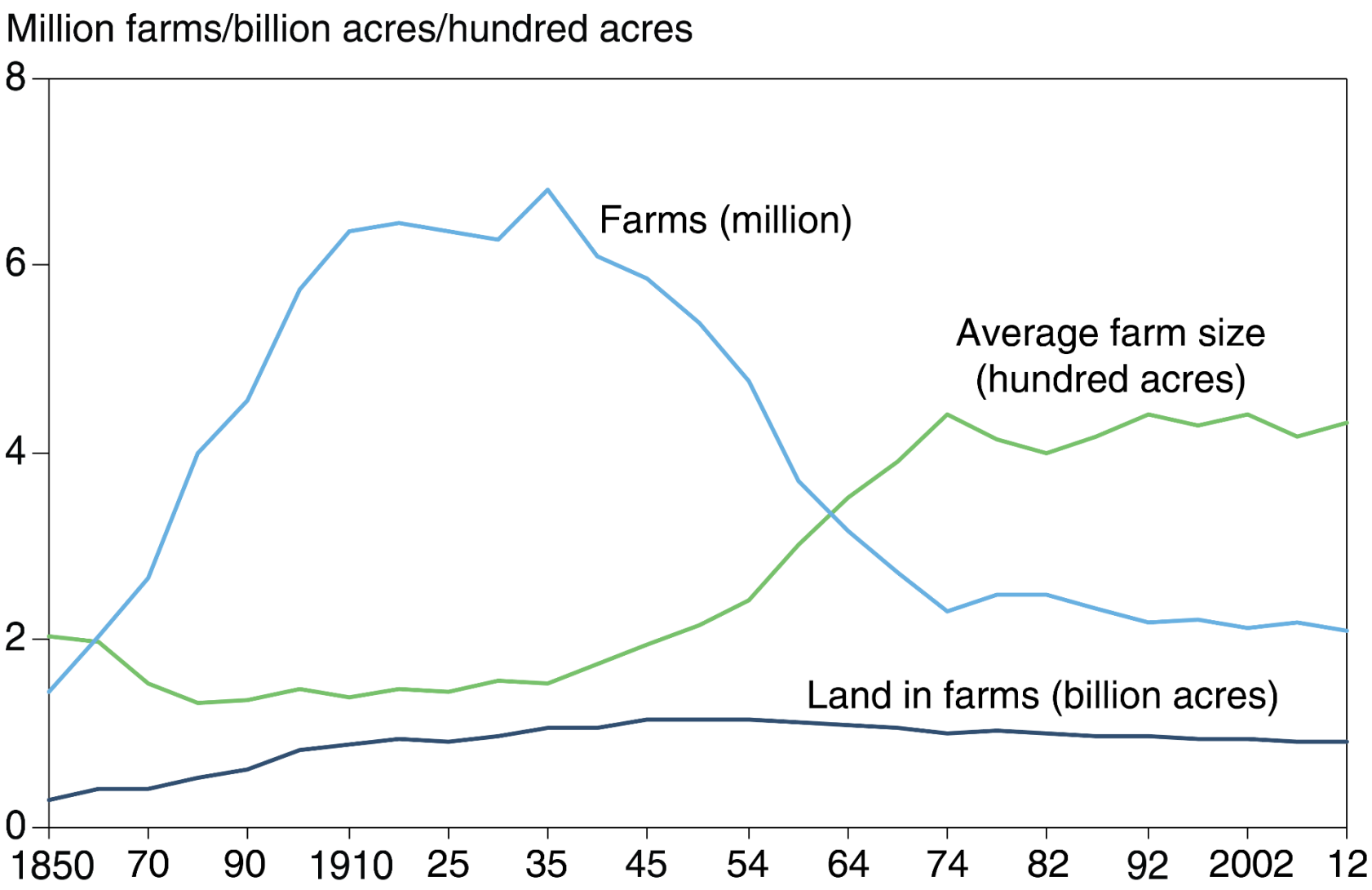


FIGURE 2-8 Links between the food supply chain and the larger biophysical and social/institutional context.

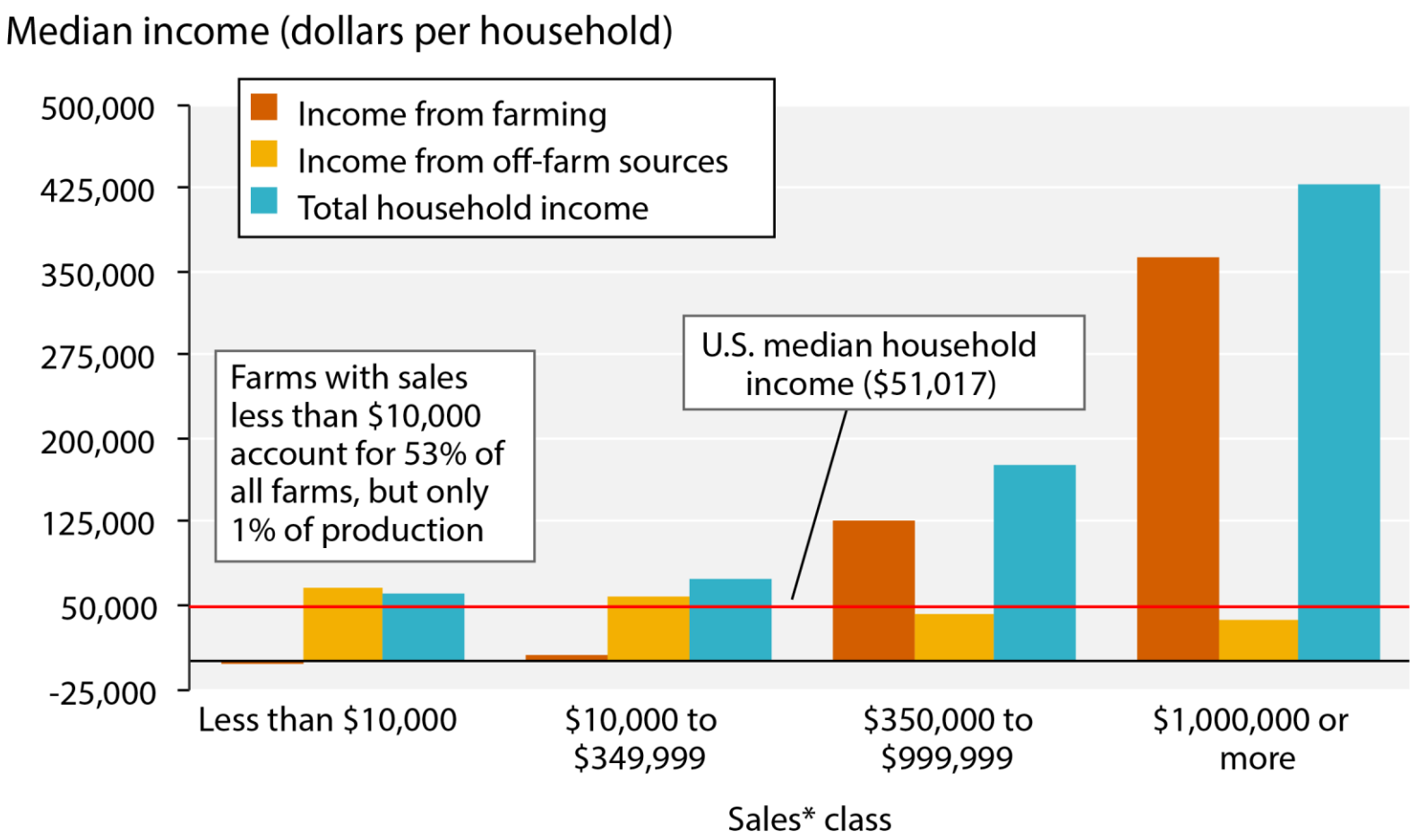
Source: NRC 2015. A Framework for Assessing Effects of the Food System

Farms, land in farms, and average acres per farm, 1850–2012



Source: USDA, Economic Research service using data from USDA, National Agricultural Statistics Service, Census of Agriculture.

Median household income of farm operators by source and sales class, 2012

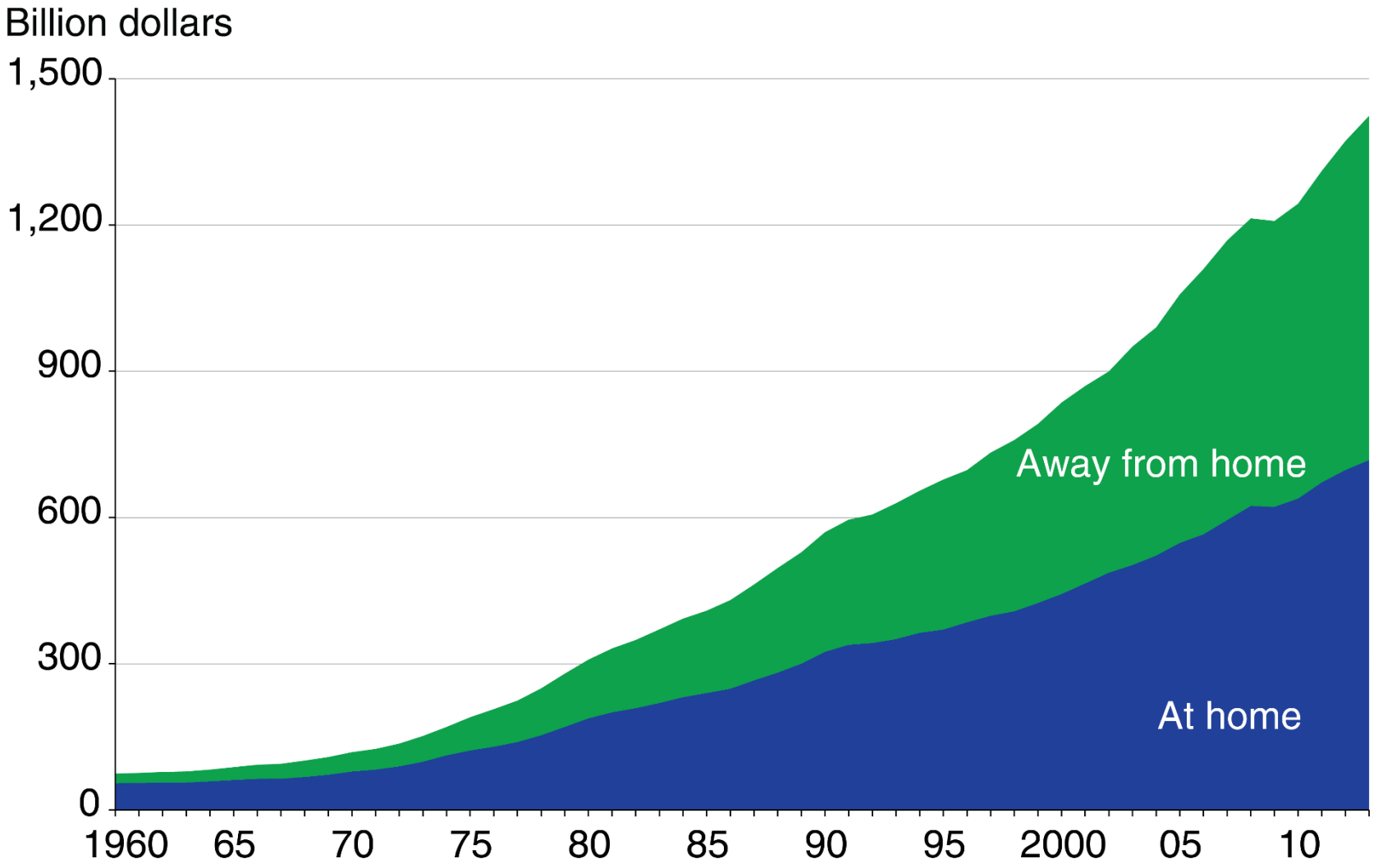


*Sales = Gross cash farm income (the sum of the farm's crop and livestock sales, government payments, and other farm-related income).
Source: USDA, Economic Research Service and USDA, National Agricultural Statistics Service, Agricultural Resource Management Survey; U.S. Census Bureau and U. S. Department of Labor, Bureau of Labor Statistics, Current Population Survey.

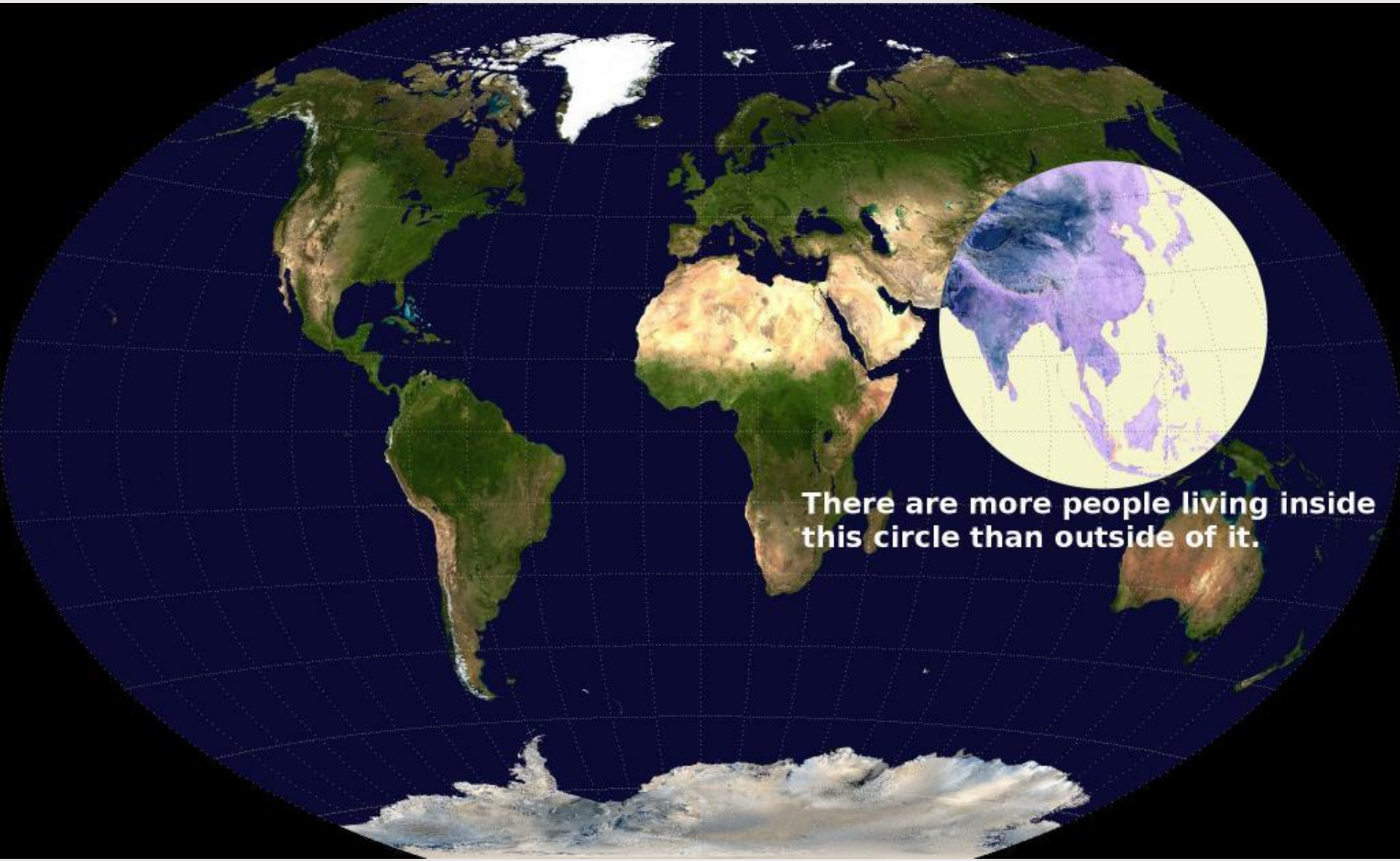
2013 Food dollar (nominal): Industry Group

Note: “Other” includes two industry groups: Agribusiness plus Legal & Accounting.
Source: USDA, Economic Research Service, Food Dollar Series.

Food-at-home and away-from-home expenditures in the United States, 1960-2013



Source: USDA, Economic Research Service, Food Expenditure Series.


There are more people living inside
this circle than outside of it.

The Well-Traveled Salad.

Do You Know Where Your Food Has Been?

As consumers, many of us fail to recognize that even our domestic and local food supplies are part of a global network. The daily activity of consuming food directly links our health as humans to the health of crops and produce, food animals, and the environments in which they are produced.

LETTUCE
Canada, Chile, Dominican Republic, Mexico, Peru, USA

CUCUMBERS
Canada, Honduras, India, Mexico, Spain, USA

FETA CHEESE
Canada, Denmark, Egypt, Germany, Greece, Israel, Italy, Turkey, UK, USA

VINAIGRETTE
Argentina, Brazil, Canada, Chile, China, France, Germany, Greece, India, Indonesia, Italy, Mexico, Morocco, Peru, Portugal, Spain, Thailand, Tunisia, Turkey, USA, Vietnam

OLIVES
Greece, Israel, Mexico, Spain, USA

SPROUTS
Argentina, Australia, Bangladesh, Canada, China, Egypt, France, India, Morocco, Nepal, Pakistan, South Africa, Spain, Turkey, USA

MANDARIN ORANGES
Israel, Mexico, Morocco, South Africa, Spain

CROUTONS
Argentina, Australia, Brazil, Canada, China, France, India, Mexico, Netherlands, Poland, Russia, Switzerland, Uruguay, USA, Vietnam

TOMATOES
Canada, Dominican Republic, Holland, Israel, Italy, Mexico, USA

ONIONS
Canada, China, Germany, India, USA

A "One Health" approach to food safety—bringing together expertise and resources from the clinical, veterinary, wildlife health, and ecology communities—has the potential to reveal the sources, pathways, and factors driving the outbreaks of foodborne illness and possibly prevent them from occurring in the first place.

NOTE: Countries are listed in alphabetical order and not by volume of export.

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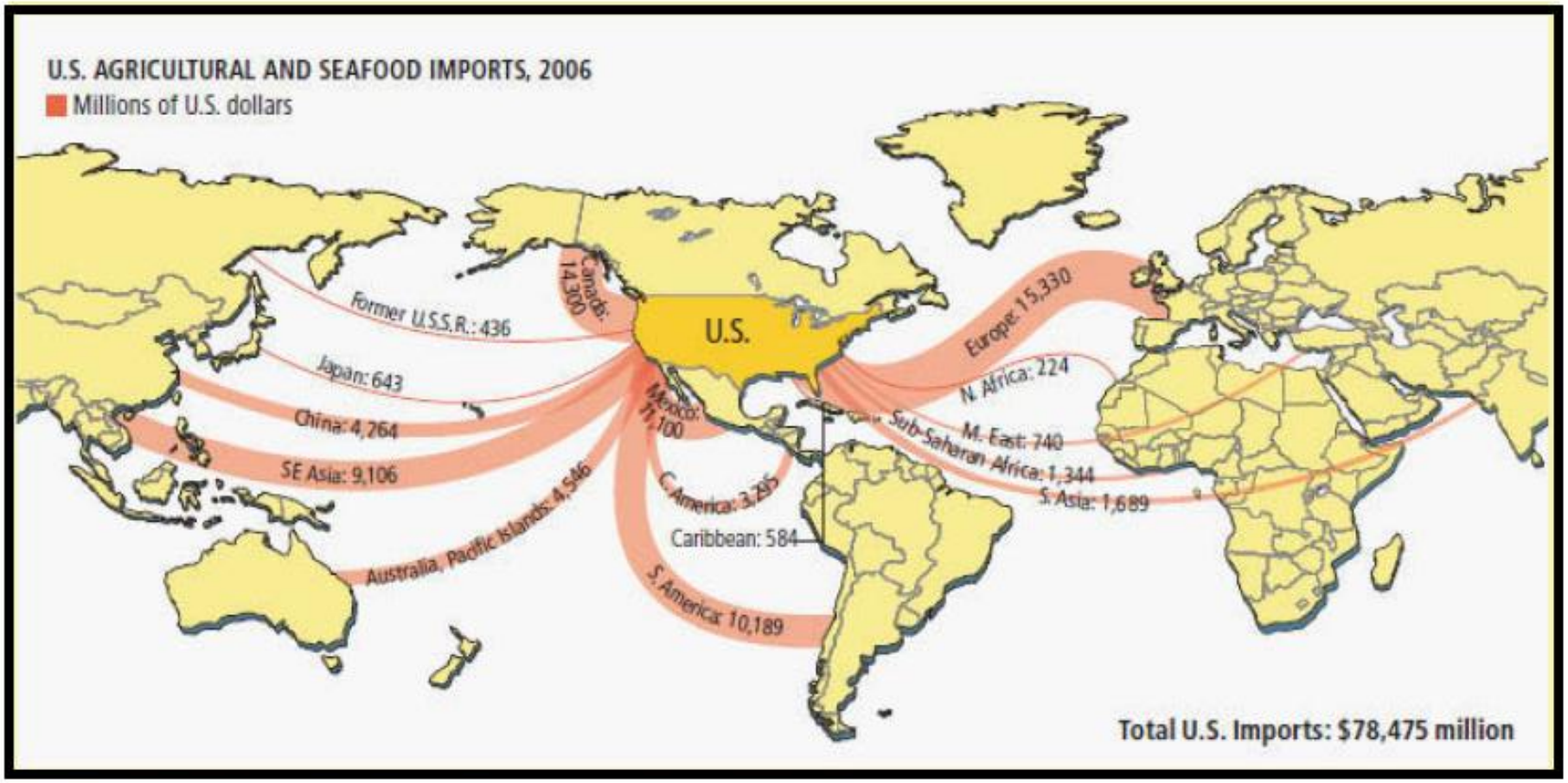
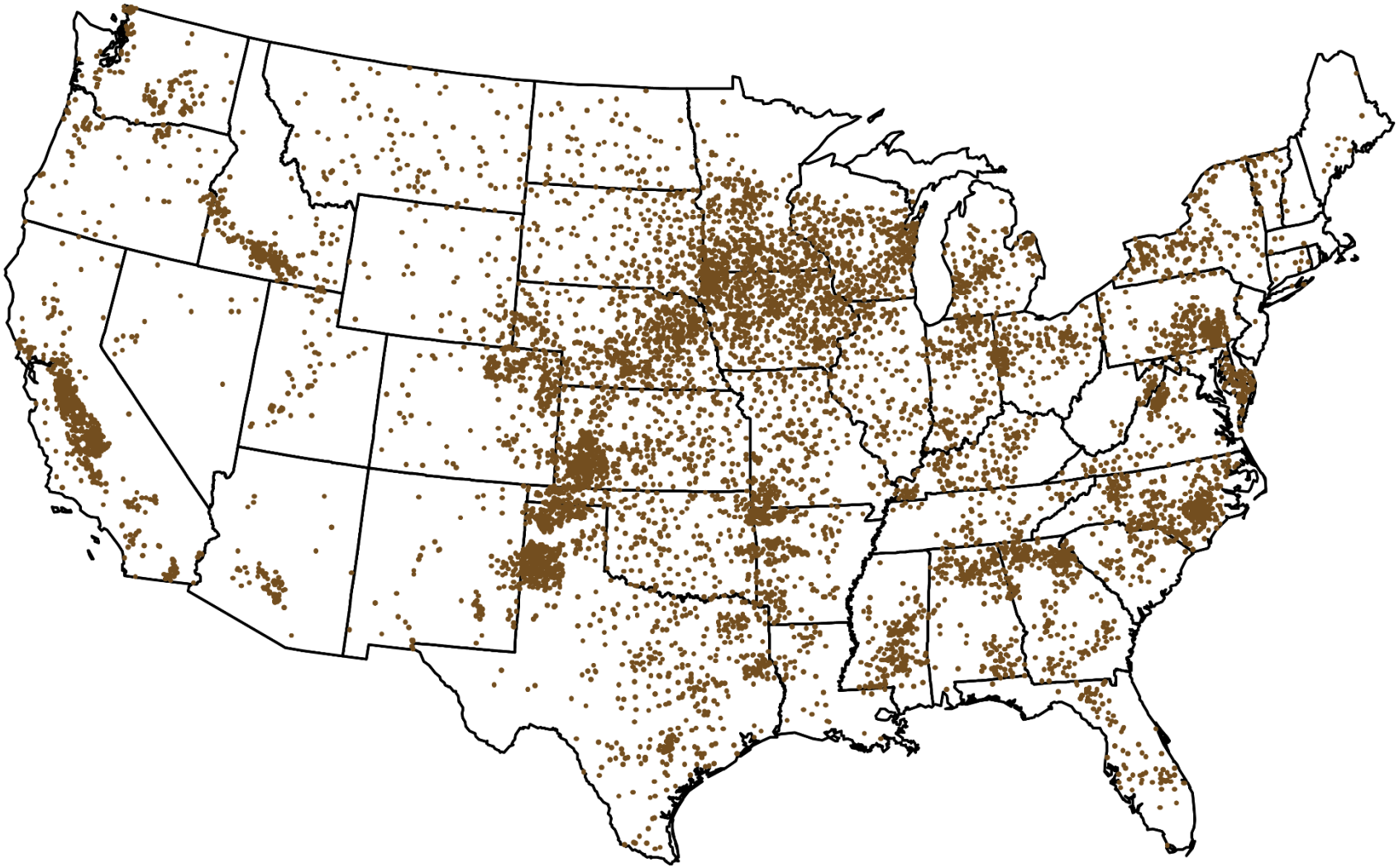


FIGURE WO-2 U.S. agricultural and seafood imports (millions of U.S. dollars).
SOURCE: George Retseck and Lucy Reading-Ikkanda for *Scientific American* magazine in Fischetti (2007).

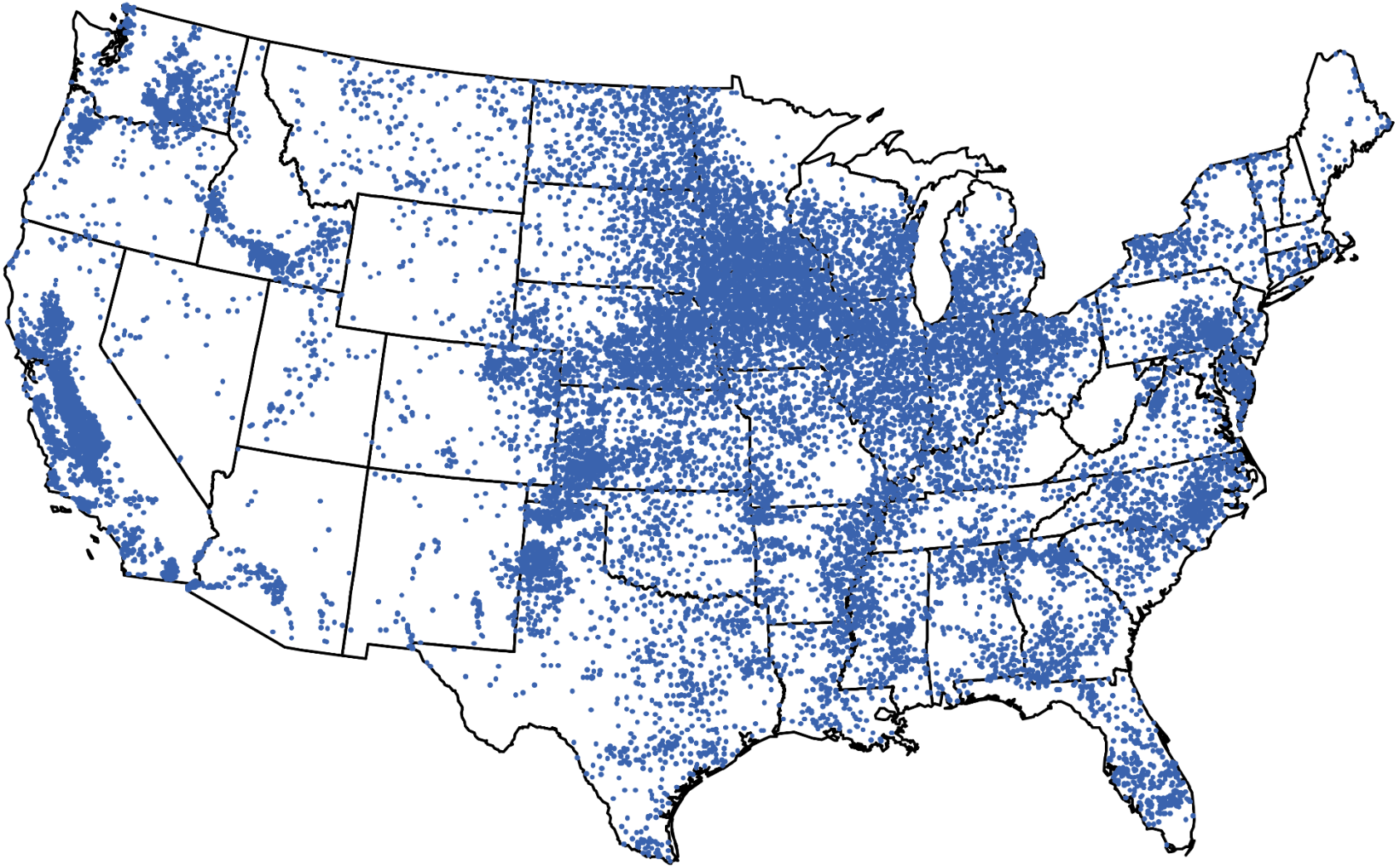
Market value of livestock, poultry, and their products sold in 2012



1 dot = $20 million

Source: USDA, Economic Research Service using data from USDA, National Agricultural Statistics Service, 2012 Census of Agriculture.

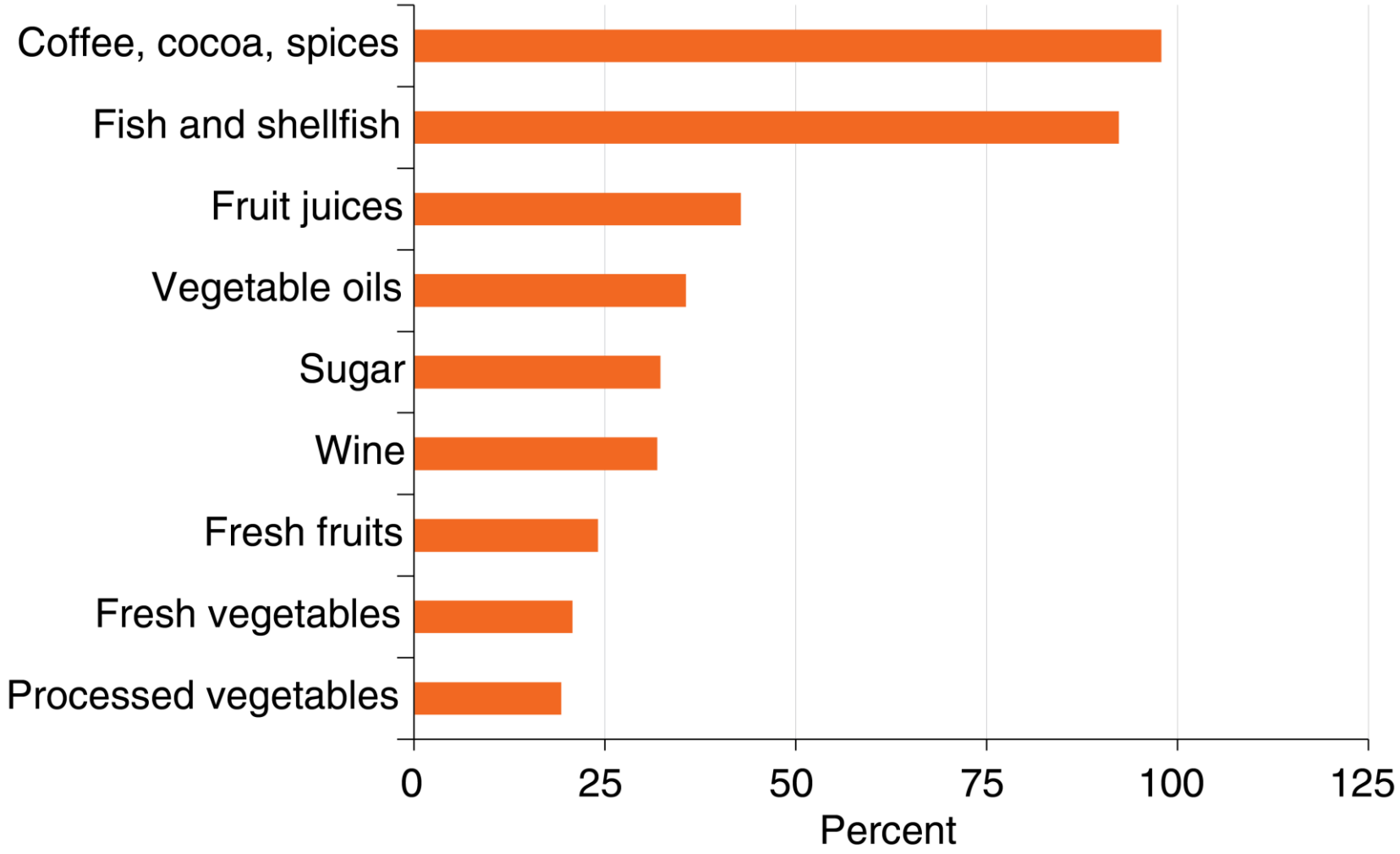
Market value of agricultural products sold in 2012



1 dot = $20 million

Source: USDA, Economic Research Service using data from USDA, National Agricultural Statistics Service, 2012 Census of Agriculture.

Import share of U.S. food consumption, 2010-12



Source: USDA, Economic Research Service calculations based on data from U.S. Department of Commerce, U.S. Census Bureau, Foreign Trade Database; and USDA, National Agricultural Statistics Service, various reports.

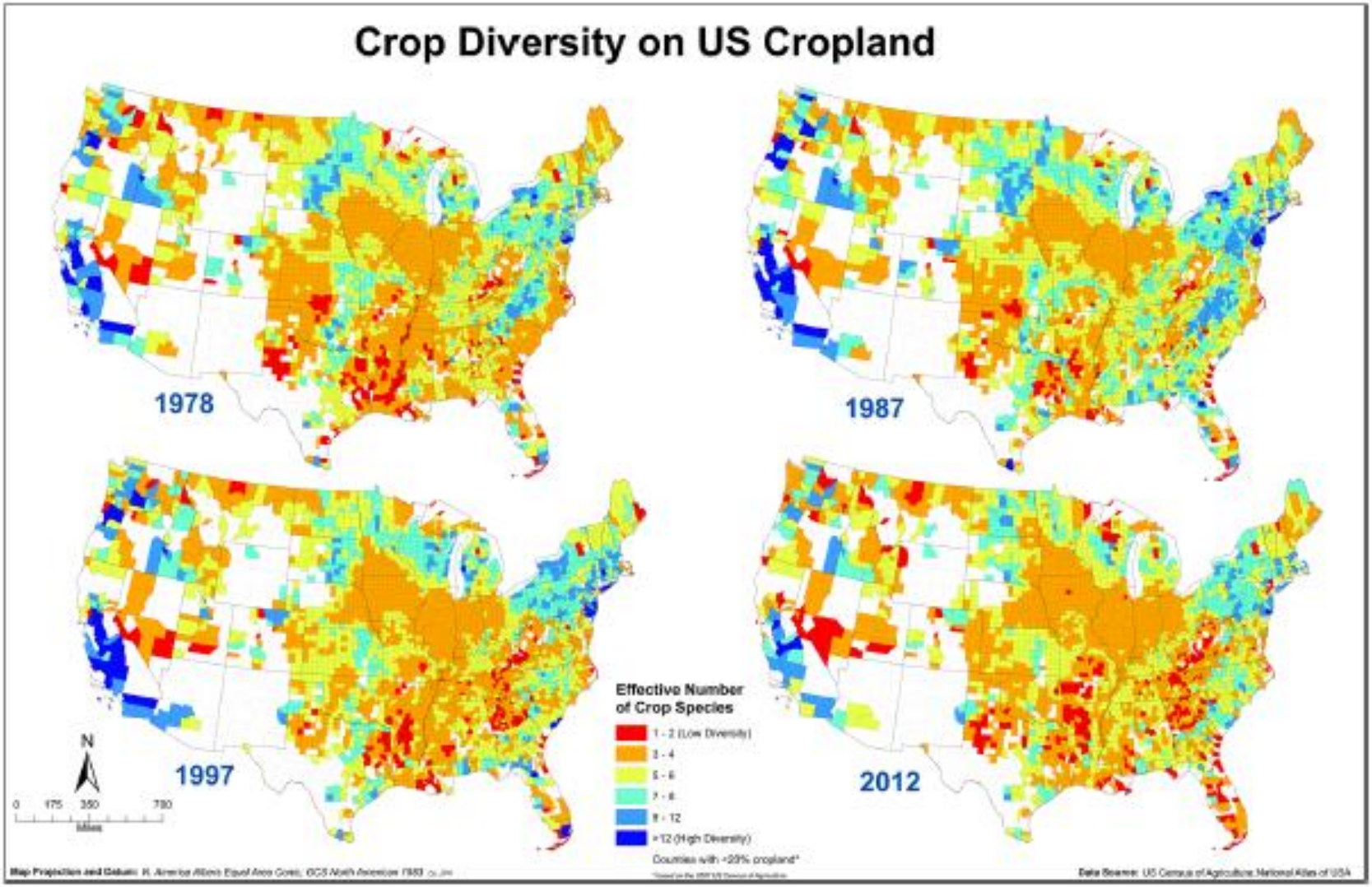


Fig 3. Crop species diversity as effective number of species in 1978, 1987, 1997 and 2012 on a county level basis for the contiguous US. The hotter colors (red hues) indicate lower ENCS values (low crop diversity) while colder colors (blue hues) indicate higher ENCS values (high crop diversity). Maps showing crop diversity for all Census years are available in S1 Fig.

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Aguilar et al., 2015

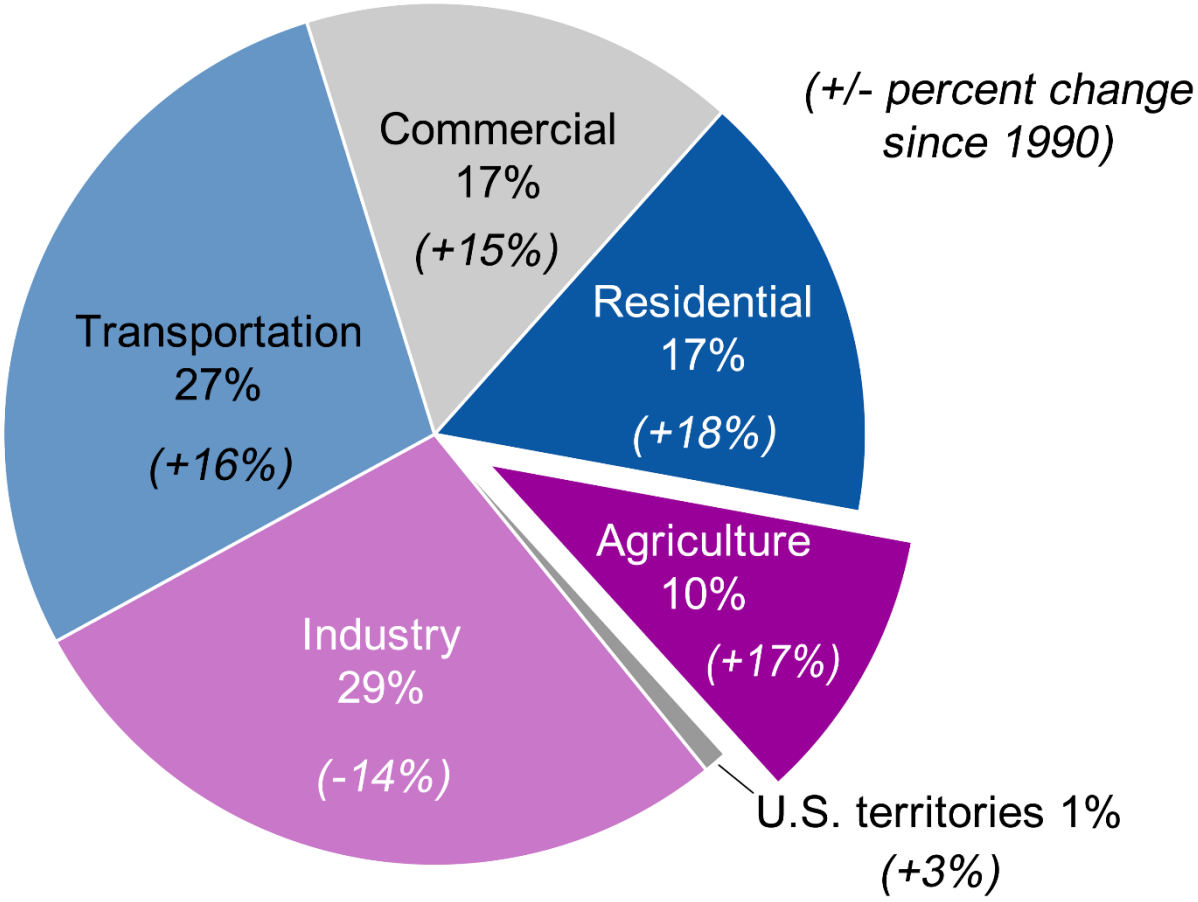
Agricultural Diversity

- Animal food production
  - 14 bird and mammal species, make up 90% of the food supply
    - 30 species of mammals and birds have been domesticated for the food system
    - 17% of the 8000 breeds are at risk of extinction and 7% are already extinct
- Fisheries
  - For 3 billion people, fish provides 20% of their animal protein
  - 10 species groups account for 30% of the marine capture fisheries production
  - 0.3% of 175,000 species of fish, mollusks, crustaceans, and aquatic plants are farmed for food
- Plants
  - Plants make up 80% of the global human diet
  - 5 Cereal crops provide 60% of the energy intake of the world population (rice, wheat, maize, millet and sorghum)
  - 30 crops are used to feed the world
  - 7000 species are cultivated or collected by humans
  - 30,000 terrestrial plant species are known to be edible by humans

Source FAO 2014

U.S. greenhouse gas emissions by economic sector, 2013

Total U.S. emissions in 2013 = 6,673 million metric tons of carbon-dioxide equivalent



Note: Electricity emissions are allocated to each end-use sector based on its consumption.
Source: USDA, Economic Research Service using data from U.S. Environmental Protection Agency, 2015. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2013.*

Risk to various industries from climate change

MALNUTRITION HAS MANY FORMS

Stunting
161 million children
under 5 have low height-for-age
because of chronic hunger

Wasting
51 million children under 5
have low weight-for-height
because of acute hunger

Micronutrient deficiencies
More than 2 billion people
are deficient in micronutrients
like vitamin A, iodine, iron & zinc

Overweight
42 million children
under 5 are overweight

Obesity
More than 500 million
adults are obese

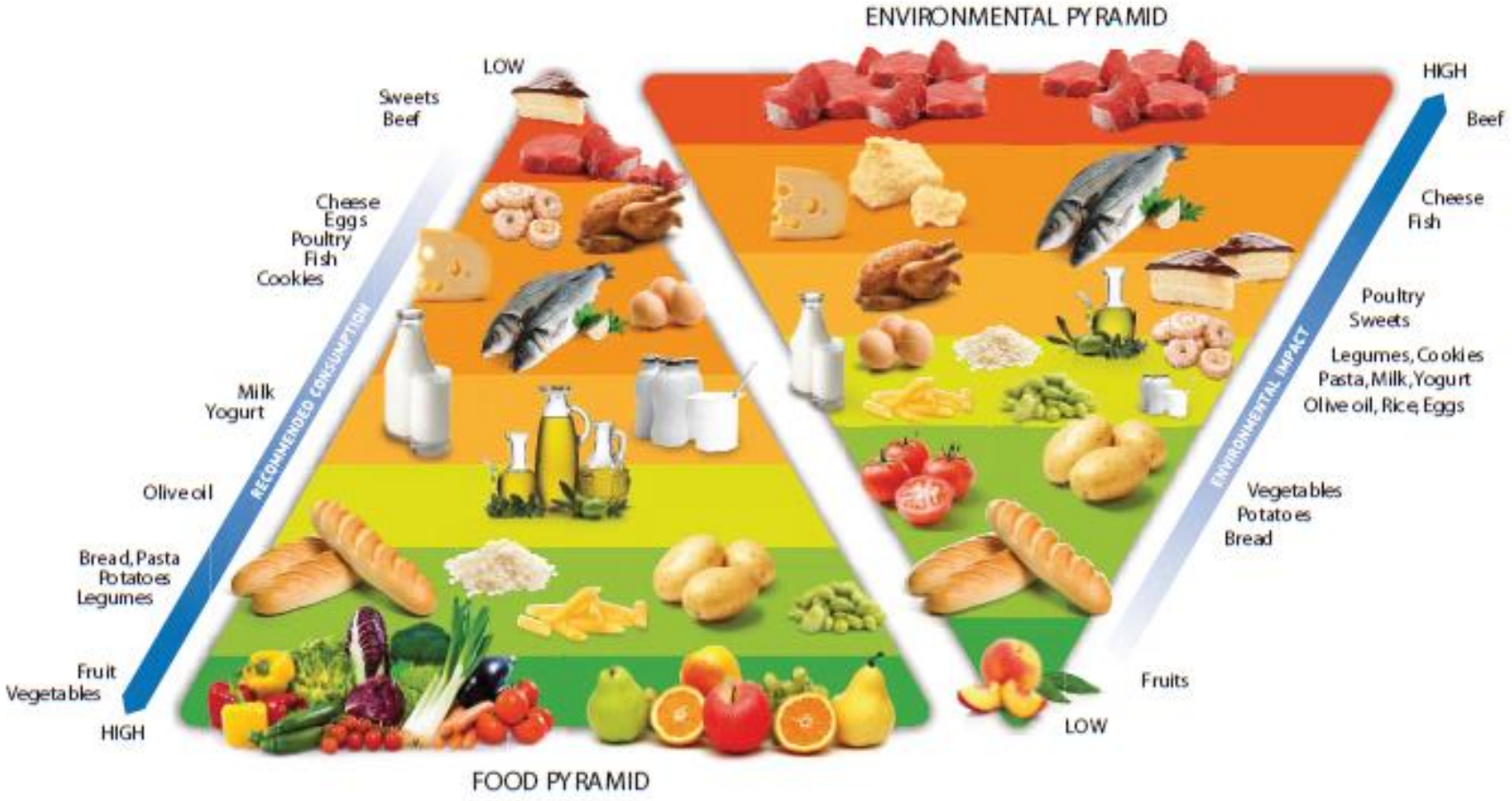


FIGURE 2-2 Cereal food losses and waste worldwide.
SOURCE: Gustavsson et al., 2011.

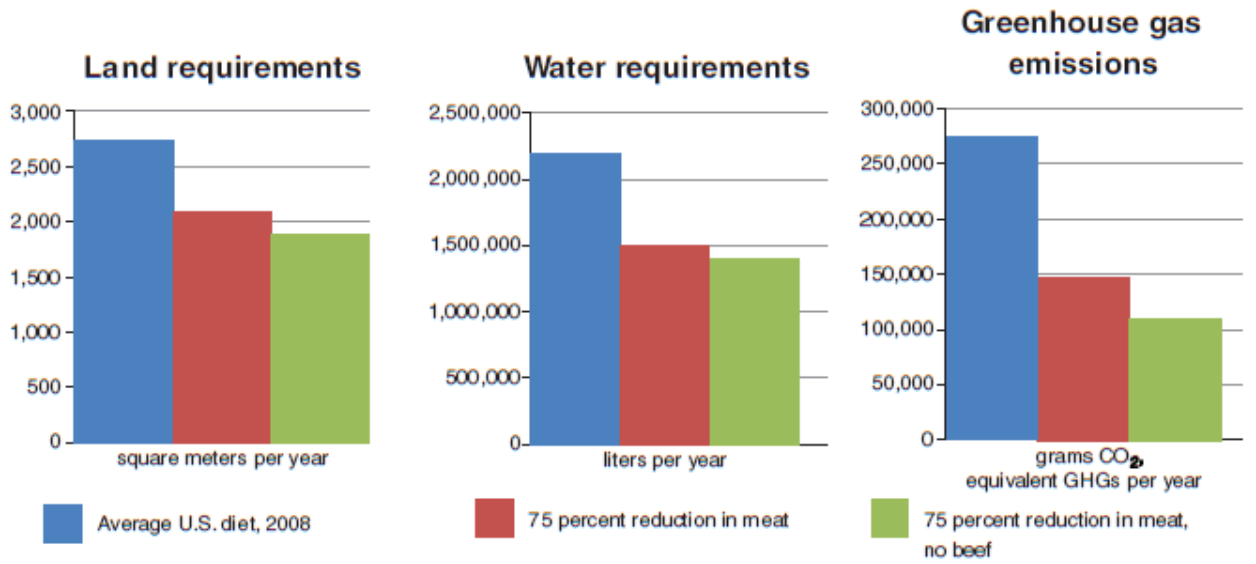


FIGURE 3-5 How a shift in the U.S. diet from 123 to 30 kilograms of meat per person per year would impact land, water, and greenhouse gas footprints.
SOURCE: Unpublished results from Cassidy.

Source: Sustainable Diets, NRC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