



# FOODSPAN<sup>TM</sup>

Teaching the Food System from Farm to Fork

[Slides]



Complete FoodSpan curriculum, resources, student handouts, teacher guides, and presentation slides can be found at [www.foodspan.org](http://www.foodspan.org).



Lesson A


# Exploring the Food System



# FoodSpan Infographic

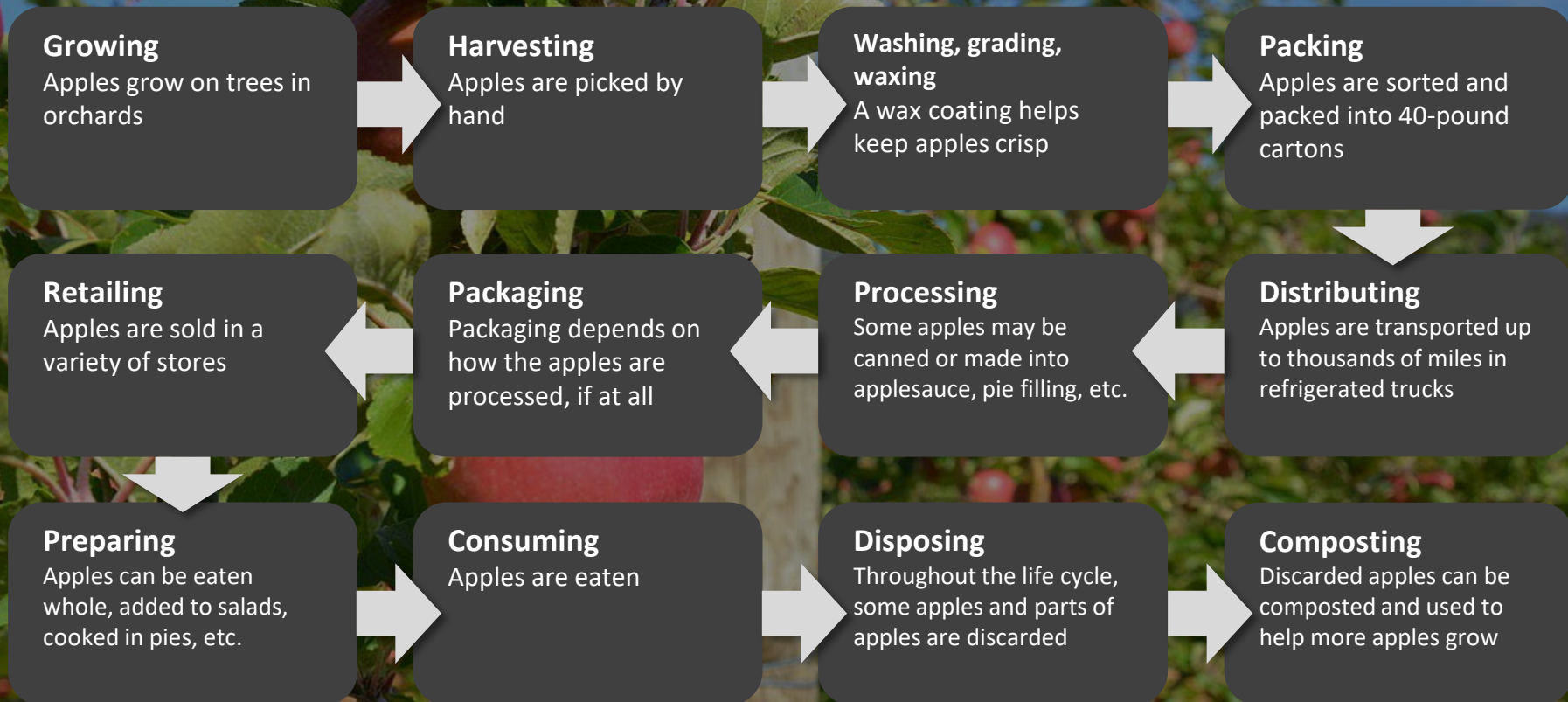
1. Crop production
2. Food animal production
3. Seafood production
4. Food chain workers
5. Climate change
6. Agroecology
7. Food distribution
8. Food safety
9. Food processing
10. Food labeling
11. Food marketing
12. Food environments
13. Food waste
14. Hunger and food insecurity
15. Food policy





“When we try to pick out anything by itself, we find it hitched to everything else in the universe.”  
– John Muir

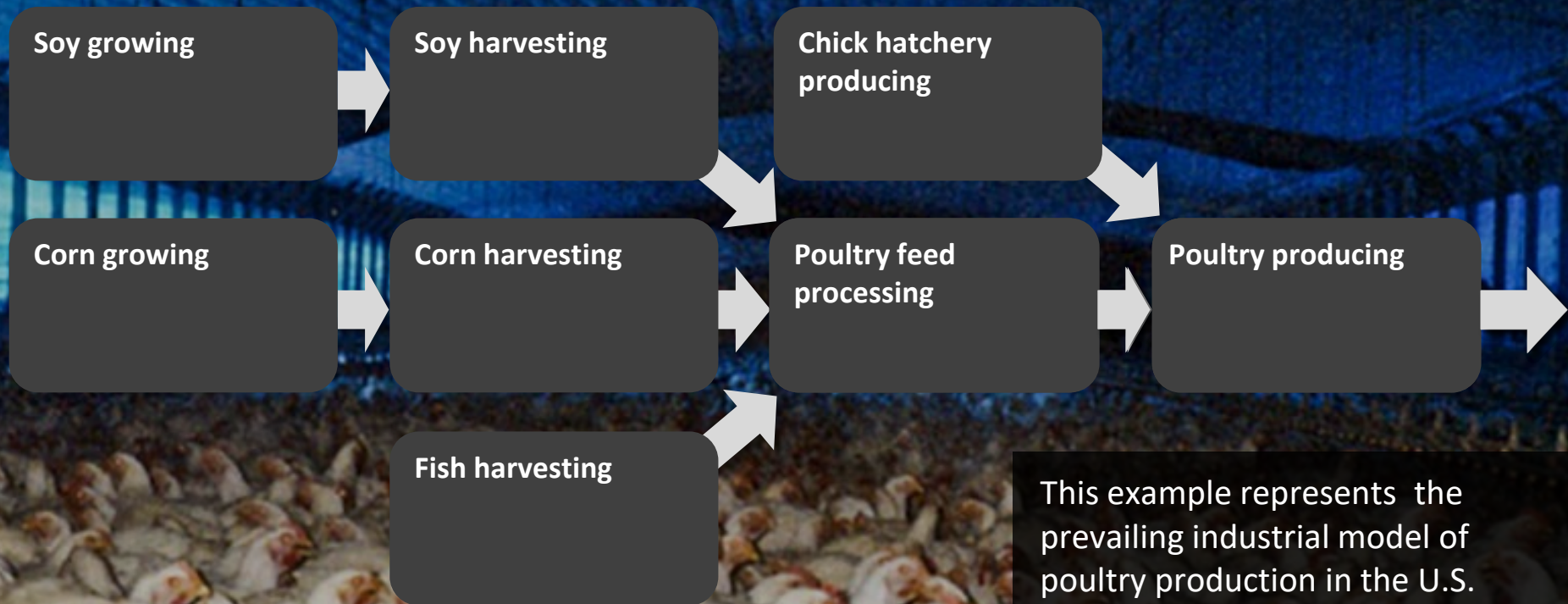
# Washington Apple Supply Chain



Adapted, with permission, from *Discovering the Food System*. [www.hort.cornell.edu/foodsys/](http://www.hort.cornell.edu/foodsys/).

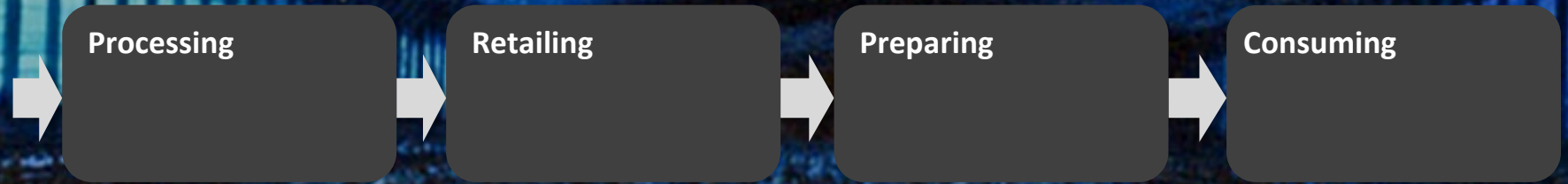
Photo credit: Apple and Pear Australia Ltd. Flickr. Creative Commons CC-BY 2.0.

# Broiler Chicken Supply Chain



This example represents the prevailing industrial model of poultry production in the U.S.

# Broiler Chicken Supply Chain (continued)



In this example, the chicken is minimally processed. Foods such as chicken nuggets would require additional processing steps.

## Lesson B

# Industrialization of Agriculture





# Farms, Then and Now



Photo credits: Carl G. von Iwonski. John Mack Farragher. Yeoman farm families. *One Out of Many: A History of the American People*, Pearson, 2011.  
Dan Davison. John Deere combine and tractor at work. Wikimedia Commons. Creative Commons CC BY 2.0.

# Agriculture Timeline



A photograph of two San people in a natural, outdoor setting. The person on the left is a man with a weathered face, looking towards the camera with a slight smile. The person on the right is a woman with her eyes closed, holding a bundle of sticks or roots. The background is a soft-focus natural landscape. A vertical white line is on the left side of the image. Two semi-transparent dark grey text boxes are overlaid on the image.

**194,000 BCE**

## Earliest evidence of Homo sapiens

For the vast majority of human history, food was acquired through hunting and gathering. Some peoples, such as the San (pictured), who live in Southern Africa, still follow a hunter-gatherer lifestyle.

**11,000 BCE**

## Earliest evidence of agriculture

The shift to agriculture is believed to have occurred independently in several parts of the world, including the Fertile Crescent (pictured), a region in the Middle East that cradled some of the earliest civilizations.



**6,000 BCE**

**Most species of  
farm animals  
domesticated**

A world map with a blue background. The continents are color-coded: North America is yellow, South America is pink, Africa is orange, Europe is green, and Asia is light green. Australia is dark grey. Two black text boxes are overlaid on the map. The first box is over South America and contains the text '5,000 BCE'. The second box is over Europe and Asia and contains the text 'Agriculture practiced on every major continent except Australia'.

**5,000 BCE**

**Agriculture practiced on every major continent except Australia**

## Widespread adoption of industrial agriculture

Synthetic nitrogen fertilizers (pictured), introduced in the 1900s, have been credited with providing the lion's share of the world's food over the 20<sup>th</sup> century. Pesticides and monocultures are also hallmarks of industrial agriculture.

1900s



## Lesson 1

# Crops: Growing Problems







# Monoculture



# Monoculture



# Ecological Impacts

Potential ecological impacts of industrial crop production:

- Soil erosion
- Decrease in bee populations
- Emergence of pesticide-resistant weeds
- Aquatic dead zones
- Depletion of phosphorous and fossil fuels
- Depletion of groundwater

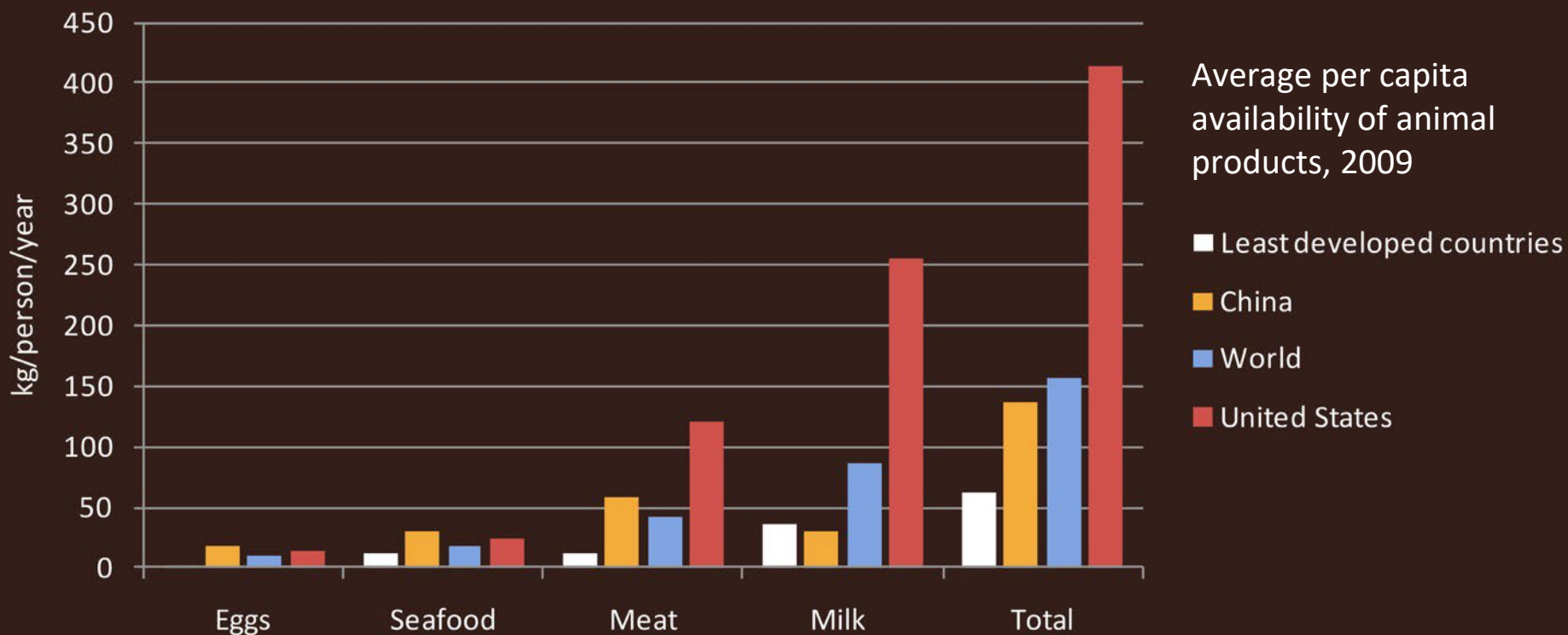
The 1930s Dust Bowl demonstrated the devastating potential of soil erosion.  
See the *Crop Production* primer for details. Photo credit: NOAA, 1935. Public domain.

## Lesson 2

# Animals: Field to Factory



# Global Animal Product Consumption



A large indoor chicken farm with many white chickens. The chickens are packed closely together, filling the lower two-thirds of the frame. The background shows the structure of the farm, including a long row of windows on the left and a dark, arched roof structure. The lighting is somewhat dim, with a blueish tint in the background.

# Chickens raised for meat

Photo credit: Farm Sanctuary. [www.farmsanctuary.org](http://www.farmsanctuary.org).

# Hogs

A long, narrow aisle in a large indoor hog farm. The aisle is flanked by rows of metal cages, each filled with numerous pink pigs. The pigs are packed closely together, and some are looking towards the camera. The floor is a mix of dirt and straw. The ceiling is high and made of metal beams with various pipes and lights. The overall atmosphere is industrial and crowded.

Photo credit: Jeff Vanuga, USDA Natural Resources Conservation Service.



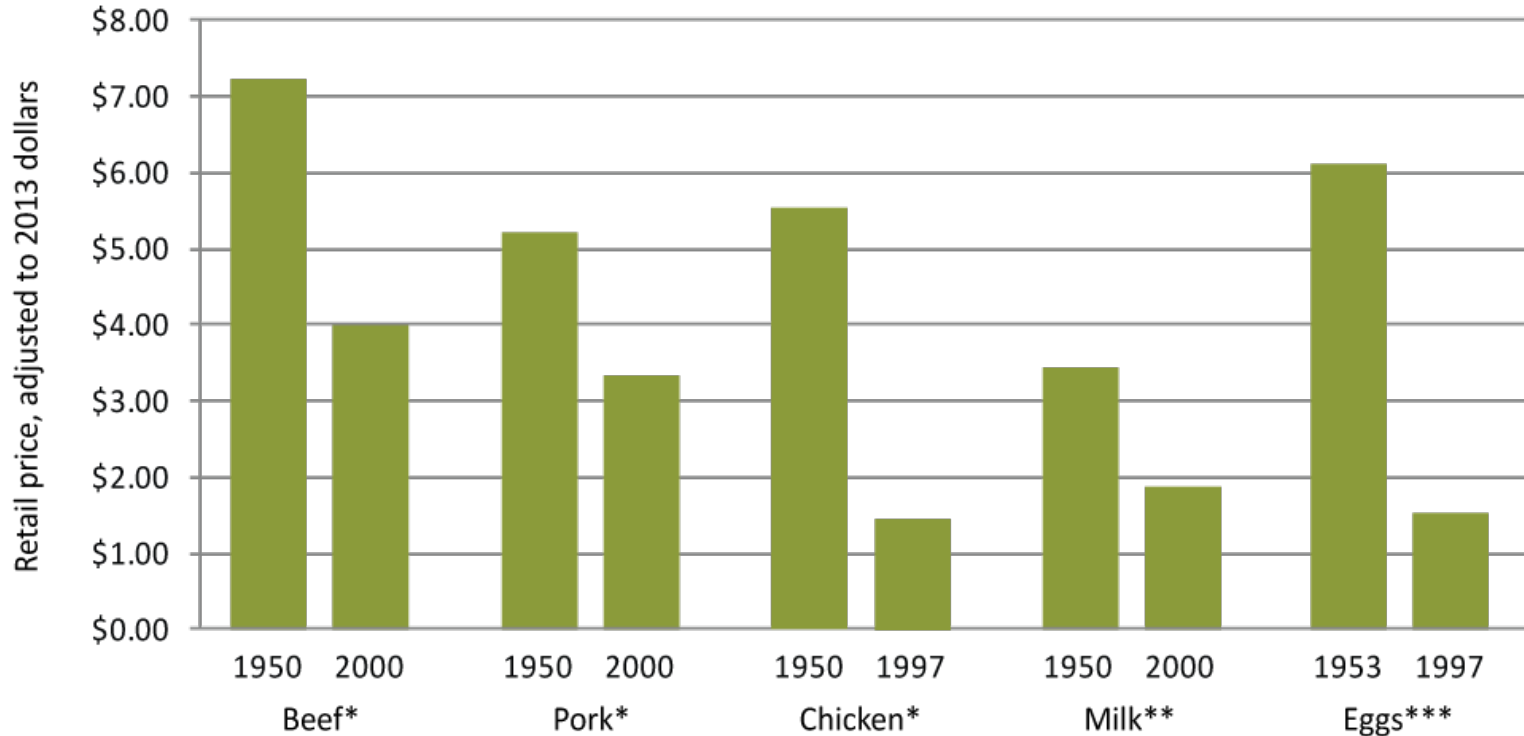
# Laying hens



# Beef cattle on feedlot



# Animal Product Prices, 1950-2000



\*Per pound, \*\*Per half gallon, \*\*\*Per dozen. Data source: USDA Economic Research Service.



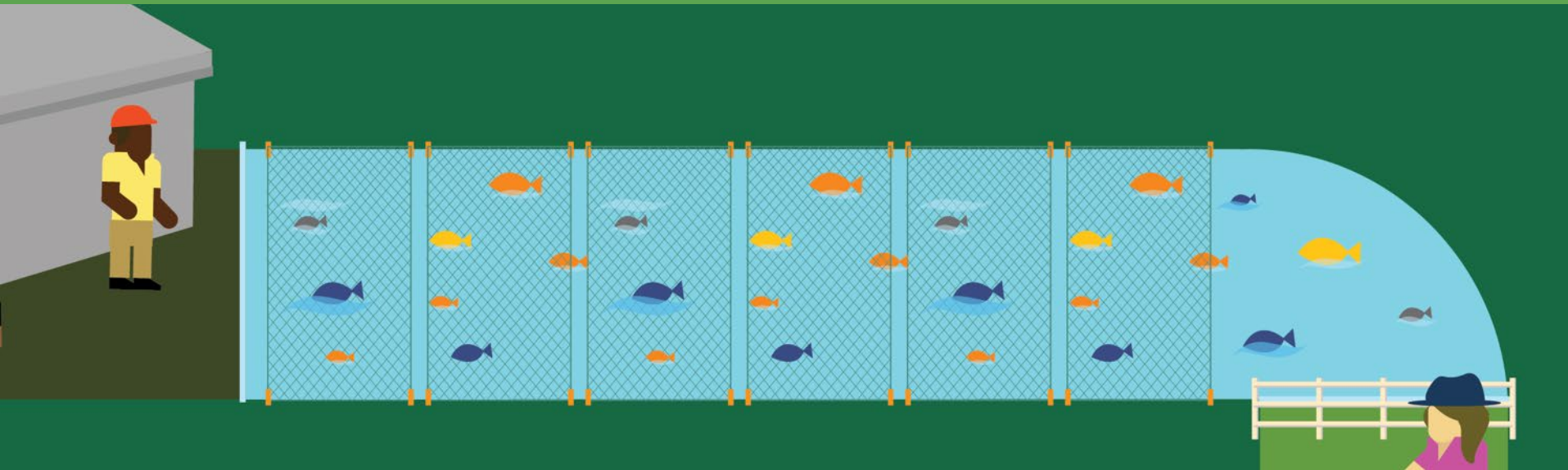
# Ecological production-Chickens



## Ecological production-Hogs

## Lesson 3

# Seafood: Wild and Farmed





# Seafood Production

About 400 tons of mackerel caught in a purse seine (a type of net) in Chile.

Most global seafood harvests use gigantic nets that are pulled through the water or along the sea floor.

Photo credit: C. Ortiz Rojas, 1997. NOAA Photo Library.



# Seafood Production-Bycatch

Separating shrimp from bycatch (non-target species caught unintentionally).

In the shrimp harvesting industry, only 5 percent of what some trawlers catch is actually shrimp, and the rest is bycatch.

Source: Davies RWD, Cripps SJ, et al. Defining and estimating global marine fisheries bycatch. *Mar. Policy* 2009;33(4):661-672.

Photo credit: National Oceanic & Atmospheric Administration, 1969. NOAA Photo Library.



# Seafood Production- Shrimp Farms

Shrimp farms in Vietnam.

In 2011, the U.S. imported 91 percent of its seafood.

Source: NOAA Fisheries Posts Statistical Report Card for U.S. Fisheries in 2011. *NOAA Fish.* 2012.

Photo credit: American Museum of Natural History, 2009. Creative Commons CC BY-NC-SA 2.0. <https://creativecommons.org/licenses/by-nc-sa/2.0/>

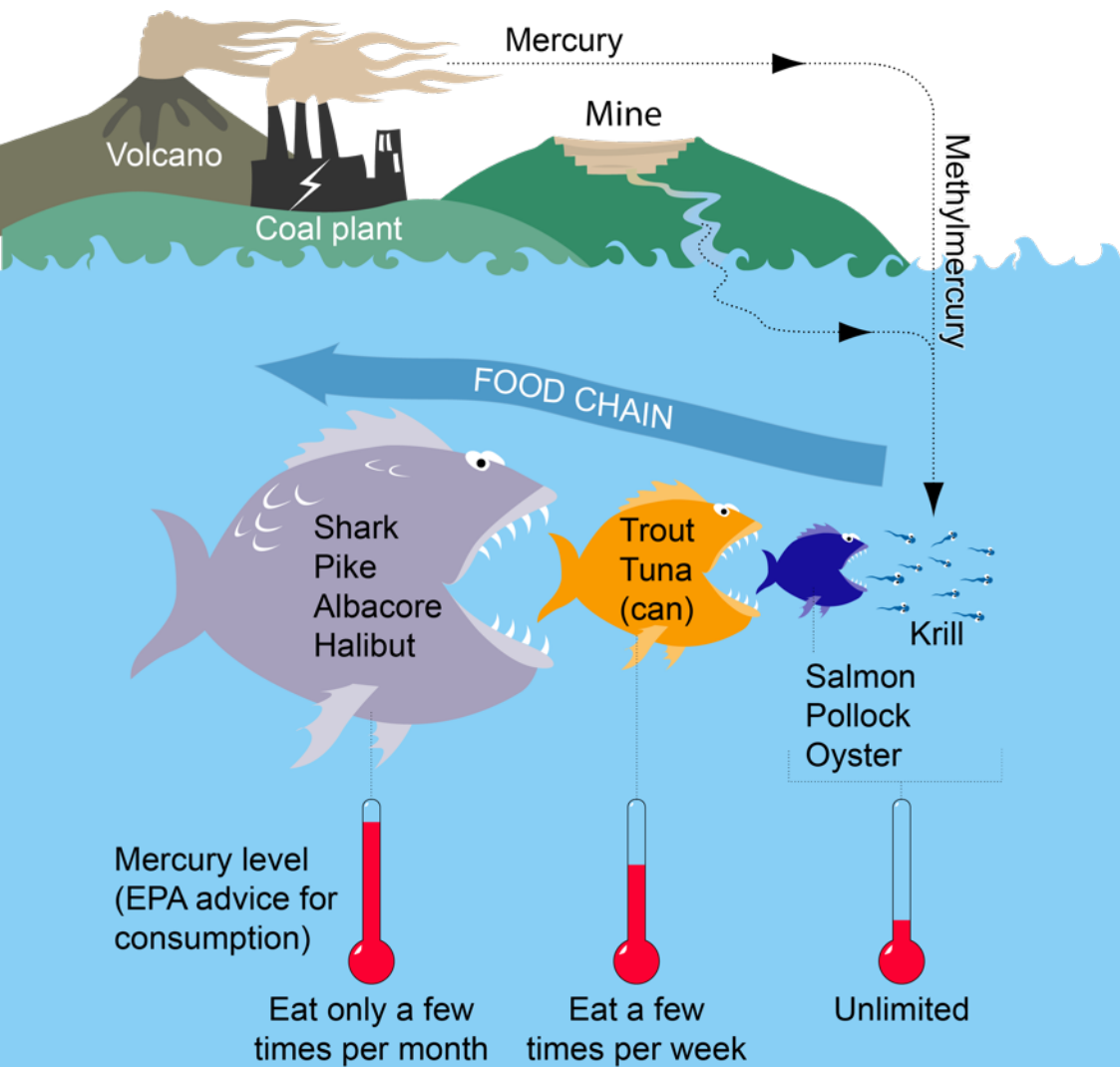




# Seafood Production- Oyster Farm

On this Australian farm, oysters are raised in submerged bags attached to poles.

Photo credit: Saoysters, 2009. Wikimedia Commons. Creative Commons CC BY 3.0. <https://creativecommons.org/licenses/by/3.0/deed.en>



# Seafood Safety

These guidelines are designed to protect children and pregnant women.

Source: U.S. Environmental Protection Agency.

Image credit: Bretwood Higman, 2009. Creative Commons CC BY 3.0. <https://creativecommons.org/licenses/by/3.0/deed.en>

## Lesson 5

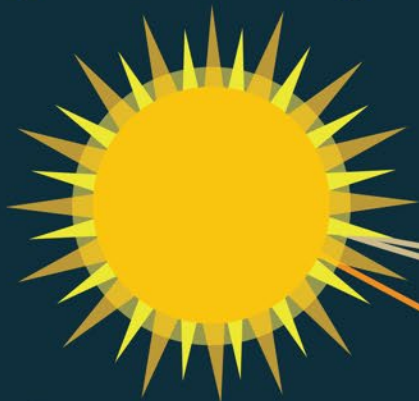
# Our Changing Climate



An aerial photograph of New York City, showing a dense urban landscape with numerous skyscrapers and buildings. The Hudson River is visible on the left side, and the city extends towards the horizon. A semi-transparent dark grey box is overlaid on the center of the image, containing text and a list of bullet points.

# Weather vs. Climate

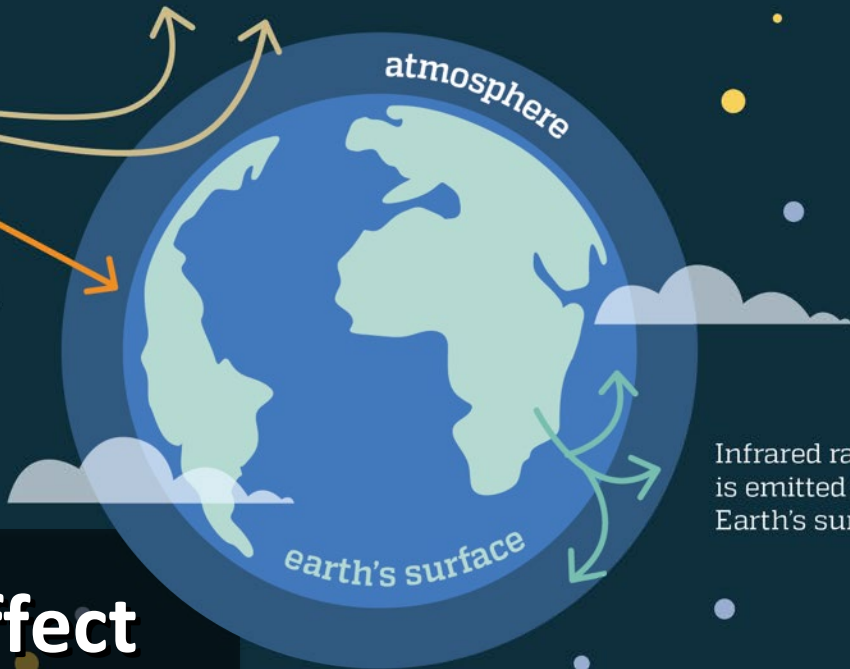
- The temperature in New York City averaged 82 degrees Fahrenheit on July 20, 2010.
- The temperature in New York City averaged 77 degrees Fahrenheit for the month of July between 1981 and 2010.



Some solar radiation is reflected by the Earth and the atmosphere.

Some of the infrared radiation passes through the atmosphere. Some is absorbed and re-emitted in all directions by greenhouse gas molecules. The effect of this is to warm the Earth's surface and the lower atmosphere.

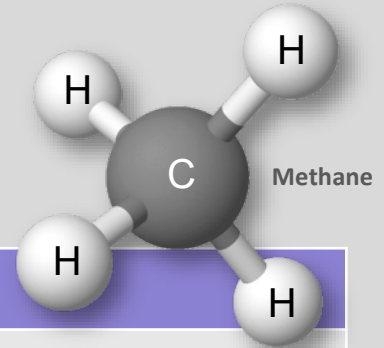
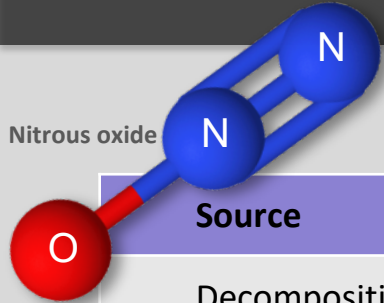
Most radiation is absorbed by the Earth's surface and warms it.



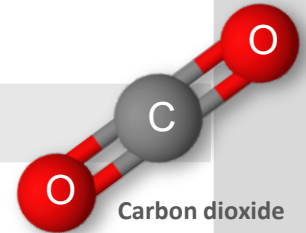
Infrared radiation is emitted by the Earth's surface.

# The Greenhouse Effect

# Sources of Greenhouse Gases



| Source                                    | Green House Gas or Gases               |
|---|--|
| Decomposition of food waste in landfills  | Methane, nitrous oxide                 |
| Use of nitrogen-based fertilizer on crops | Nitrous oxide                          |
| Transporting food products                | Carbon dioxide, nitrous oxide, methane |
| Bacterial decomposition in rice paddies   | Methane, nitrous oxide                 |
| Livestock manure                          | Methane, nitrous oxide                 |
| Clearing forests for farmland             | Carbon dioxide                         |
| Cattle belching                           | Methane, carbon dioxide, nitrous oxide |
| Running agricultural machinery            | Carbon dioxide, nitrous oxide, methane |



# Drought



Photo credit - Bob Nichols, 2013. Texas drought affecting corn crops. USDA. Creative Commons CC BY 2.0.

# Climate Change Impacts on Agriculture

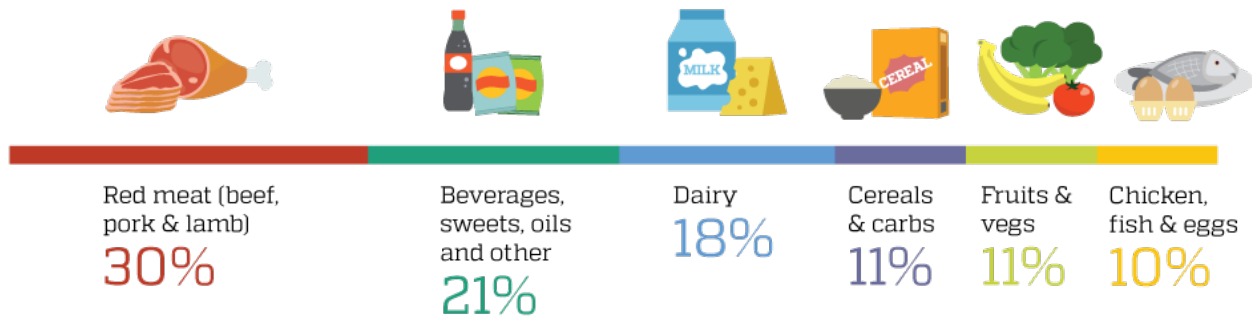
- Loss of topsoil
- Fungus invasion in corn crop
- Saltwater contamination of freshwater supply
- Increased cost to fight weeds
- Increase in a crop's water needs
- Higher food prices
- Depletion of freshwater sources for irrigation





# Food System Greenhouse Gas Emissions

## U.S. GHG emissions by food type

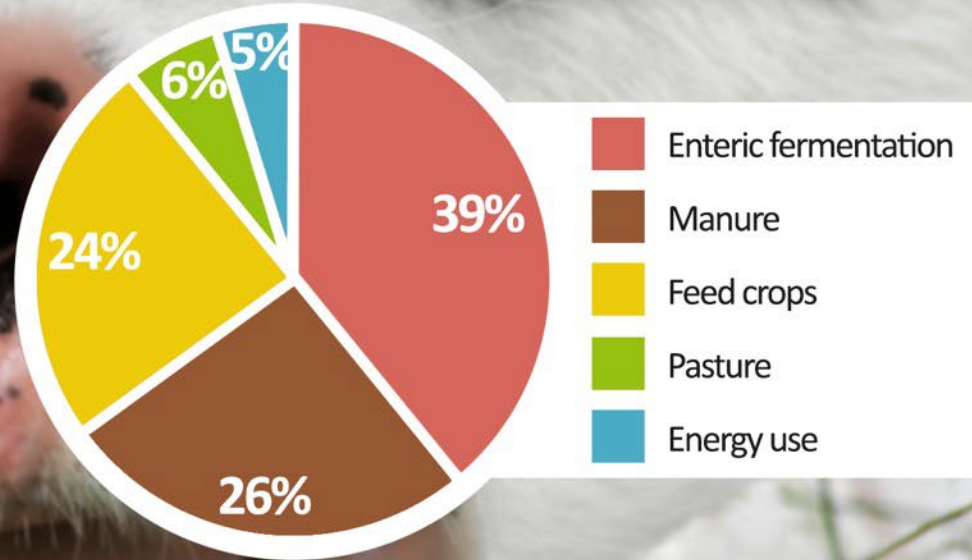


## U.S. GHG emissions by supply chain stage



# Livestock Greenhouse Gas Emissions

- Livestock are responsible for 15% of global GHG emissions from human activities – more than transportation
- 39% of livestock's GHG emissions are from enteric fermentation, a digestive process that produces methane
- Cattle release most of the methane through belching



# Lesson 6

# Turning Toward Sustainability





## Sustainable

- Ecologically sound
- Economically viable
- Socially just



## Efficiency

Agroecology recycles and reuses resources whenever possible, just as natural systems continually recycle rainfall and organic matter.

Composting (pictured) recycles organic matter, converting waste into fertilizer to help crops grow.



## Self-sufficiency

Agroecology requires minimal inputs beyond what Nature already provides (sunlight, soil, water, and biodiversity).

Dryland farming (pictured) relies exclusively on rainwater and soil moisture.

# Diversity

Agroecology makes use of many different species of plants and animals on the same farm, and benefits from their interactions.

Growing a variety of different crops (pictured) and rotating them over time helps control pests.





## Resilience

Agroecology can better withstand and recover from shocks like floods, hurricanes, and droughts.

Contour farming (pictured) can help reduce soil erosion during heavy storms.



# Duck-Rice-Fish Case Study



## Lesson 7

# Our Food's Journey



# U.S. Food System Greenhouse Gas Emissions

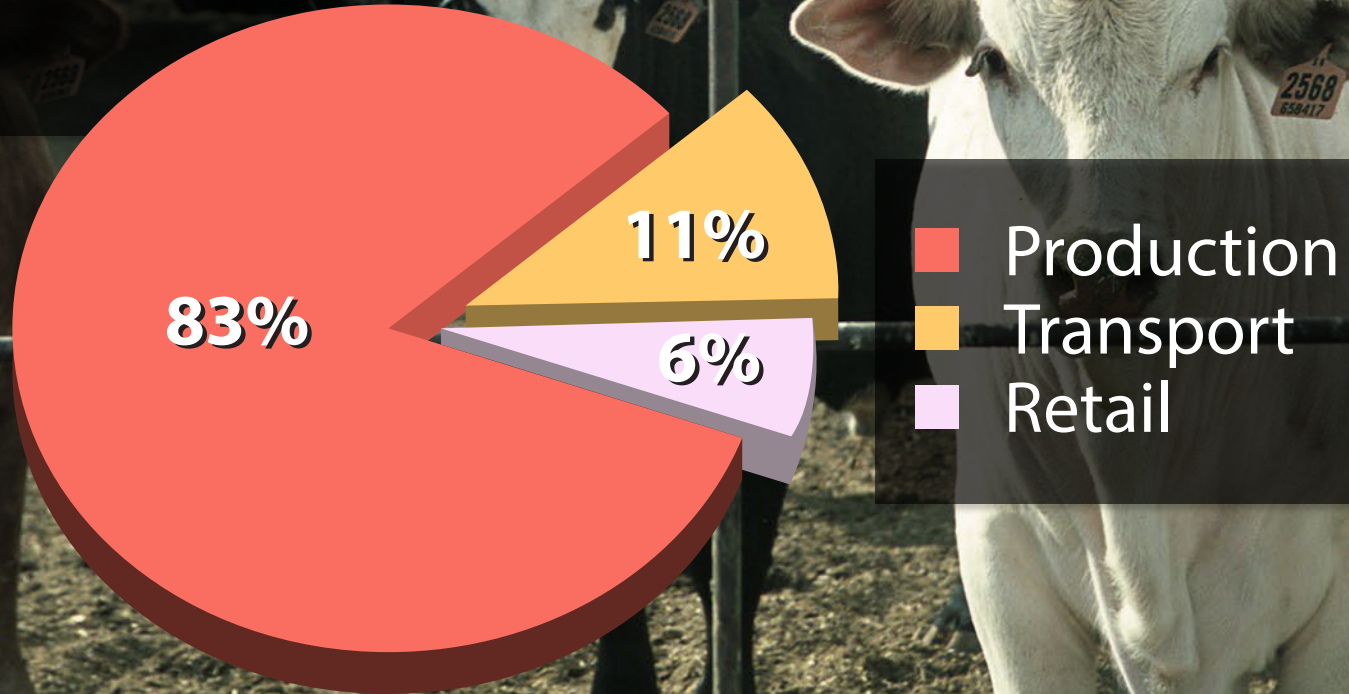
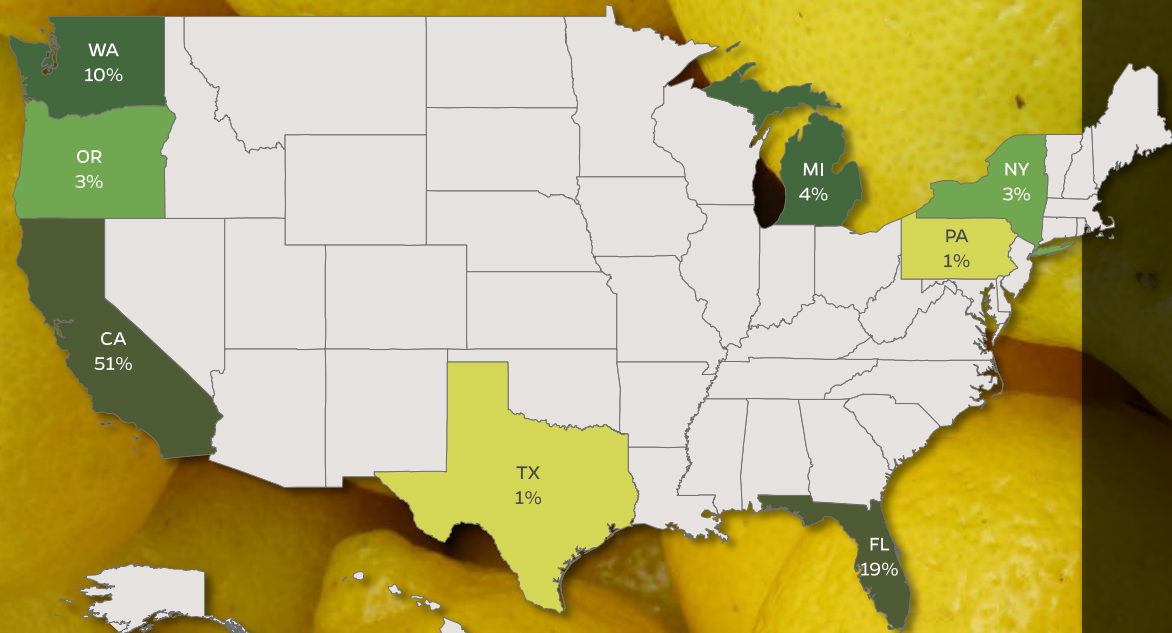


Photo credit: Jeff Vanuga, USDA Natural Resources Conservation Service.

Data source: Weber CL, Matthews HS. Food-miles and the relative climate impacts of food choices in the United States. *Environ Sci Technol.* 2008;42(10):3508-3513.



## Top U.S. States in Fruit Production

California harvests about  
half of U.S. fruit.

Florida harvests almost  
one-fifth of U.S. fruit.

Photo credit: Leo Horrigan, CLF.

Data source: USDA, Economic Research Service using data from USDA, National Agricultural Statistics Service, *Citrus Fruits 2010 Summary and Noncitrus Fruits and Nuts 2010 Preliminary Summary*.

## Lesson 8

# Keeping Our Food Safe





Grasses are the natural diet of cattle. Feeding them grain changes their gut environment in ways that increase populations of certain pathogens.

Poultry processing plants can operate at very high speeds – up to 140 birds per minute.

This allows just seconds to identify and remove contaminated carcasses before they enter the food supply.



Industries such as mining, coal burning, and manufacturing release chemicals into air, water, and soil.

These chemicals can make their way into our food supply.





Some potentially harmful chemicals, such as some caramel color in soft drinks, are present in food or beverages because manufacturers add them directly to products.

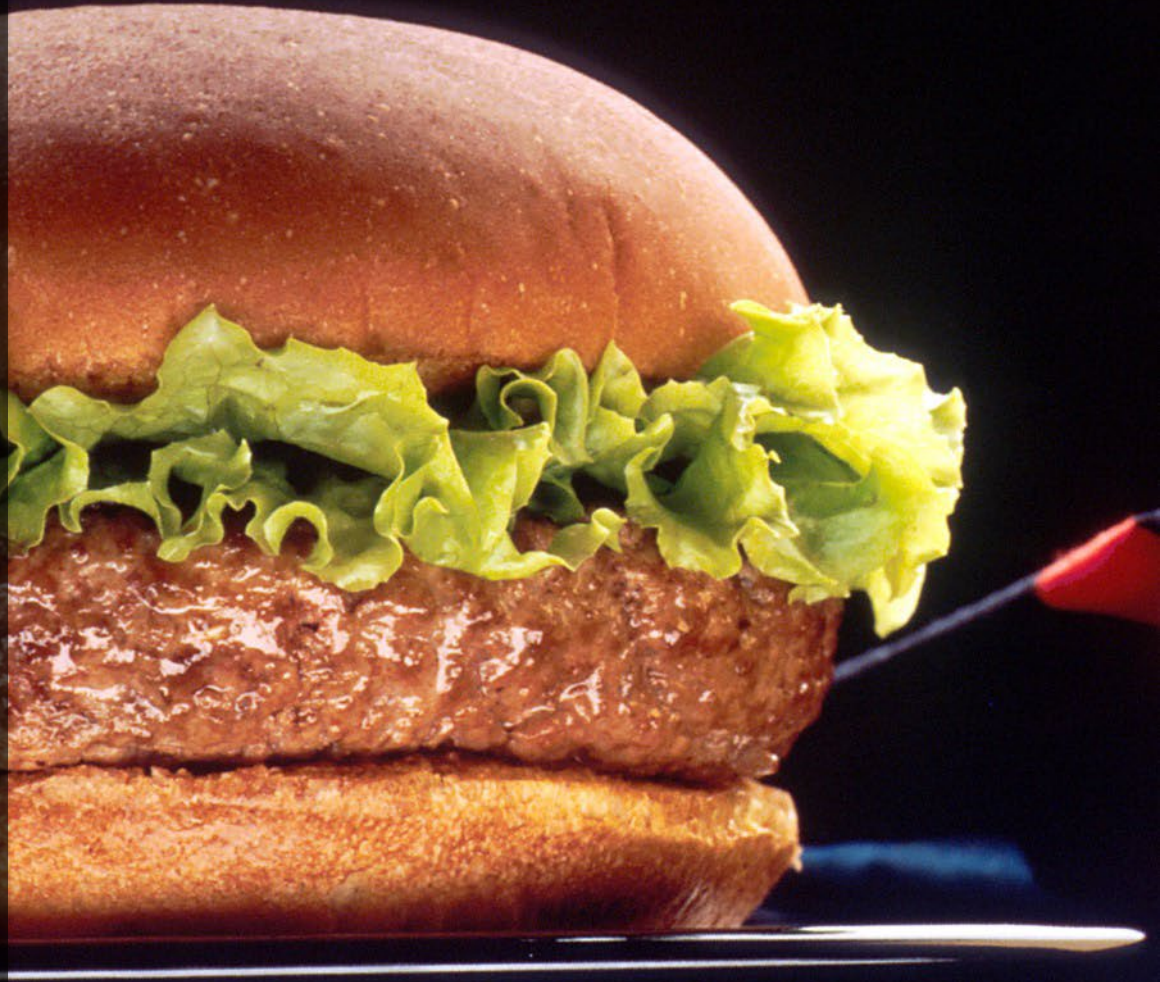




Some pesticides persist in the environment and can accumulate in animals, contaminating meat and seafood.

FLIT (DDT) advertisement: Dr. Seuss Collection, Special Collections & Archives, University of California, San Diego. Used with permission. <http://library.ucsd.edu/speccoll/dsads/index.html#ark:bb48133018>.

Hamburger: Len Rizzi. National Cancer Institute, 1990. Public domain.



## Lesson 10

# Decoding Food Labels



# Nutrition Facts

Federal law requires this label on most foods.

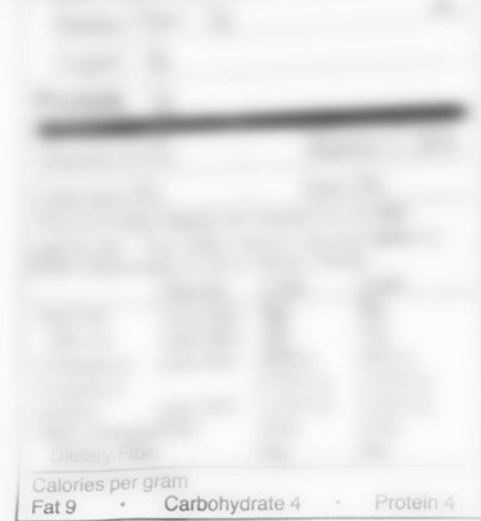
Includes information about:

- Serving size
- Calories
- Fats and cholesterol
- Sodium
- Carbohydrates
- Fiber
- Sugars
- Protein
- Vitamins and minerals

| <b>Nutrition Facts</b>  |                  |                       |                |
|---|------------------|-----------------------|----------------|
| Serving Size 1/6 Sheet (41g /1.5oz)   |                  |                       |                |
| Servings Per Container 12   |                  |                       |                |
| <b>Amount Per Serving</b>   |                  |                       |                |
| <b>Calories</b> 160    Calories from Fat 90   |                  |                       |                |
|   |                  | <b>% Daily Value*</b> |                |
| <b>Total Fat</b>  | 10g              |                       | <b>15%</b>     |
|   | Saturated Fat 5g |                       | <b>25%</b>     |
|   | Trans Fat 0g     |                       |                |
| <b>Cholesterol</b>  | 0mg              |                       | <b>0%</b>      |
| <b>Sodium</b>   | 140mg            |                       | <b>6%</b>      |
| <b>Total Carbohydrate</b>   | 16g              |                       | <b>5%</b>      |
|   | Dietary Fiber 1g |                       | <b>4%</b>      |
|   | Sugars 1g        |                       |                |
| <b>Protein</b>  | 3g               |                       |                |
| Vitamin A   | 0%               | •                     | Vitamin C 0%   |
| Calcium   | 0%               | •                     | Iron 6%        |
| * Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs: |                  |                       |                |
|   |                  | Calories:             | 2,000    2,500 |
| Total Fat   | Less than        | 65g                   | 80g            |
| Sat Fat   | Less than        | 20g                   | 25g            |
| Cholesterol   | Less than        | 300mg                 | 300mg          |
| Sodium  | Less than        | 2,400mg               | 2,400mg        |
| Total Carbohydrate  |                  | 300g                  | 375g           |
| Dietary Fiber   |                  | 25g                   | 30g            |

# Ingredients

Listed in descending order  
by weight.



## Ingredients

Select potatoes, expeller pressed high oleic sunflower oil, seasoning (lactose, dextrose, salt, sodium diacetate, garlic powder, onion powder, citric acid, malic acid, dill weed and spice extractive).

Contains milk.

No MSG

# USDA Organic

Requirements include:

- No synthetic fertilizers
- Most pesticides are prohibited
- No hormones or antibiotics in animals
- No genetically engineered organisms
- Animals must be able to express certain natural behaviors (e.g., grazing)



# Natural

Should contain no:

- Artificial colors
- Artificial flavors
- Synthetic ingredients

These FDA standards are not enforced.

USDA regulates the label on meat and poultry products.



# Third-party labels





## Lesson 11

# Marketing: Under the Influence

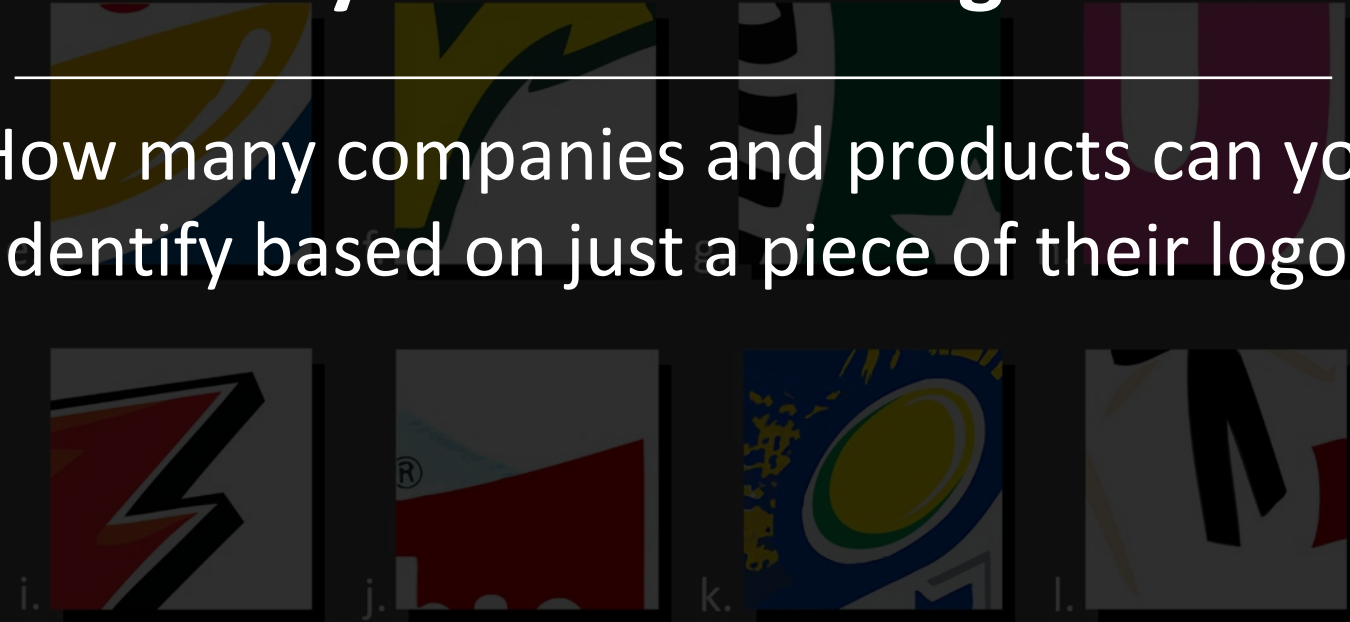




# Test your brand recognition

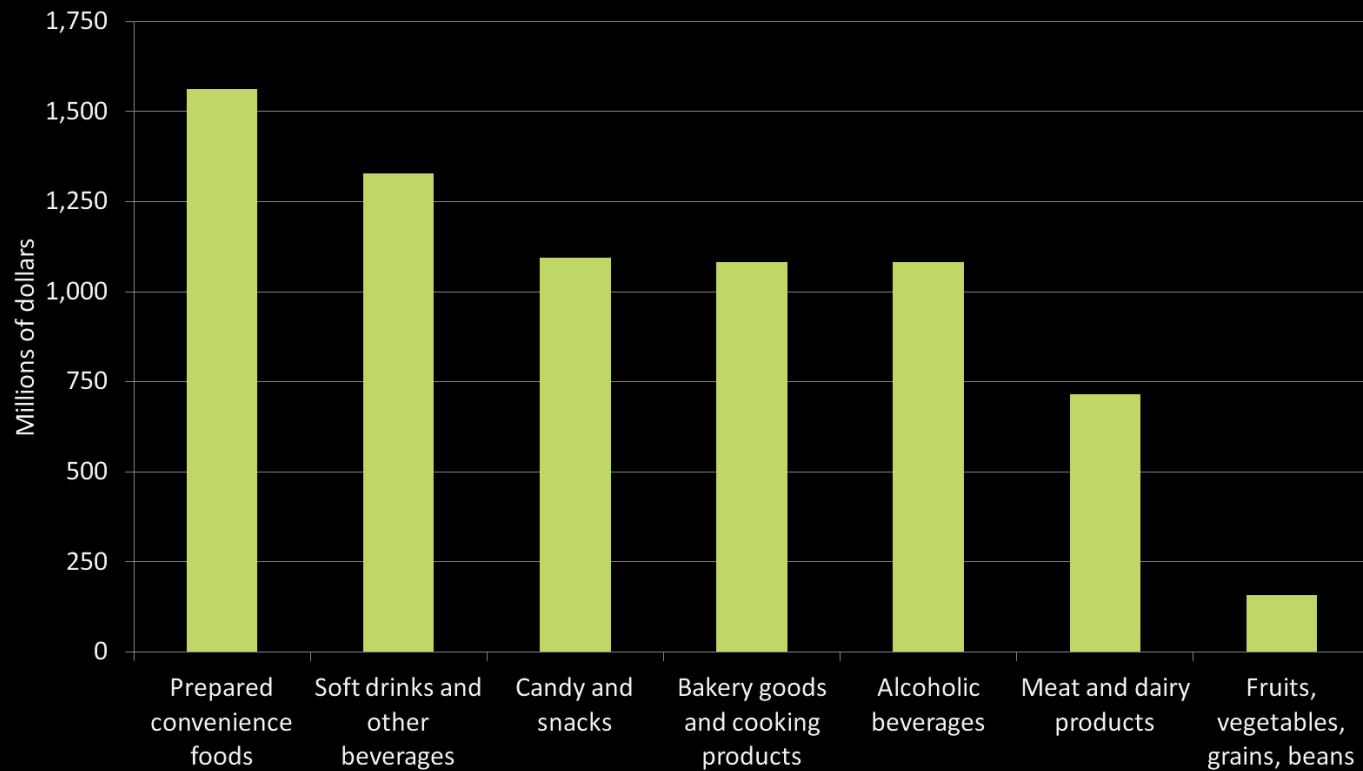
---

How many companies and products can you identify based on just a piece of their logo?





# Food Advertising Spending



Annual spending by U.S. food and beverage manufacturers on advertising in 1997 (the last year industry-wide data were openly available)

Source: Gallo A. Food Advertising in the United States. In: *America's Eating Habits: Changes and Consequences*. USDA Economic Research Service; 1999:173-180.

## Lesson 12

# Why We Eat What We Eat



# HEALTHY EATING PLATE

Use healthy oils (like olive and canola oil) for cooking, on salad, and at the table. Limit butter. Avoid trans fat.



The more veggies – and the greater the variety – the better. Potatoes and French fries don't count.

Eat plenty of fruits of all colors.



**STAY ACTIVE!**

© Harvard University



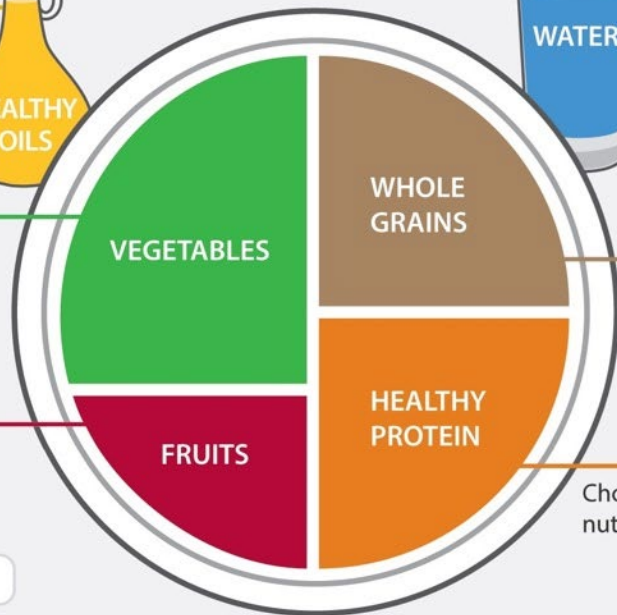
Harvard School of Public Health  
The Nutrition Source  
[www.hsph.harvard.edu/nutritionsource](http://www.hsph.harvard.edu/nutritionsource)



Drink water, tea, or coffee (with little or no sugar). Limit milk/dairy (1-2 servings/day) and juice (1 small glass/day). Avoid sugary drinks.

Eat a variety of whole grains (like whole-wheat bread, whole-grain pasta, and brown rice). Limit refined grains (like white rice and white bread).

Choose fish, poultry, beans, and nuts; limit red meat and cheese; avoid bacon, cold cuts, and other processed meats.

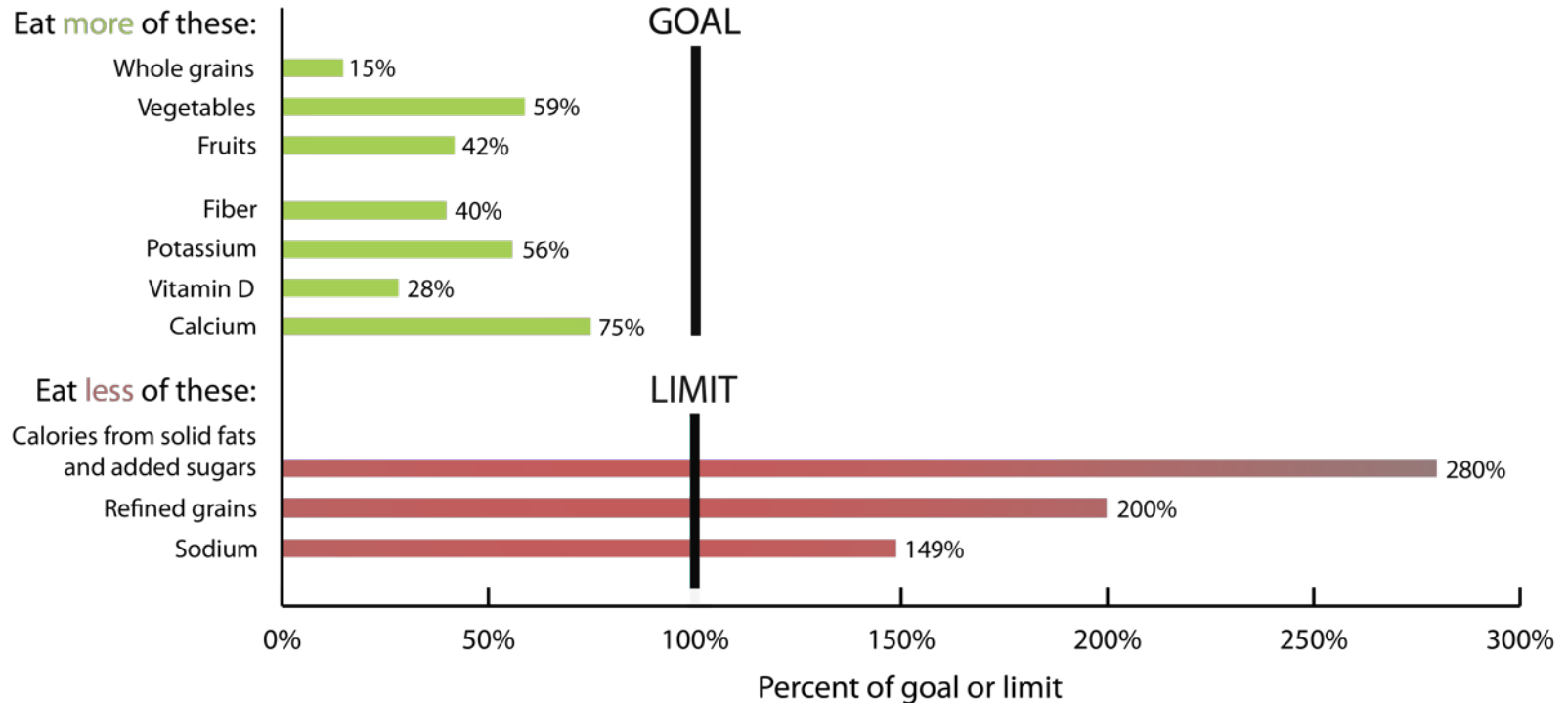


Harvard Medical School  
Harvard Health Publications  
[www.health.harvard.edu](http://www.health.harvard.edu)



Copyright © 2011, Harvard University. For more information about The Healthy Eating Plate, please see The Nutrition Source, Department of Nutrition, Harvard School of Public Health, [www.thenutritionsource.org](http://www.thenutritionsource.org), and Harvard Health Publications, [www.health.harvard.edu](http://www.health.harvard.edu).

# How do typical American diets compare to U.S. dietary guidelines?



## Lesson 13

# Our Wasted food

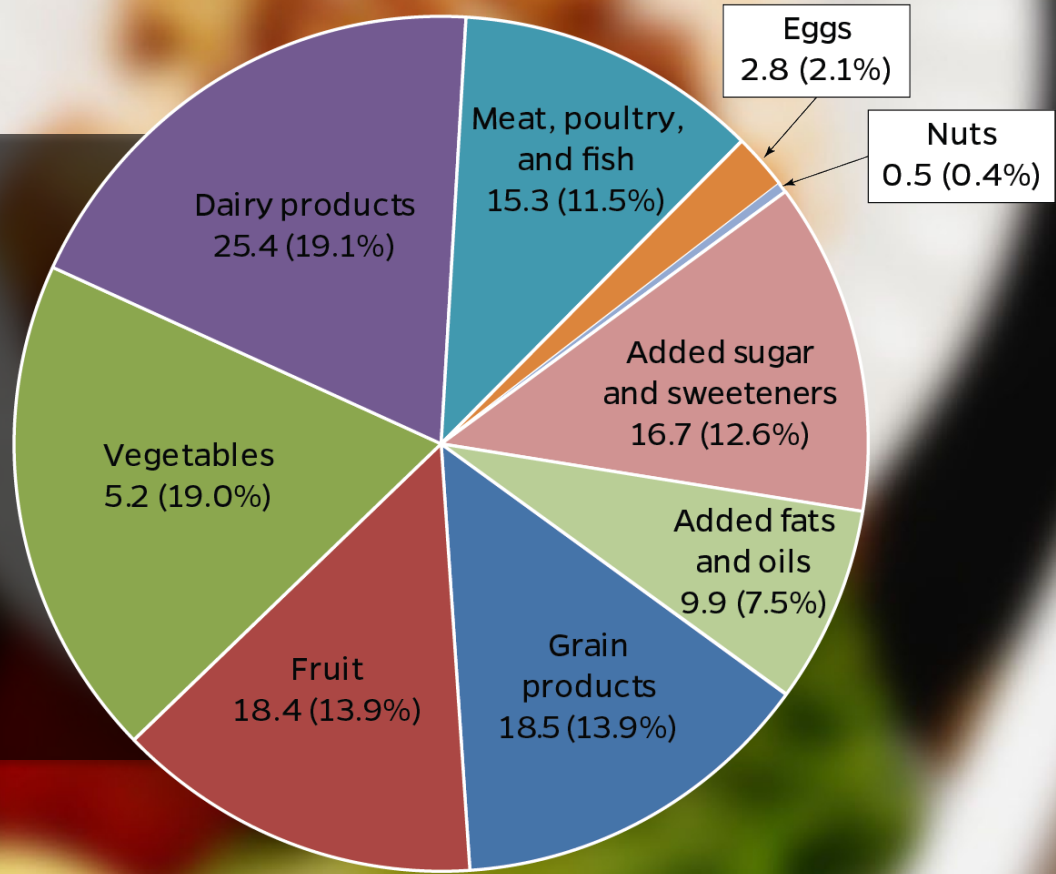




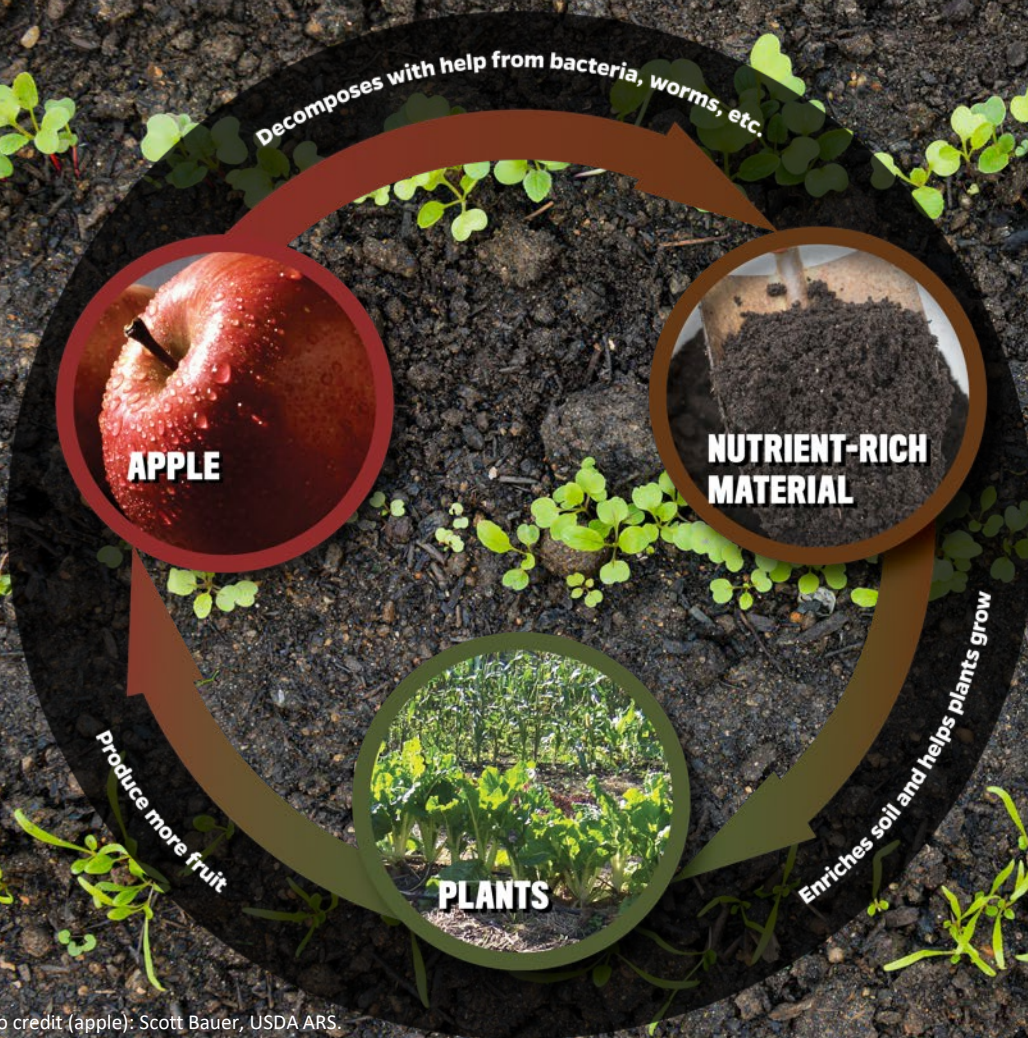
# Waste by Food Group

U.S. food waste, in billions of pounds, 2010

Data source: Buzby JC, Wells HF, Hyman J. *The Estimated Amount, Value, and Calories of Postharvest Food Losses at the Retail and Consumer Levels in the United States*. USDA ERS; 2014.



# Nutrient Cycle



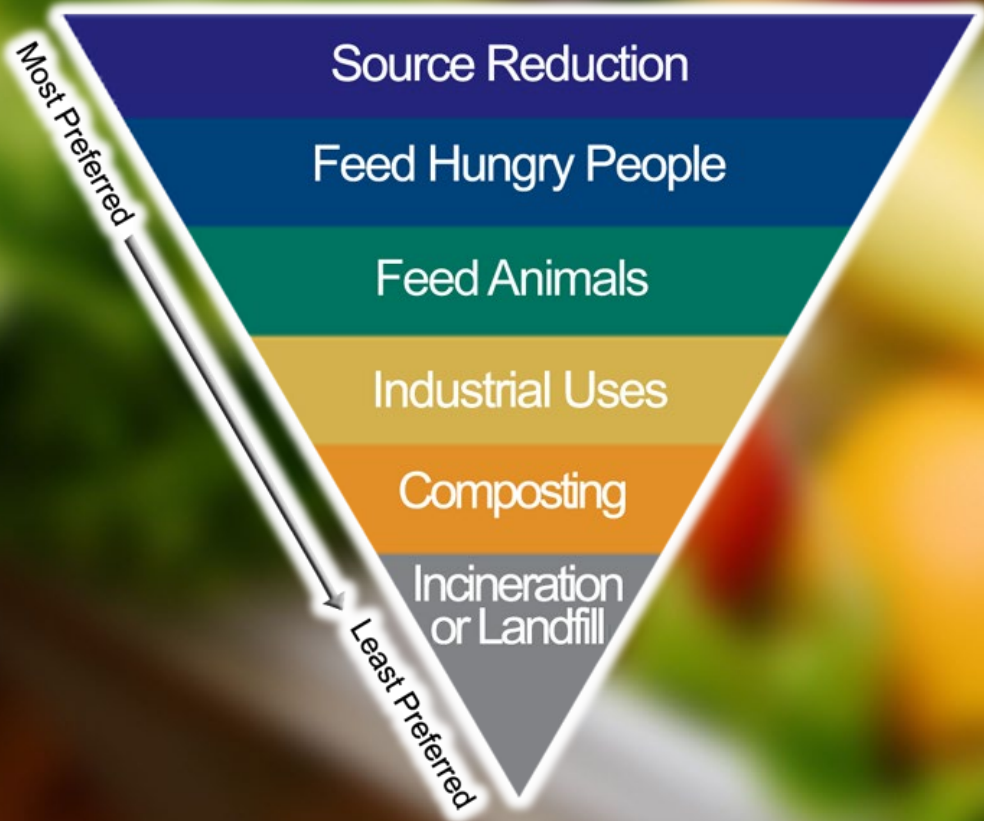
# Landfills

Food represents the single largest component (21%) of solid waste in landfills and incinerators.

Source: U.S. Environmental Protection Agency.  
Reducing Food Waste for Business. 2014.

Photo credit : Andrea Westmoreland, 2008. Wikimedia Commons. Creative Commons CC BY-SA 2.0 . <http://creativecommons.org/licenses/by-sa/2.0/deed.en>



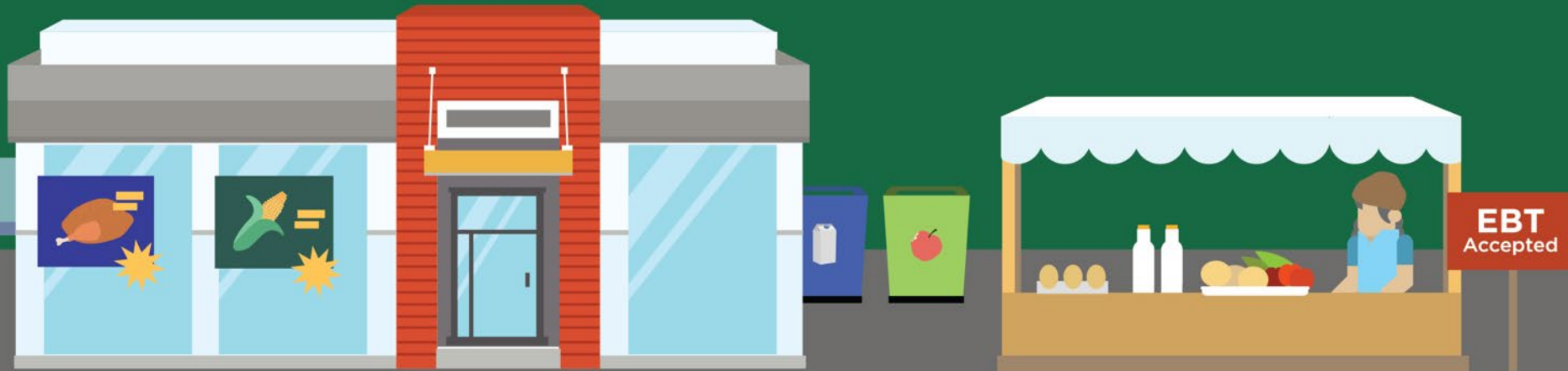


# EPA Food Recovery Hierarchy

United States Environmental Protection Agency.  
<https://www.epa.gov/sustainable-management-food/food-recovery-hierarchy>

## Lesson 14

# The Hunger Gap



# Food Security Definition

Consistent access to enough safe, nutritious food for an active, healthy life, without resorting to emergency food programs, scavenging, or stealing.



Source: Andrews M, Nord M, Bickel G, Carlson S. *Household food security in the United States, 1999*. USDA ERS. 2000.

Photo credit: Michael Milli, CLF.

# Household Food Security

Members of food-insecure households may:

- Be forced to skip meals
- Be unable to afford balanced meals
- Worry their food will run out before they can afford to buy more
- Eat less than they feel they should because they lacked money to buy more
- Lose weight because there wasn't enough money for food

Source: Coleman-Jensen A, Nord M, Andrews M, Carlson S. *Household Food Security in the United States in 2010*. USDA ERS. 2011.

Photo credit: Michael Milli, CLF.



# Household Food Security

Almost one in seven U.S. households — over 17 million — suffer from food insecurity.



Source: Coleman-Jensen A, Gregory C, Singh A. *Household Food Security in the United States in 2013*. USDA ERS. 2014.

Photo credit: Michael Milli, CLF.





# Food Deserts

Areas with limited access to healthy food, often defined using these four criteria:

- Household income
- Distance from a supermarket
- Vehicle ownership
- Availability of healthy food in local stores

Source: Johns Hopkins Center for a Livable Future. The Maryland Food System Mapping Resource. 2012: Documentation.  
[http://www.jhsph.edu/clf/programs/food\\_mapping/documentation/](http://www.jhsph.edu/clf/programs/food_mapping/documentation/)

Photo credit: Spence Lean. Pigtown: All Things Baltimore, 2009.  
[www.sustainablecitiescollective.com](http://www.sustainablecitiescollective.com). Used with permission.

# Community Food Availability Map: Clifton Park

- Median household income: \$25,737
- Percent of households with no vehicles available: 44.2%

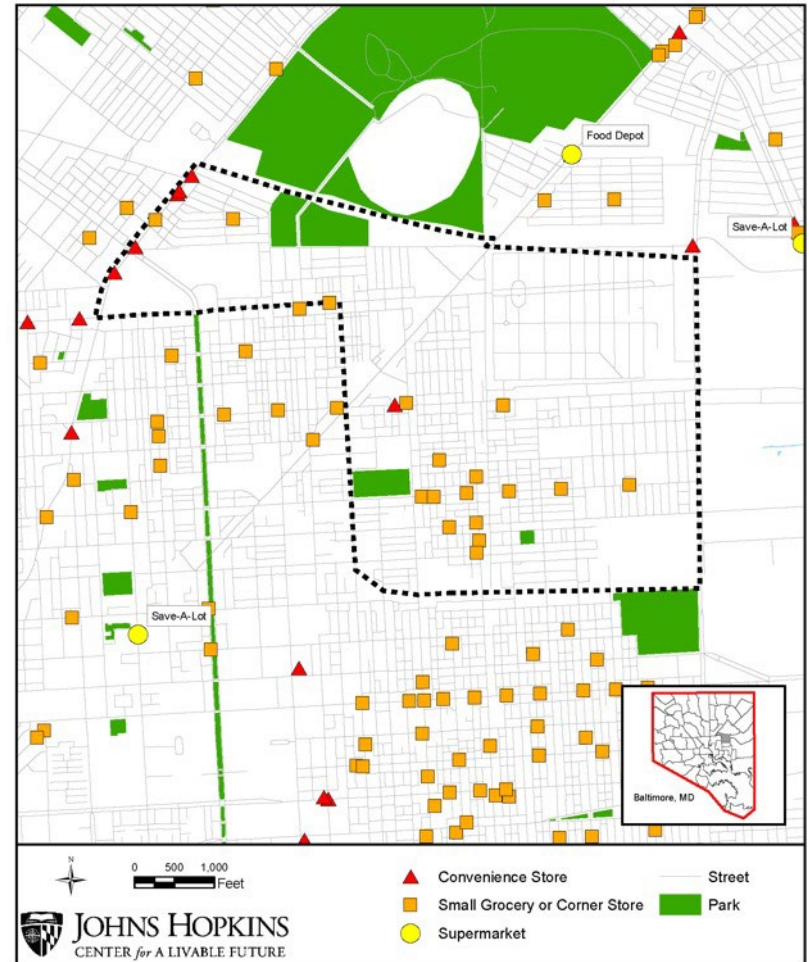


Image credit: Maryland Food System Map. Johns Hopkins Center for a Livable Future.  
<http://mdfoodsystemmap.org/>

Data source: Baltimore Neighborhood Indicators Alliance. Jacob France Institute.  
<http://bniajfi.org/>

# Community Food Availability Map: Southwest Baltimore

- Median household income: \$24,946
- Percent of households with no vehicles available: 52.8%

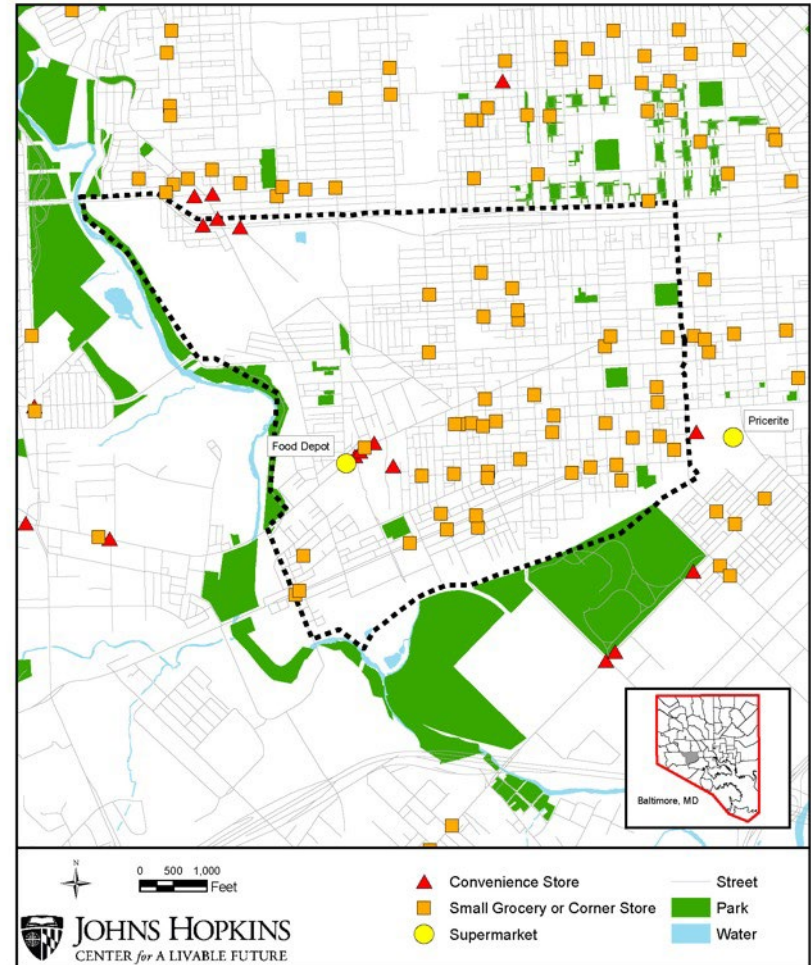


Image credit: Maryland Food System Map. Johns Hopkins Center for a Livable Future.  
<http://mdfoodsystemmap.org/>

Data source: Baltimore Neighborhood Indicators Alliance. Jacob France Institute.  
<http://bniajfi.org/>

# Community Food Availability Map: Roland Park

- Median household income: \$104,481
- Percent of households with no vehicles available: 4.4%

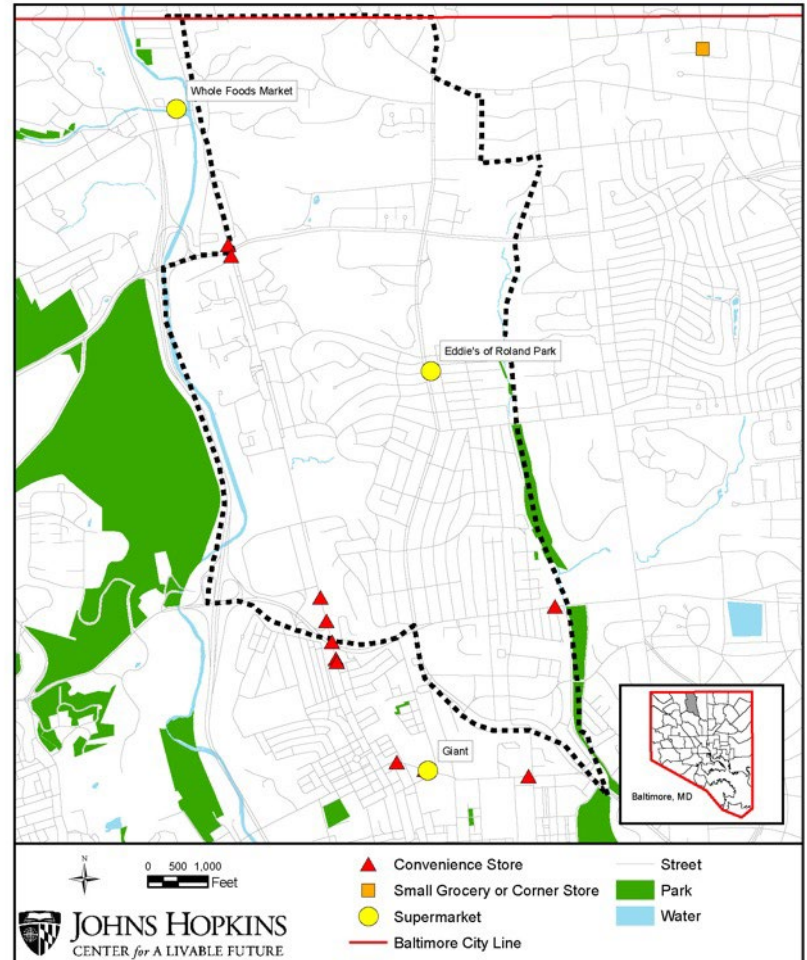
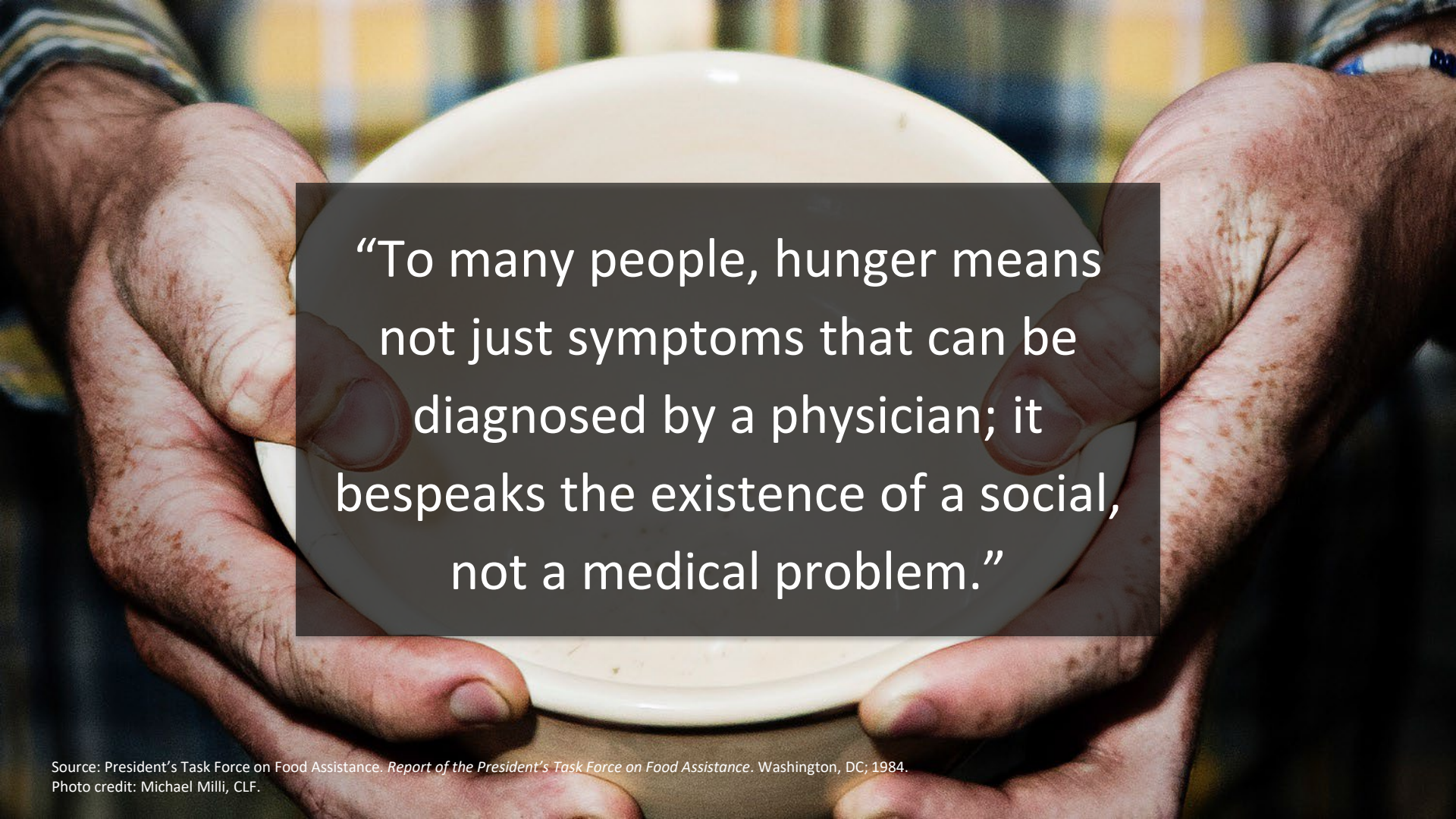


Image credit: Maryland Food System Map. Johns Hopkins Center for a Livable Future.  
<http://mdfoodsystemmap.org/>

Data source: Baltimore Neighborhood Indicators Alliance. Jacob France Institute.  
<http://bniajfi.org/>



“To many people, hunger means not just symptoms that can be diagnosed by a physician; it bespeaks the existence of a social, not a medical problem.”


Source: President's Task Force on Food Assistance. *Report of the President's Task Force on Food Assistance*. Washington, DC; 1984.

Photo credit: Michael Milli, CLF.

## Lesson 15

# Food Policy in Action





## What does a food policy council do?

Looks for opportunities to improve the food system, particularly where food security is concerned

Provides policy recommendations to local, state, and federal governments

Reggie, an urban farmer, testifies before a Minneapolis City Council Committee to advocate for changing the urban agriculture policy.

# Who is part of a food policy council?

- School food service director
- Public health advocate
- Hospital administrator
- Anti-hunger advocate
- City planner
- Supermarket manager
- Restaurant owner
- Community member
- Farmer
- Labor representative
- Environmental non-profit representative

