Complete FoodSpan curriculum, resources, student handouts, teacher guides, and presentation slides can be found at 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

Photo credit: Kathrin & Stefan Marks. Redwood Forest Morning. Flickr. Creative Commons CC BY-NC-ND 2.0.
Washington Apple Supply Chain

Growing
Apples grow on trees in orchards

Harvesting
Apples are picked by hand

Washing, grading, waxing
A wax coating helps keep apples crisp

Packing
Apples are sorted and packed into 40-pound cartons

Retailing
Apples are sold in a variety of stores

Packaging
Packaging depends on how the apples are processed, if at all

Processing
Some apples may be canned or made into applesauce, pie filling, etc.

Distributing
Apples are transported up to thousands of miles in refrigerated trucks

Preparing
Apples can be eaten whole, added to salads, cooked in pies, etc.

Consuming
Apples are eaten

Disposing
Throughout the life cycle, some apples and parts of apples are discarded

Composting
Discarded apples can be composted and used to help more apples grow

Adapted, with permission, from Discovering the Food System. 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.

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
Agriculture Timeline
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.
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.
Most species of farm animals domesticated

6,000 BCE

Photo credit: Maler der Grabkammer des Menna. Wikimedia Commons. Public domain.
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 20th century. Pesticides and monocultures are also hallmarks of industrial agriculture.
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

Average per capita availability of animal products, 2009

Chickens raised for meat

Photo credit: Farm Sanctuary. www.farmsanctuary.org.
Hogs

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

Photo credit: Farm Sanctuary. www.farmsanctuary.org.
Animal Product Prices, 1950-2000

*Per pound, **Per half gallon, ***Per dozen. Data source: USDA Economic Research Service.
Ecological production - Chickens

Photo credit: Michael Milli, CLF.
Ecological production - Hogs

Photo credit: Michael Milli, CLF.
Lesson 3

Seafood: Wild and Farmed
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.
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.


Seafood Production - Shrimp Farms

Shrimp farms in Vietnam.

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


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
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.
The Greenhouse Effect

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

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

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.

Infrared radiation is emitted by the Earth's surface.

## Sources of Greenhouse Gases

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

- **Red meat (beef, pork & lamb)**: 30%
- **Beverages, sweets, oils and other**: 21%
- **Dairy**: 18%
- **Cereals & carbs**: 11%
- **Fruits & veggies**: 11%
- **Chicken, fish & eggs**: 10%

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

- **Production**: 83%
- **Transport**: 11%
- **Retail**: 6%

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
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.

Photo credit: Anna Frodesiak, A small vegetable farm in rural Hainan Province, China. Public domain.
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.

Photo credit: Tim McCabe. Contour farming. USDA Natural Resources Conservation Service.
Duck-Rice-Fish Case Study

Photo credit: Greenpeace East Asia, 2011.
Lesson 7
Our Food’s Journey
U.S. Food System Greenhouse Gas Emissions

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

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.
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.

Photo credit: Michael Milli, CLF.
Some pesticides persist in the environment and can accumulate in animals, contaminating meat and seafood.
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

Photo credit: CarrotNewYork.
Ingredients

Listed in descending order by weight.

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

Photo credit: Michael Milli, CLF.
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

Photo credit: James Duncan.
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)

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.

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.

STAY ACTIVE!

Harvard School of Public Health
The Nutrition Source
www.hsph.harvard.edu/nutritionsource

Harvard Medical School
Harvard Health Publications
www.health.harvard.edu
How do typical American diets compare to U.S. dietary guidelines?

**Eat more of these:**
- Whole grains: 15% (Goal: 59%)
- Vegetables: 42% (Goal: 59%)
- Fruits: 40% (Goal: 59%)
- Fiber: 28% (Goal: 75%)
- Potassium: 56% (Goal: 75%)
- Vitamin D: 75% (Goal: 75%)
- Calcium: 75% (Goal: 75%)

**Eat less of these:**
- Calories from solid fats and added sugars: 280% (Limit: 200%)
- Refined grains: 149% (Limit: 200%)
- Sodium: 149% (Limit: 200%)

Lesson 13

Our Wasted food
Waste by Food Group

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

Nutrient Cycle

APPLE
Decomposes with help from bacteria, worms, etc.
NUTRIENT-RICH MATERIAL
PLANTS
Produce more fruit
Enriches soil and helps plants grow

Photo credit [apple]: Scott Bauer, USDA ARS
Landfills

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


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

Photo credit: Michael Milli, CLF.
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.


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


Photo credit: Michael Milli, CLF.
Household Food Security

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


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

http://www.jhsphs.edu/clf/programs/food_mapping/documentation/

Community Food Availability Map: Clifton Park

- Median household income: $25,737
- Percent of households with no vehicles available: 44.2%
Community Food Availability Map: Southwest Baltimore

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


Community Food Availability Map: Roland Park

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

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.

Photo credit: Michelle Horovitz, CLF Food Policy Network Photo contest, 1st place winner “food policy process” category.
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

Photo credit: DeVon Nolen, CLF Food Policy Network Photo contest, 2nd place winner “food policy in action” category.