

Healthy Food, Healthy Iowans, Healthy Communities

Public Health Tools to Advance Healthy, Sustainable Food Systems



Part 1. Community Food Systems: A Primer for Local Public Health Agencies

Iowa Department of Public Health

June 2014

Healthy Food, Healthy Iowans, Healthy Communities

Part 1. Community Food Systems: A Primer for Local Public Health Agencies

June 2014

For more information, contact:
Iowa Department of Public Health
Division of Health Promotion & Chronic Disease Prevention
Lucas State Office Building
321 East 12th Street
Des Moines, Iowa 50319
515.281.7689
www.idph.state.ia.us

Acknowledgements

This publication was supported by the Iowa Department of Public Health through a Community Transformation Grant (CTG) from the Centers for Disease Control and Prevention (CDC). It was a signature program of the Prevention and Public Health Fund, made possible by the Affordable Care Act. The contents are solely the responsibility of the author and do not necessarily represent the official views of the Iowa Department of Public Health or CDC. Links to external resources are provided as a public service and do not imply endorsement by the Iowa Department of Public Health.

Prepared by: Angie Tagtow, MS, RD, LD, Food Systems Consultant, Iowa Department of Public Health

Additional support and input provided by: Christine Sexton, Iowa State University Dietetic Intern, IDPH staff, CTG Advisory Committee, CTG Leadership Team and the Iowa CTG grantees.



Table of Contents

Introduction to Community Food Systems	4
Food System Challenges & Public Health Impacts.....	8
Opportunities to Advance a Healthy and Sustainable Food System	22
Appendix A. Principles of a Healthy, Sustainable Food System	30

Introduction to Community Food Systems

Everyone eats! Food is a basic human need yet several of the leading causes of death in Iowa are the result of diet-related chronic diseases. This includes heart disease, stroke, cancer and diabetes, which are the most costly, yet most preventable, of all health problems.¹ Strengthening Iowans' knowledge and behavior on healthy eating and active living is but one approach to alleviating the impact of diet-related chronic diseases. Effectively preventing diet-related chronic diseases requires a multifaceted range of strategies including policy, system and environmental changes, in this case, using a food systems lens.

The National Prevention Strategy² focuses on healthy eating as a priority. Healthy food consumption is a key strategy in reducing/eliminating risk of diet-related chronic diseases. The healthy eating recommendations outlined in the National Prevention Strategy include:

- Increase access to healthy and affordable food in communities,
- Implement organizational and programmatic nutrition standards and policies,
- Improve nutrition quality of the food supply,
- Help people recognize and make healthy food and beverage choices,
- Support policies and programs that promote breastfeeding, and
- Enhance food safety

However, healthful foods are derived from production and transformation processes that produce healthful foods. The charge for public health practitioners is to broaden the scope of healthy eating indicators beyond access and consumption to healthy food systems.

The purposes of the *Healthy Food, Healthy Iowans, Healthy Communities Series* are to demonstrate the interconnectedness of the food system to public health issues (Part 1) and to provide tools to local public health agencies for assessing, planning, implementing and evaluating food system initiatives (Part 2).



Figure 1. Food System Sectors

What is a Food System?

A **food system** includes all processes and infrastructure involved in feeding a population: growing, harvesting, processing, packaging, transporting, marketing, consumption, and disposal of food and food-related items. Within each food system sector, there is a myriad of activities and stakeholders (Figure 1).³

A **foodshed** is a geographic region in which there is a flow of food from where it is grown to a place where it is consumed. This also includes the land on which it is grown, the routes it travels, the markets it passes through and ultimately the tables on which it is served. A foodshed is similar to a watershed in that foodsheds outline the flow of food feeding a particular population, whereas watersheds outline the flow of water draining to a particular location.

A **community food system** is a food system in which food production, transformation, distribution, consumption and waste management are interconnected to enhance the human, environmental, social and economic health of a particular geographic area. A community food system can refer to a neighborhood, town, city, county, region, or bioregion. Community food systems may be used interchangeably with "local" or "regional" food systems. However, "community" places an emphasis on strengthening existing (or developing new) relationships between all components and stakeholders of the food system.^{4,5} Approaching food systems from a community lens offers a framework to advance **sustainability** - the capacity of being maintained over the long term while meeting the needs of the present without jeopardizing the ability to meet the needs of future generations.⁶

A food system also includes the inputs needed and outputs generated at each of these steps. A food system operates within and is influenced by social, political, economic and environmental contexts. It also requires human resources that provide labor, research and education (Figure 2).⁷

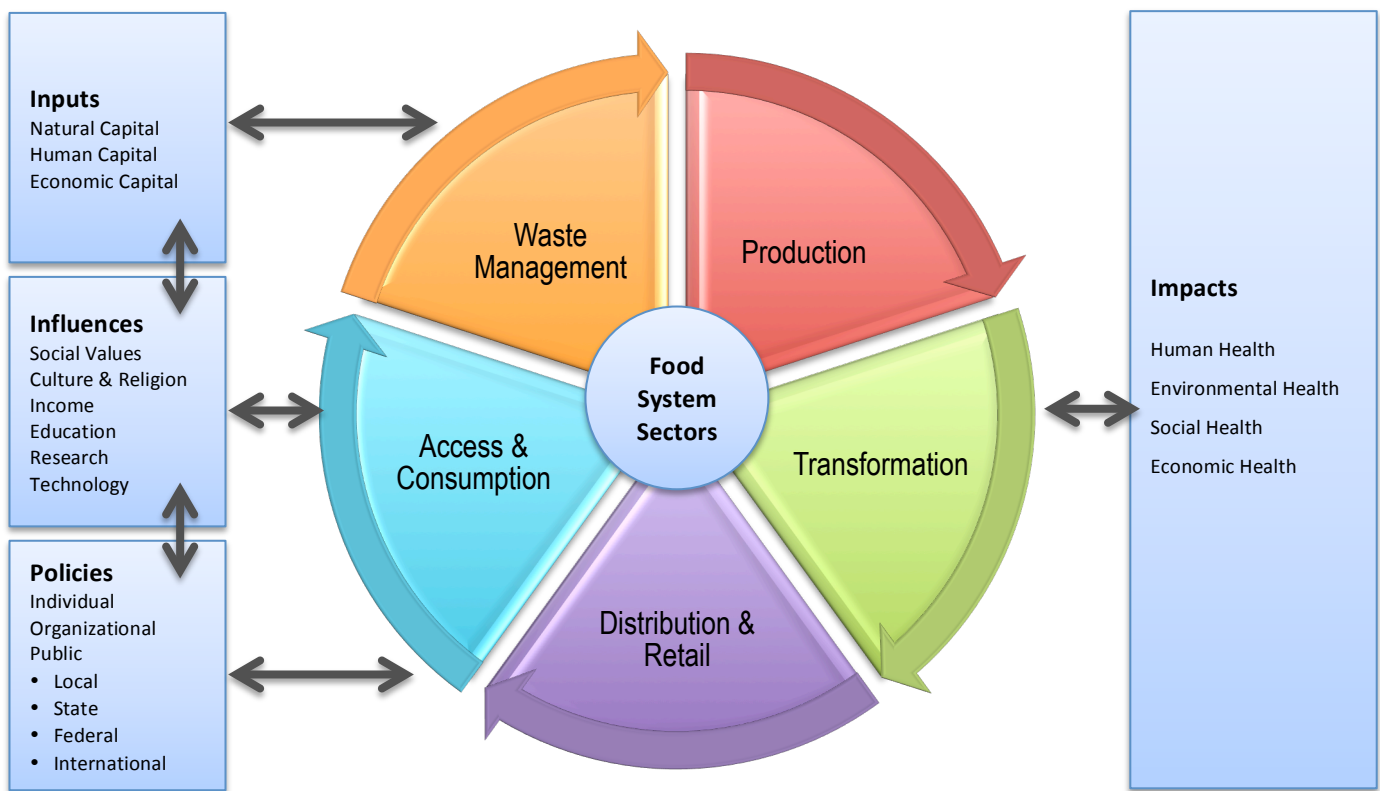


Figure 2. Interconnections of a Food System⁸

How Does the Food System Impact Public Health?

In Iowa, the challenges are numerous. Obesity and diet-related chronic disease rates continue to rise, while the health of Iowans is further exposed to antibiotic resistance; harmful chemicals and pathogens in food, air, soil and water; degradation of natural resources such as soil, water, energy and biodiversity; and erratic weather patterns. Contemporary food systems have evolved to increase efficiencies, lower production costs, maximize yields, increase profits, and reduce food costs. The challenge to public health practitioners is determining how the food system impacts human, social, environmental and economic health.

In the report, *Cultivating Resilience: A Food System Blueprint that Advances the Health of Iowans, Farms and Communities*, the trends of 14 indicators were analyzed and it was determined the resilience and health of Iowa's food system from an overall, composite rating of the sum of all indicators is 'Poor.'⁹ Although most Iowa food consumption occurs within this system, healthier and more sustainable alternatives are available.¹⁰

What is a Healthy, Sustainable Food System?

A healthy, sustainable food system ensures all Iowans have equal and adequate access to nutritious food and clean water, now and in the future. The four domains of a healthy sustainable food system (Figure 3) include:

- **Human Health & Wellbeing:** Fulfills the food and nutrition needs of all Iowans through regular access to a safe, nutritious and diverse food supply and clean water that supports self-reliance and a healthy lifestyle.
- **Environmental Health:** Conserves, renews and protects Iowa's farmland and natural resources (soil, water, air, energy, biodiversity) and supports thriving ecosystems.
- **Social & Cultural Health:** Empowers social responsibility, community engagement and ensures Iowa's food and farming systems are fair, just and culturally appropriate.
- **Economic Health:** Builds community wealth, economic viability, resilient agricultural diversity and regionalized infrastructure for food and farming systems in Iowa.

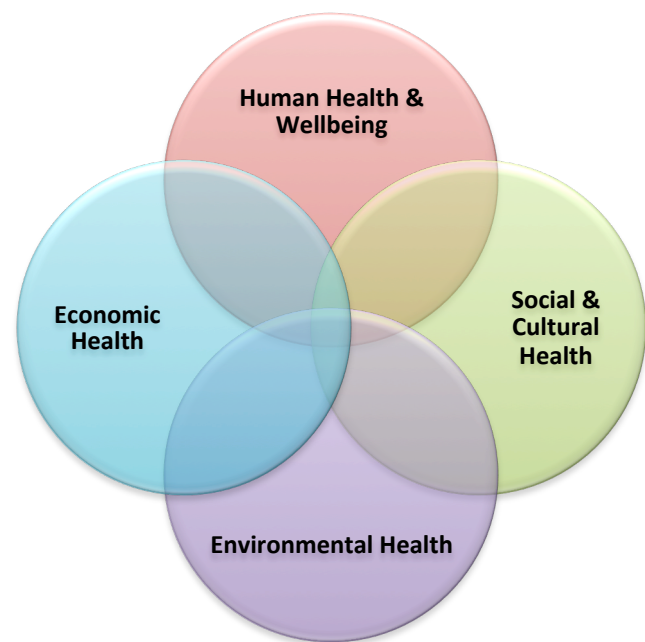


Figure 3. Domains of a Healthy, Sustainable Food

The American Public Health Association defines a **sustainable food system** as “one that provides healthy food to meet current food needs while maintaining healthy ecosystems that can also provide food for generations to come with minimal negative impact to the environment. A sustainable food system also encourages local production and distribution infrastructures and makes nutritious food available, accessible, and affordable to all. Further, it is humane and just, protecting farmers and other workers, consumers, and communities.”¹¹

The American Public Health Association, American Nursing Association, Academy of Nutrition and Dietetics and the American Planning Association developed principles for a healthy, sustainable food system. This unique collaborative established a framework to support socially, economically and ecologically sustainable food systems that promote health – the current and future health of individuals, communities and the natural environment.¹² The Principles of a Healthy, Sustainable Food System are located in Appendix A.

How Can Local Public Health Agencies Advance a Healthy, Sustainable Food System?

Local public health practitioners are well prepared to lead community food system initiatives by serving in the following functions:

- **Convening.** Provide leadership in assembling food system stakeholders from the community in food system discussions. Become a guiding force in the establishment of healthy and sustainable community food systems. Establish a food policy council in the community.
- **Assessment.** Integrate food system elements into the Community Health Needs Assessment and Health Improvement Planning process. The findings may lead to encouraging municipalities to include food system and sustainability goals in their comprehensive plan (e.g., agricultural land preservation and smart growth strategies).
- **Educating and Assisting.** Host networking and educational opportunities where stakeholders have access to one another as well as local, state or national experts on healthy, sustainable food systems. Inform partners of funding opportunities that support food system initiatives. Provide technical assistance or letters of support to stakeholders applying for loans or grants.

How Does Assessing Community Food Systems Support Core Functions and Essential Public Health Services?

Science proves that the health of the food system directly impacts the health of populations. Community food system assessment and planning aligns with the core public health functions (assessment, policy development and assurance) and the essential public health services. Specifically:

- Monitor health status to identify and solve community health problems,
- Diagnose and investigate health problems and health hazards in the community,
- Inform, educate and empower people about health issues,
- Mobilize community partnerships and action to identify and solve problems,
- Develop policies and plans that support individual and community health efforts,
- Enforce laws and regulations that protect health and ensure safety,
- Assure a competent public and personal health-care workforce,
- Evaluate effectiveness, accessibility and quality of personal and population-based health services, and
- Research new insights and innovative solutions to health problems.

**Tools for conducting community food system assessments can be found in
*Healthy Food, Healthy Iowans, Healthy Communities- Part 2. A Community Food Systems
Assessment & Planning Toolkit for Local Public Health Agencies***

Food System Challenges & Public Health Impacts

Overview

Public health often leads efforts in addressing the outcomes of the current food system including obesity, diet-related chronic diseases, food insecurity, food borne illnesses and contaminated water supplies. However, to increase efficacy of public health interventions a comprehensive examination of the human, environmental, social and economic health impacts of the food system is warranted. A comprehensive examination using an evidence-based approach enables local public health agencies and their partners to identify the interconnections and interdependence embedded within the food system. Understanding the connections will lead to broader awareness of food system related issues, stronger public health program development and coordination, and greater capacity to create positive food system change.

What follows is a state level snapshot of the challenges within each food system sector and the human, environmental, social and economic health impacts resulting from the challenges. The goal of the snapshot is to demonstrate the wide range of food system issues and data that may be examined and their impact on public health. The challenge and impact sections are not exhaustive lists and local public health agencies are encouraged to expand their community examination beyond this snapshot.

Food System Sector – Production

Key Terms

- **Agrobiodiversity** is the diversification of animals, plants and microorganisms that are used directly or indirectly for food and agriculture, including crops, livestock, forestry and fisheries. It comprises the diversity of genetic resources (varieties, breeds) and species used for food, feed, fiber, fuel and pharmaceuticals. It also includes the diversity of non-harvested species that support production (soil microorganisms, predators, pollinators) and those in the wider environment that support agro-ecosystems (agricultural, rangeland, forest and aquatic) as well as the diversity of agro-ecosystems.¹³
- **Animal agriculture** includes the raising of livestock, as well as fishing and hunting.
- **Crop production** is the process of growing food, feed, fiber and fuel by the cultivation of certain plants. The scale, methods and type of food production vary widely across Iowa, but include small, mid-sized and large farming operations; backyard, community, workplace and school gardens/orchards; fishing; hunting and foraging.
- **Monocropping** is the agricultural practice of growing large areas of one crop in the same location year after year.
- **Specialty crops** consist of fruits and vegetables, tree nuts, dried fruits, horticulture, and nursery crops (including floriculture). Eligible plants must be intensively cultivated and used by people for food, medicinal purposes, and/or aesthetic gratification to be considered specialty crops.¹⁴

Production Challenges

Agricultural consolidation - Iowa has lost 113,000 farms over the past 60 years.¹⁵

- Iowa has lost about 9,800 farm proprietors since 2001, nearly 100 per county.¹⁶
- Most small farmers in Iowa derive the majority of their incomes from nonfarm sources.¹⁷

Biodiversity - The variety of agricultural commodity crops produced in Iowa has decreased from 34 in 1920 to just 7 in 2007.¹⁹

- The commoditization of agriculture has reduced the species of fruits, vegetables, and grains that are available for consumers to purchase. For example, there were once over 15,000 distinct apple varieties grown in the U.S. Today, only 11 varieties regularly appear on supermarket shelves.²⁰
- In 2008, 93% of harvested acres were either corn or soybeans.²¹ In 2009, more than two-thirds of Iowa's corn crop was used for ethanol production or livestock feed.²²

Fruits and vegetables - The number of acres devoted to fruit and vegetable production in Iowa has decreased by more than 88% since 1929.^{26,27} Out of the 50 states, Iowa ranks 42nd and 38th in vegetable and fruit production, respectively.²⁸

Pesticide use - Monocropping makes crops more vulnerable to pests, often resulting in higher levels of pesticide use.

- Pesticide use in Iowa has been steadily increasing since the 1940's.³² Each year, 55 million pounds of pesticides are transported, handled, and applied by farmers and commercial applicators in Iowa.³³

Impacts on Public Health

Economic and social health - As agricultural consolidation has occurred, small- and mid-sized farms have been less able to compete.

- Agricultural consolidation is associated with money moving out of rural economies.¹⁸

Human and environmental health - As diversity of food crops decreases, rates of poor health increase.²³

- Industrial agriculture crops do not develop to their full nutrient potential, due to depleted soil nutrients as a result of monocropping, hybridization, plant spacing, and harvest prior to peak ripeness.^{24,25}

Human health - If Iowa farms were to produce enough fruits and vegetables for the entire population to eat the number of servings recommended per day, only about 12,300 acres would be required for production. This is the equivalent of just 123 acres per county – slightly less than one-fifth of a square mile.²⁹

- Between 1997 and 2007, U.S. imports of fish and seafood more than doubled; imports of fruits, vegetables, nuts, and grains doubled; imports of meat, poultry, and dairy products almost doubled.³⁰ Total value of food imports exceeds \$43 billion.³¹ Greater reliance on other states and countries for the food that we eat increases food insecurity in our state.

Environmental health - Pesticide runoff and airborne “drift” affects surface and ground waters, and causes decline in bird and beneficial insect populations.³⁴

Human health – Long-term effects include some cancers and problems in the reproductive, immune, endocrine, and nervous systems.³⁵

- Pesticide exposures are elevated for farm workers and those living near farms.^{36,37}

Economic health – The public health costs of pesticides have been estimated at over \$1 billion per year.³⁸

Production Challenges

Erosion – The USDA estimates that, in 2007, soil erosion in Iowa averaged 5.2 tons per acre per year. Rates of erosion vary across time and location, however.³⁹

- Researchers from Iowa State University estimate that in some townships, more than 64 tons of soil per acre was lost each year.⁴⁰
- When soil is lost, vital nutrients and microorganisms are lost, resulting in reduced ability to grow food or plants with reduced levels of nutrients.⁴¹

Water quality - The quality of Iowa's streams has improved, however the average water quality score still remains in the poor category.⁴²

- Fertilizers and pesticides applied to farm fields, commercial and residential lands are the leading cause of water pollution in Iowa's rivers and streams.⁴³

Gardening surveillance - While national estimates indicate that the popularity of gardening has been growing in recent years, no systems for monitoring state or local data are in place.⁴⁶

Consolidation of livestock - As consolidation of beef, pork, and poultry processing companies has occurred, farmers have been forced to increase the size of their operations, or go out of business.⁴⁸

- In 1978, there were over 60,000 hog producers in Iowa; in 2007, there were only 8,700. In 1978, the average number of hogs sold per producer was 368; by 2007 that number had jumped to 5,398.
- In 1978, there were over 69,000 farms raising cattle in Iowa; in 2007, there were 29,000.
- In 1978, there were 1142 poultry operations in Iowa; in 2007, there were 598.⁴⁹ In 1978, the average number of chickens sold per producer was 592; by 2007 that number had jumped to 17,153.⁵⁰

Food value - The dollar value of Iowa agricultural products sold to Iowans for direct human consumption has decreased by almost \$9 million since 1997.⁵¹

Impacts on Public Health

Human and environmental health – Healthy soil is necessary to grow healthy foods. According to the Soil Science Society of America, it takes 500 years to build one inch of topsoil. Loss of soil will deteriorate Iowa's ability to grow healthy, fresh foods and negatively impact the farm economy on which Iowans rely.

Human and environmental health – Water is necessary for the maintenance of life for humans, plants, animals, food production and as a raw ingredient in industry.

- Poor water quality can result in reduced ability for aquatic life to survive, health hazards in drinking water supplies, and reduced opportunities for water-related recreational activities.⁴⁴
- Climate change affects water quality. Scientists predict that the amount of rainfall during heavy storms is likely to increase, which could cause both increased soil erosion and decreased water quality.⁴⁵

Human and environmental health – The public health impact of food gardens is difficult to estimate, due to lack of data regarding prevalence, methods, types of food grown, and contribution of garden produce to consumers' diets. However, food gardening can lessen the impact of food insecurity, poor health, declining economy, environmental degradation, and social problems.⁴⁷

Social and economic health – As the number of producers has declined, rural areas have lost valuable jobs and income.

- Although remaining producers are selling larger numbers of animals to processors, net real income that they receive has declined due to consolidation among processors and increased grain prices. For example, while Iowa farmers sold twice as many hogs in 2007 as in 1982, the total real value of Iowa's hog sales was 12% lower in 2007.⁵²
- About one in ten farm households has income below the poverty line.⁵³

Production Challenges

Agrobiodiversity – Changes in agriculture have led to specialization of farm animals. The most productive species are used. For example, while there are more than 250 species of cattle worldwide, and more than 60 species bred in the U.S., one breed (Holstein) produces almost all milk.⁵⁴ The Holstein was selected for its ability to produce large amounts of milk.⁵⁵

- In the U.S., a single breed of chicken (White Leghorn) is used for almost all egg production, and one turkey variety (Broad Breasted White) is used for almost all turkey meat production.⁵⁶
- In the U.S., about one hundred farm animal breeds are rare, and some are in danger of extinction.⁵⁷

Antibiotic use – Up to 70% of antibiotics sold in the U.S. go to healthy food animals.⁶² This translates to about 25 million pounds of antibiotics given to livestock per year.⁶³

- Antibiotics are routinely used with livestock that are raised in confinement facilities to control the spread of disease and promote growth.⁶⁴

Use of resources – Converting grain into meat entails a large loss of food energy. Conservative estimates state that cattle require 7kg of grain to create 1 kg of beef.⁶⁹ Approximately 55% of the corn grown in the U.S. and 50% of the soybeans grown are used to feed livestock.⁷⁰ The U.S. livestock population consumes seven times as much grain as consumed directly by the entire U.S. population.⁷¹

- Compared to the water required to produce grains, beef production requires 100 times the volume of water to produce the same amount of protein.⁷²
- The amount of fossil fuel energy required in a typical feedlot has been estimated to be 35 kcal of energy per kcal of beef protein produced. This does not include the energy required for processing, packaging, cold storage, and transportation.⁷³

Greenhouse gas emissions – Approximately 18% of all greenhouse gas emissions come from industrial livestock production.⁷⁴

Impacts on Public Health

Environmental and economic health - Species diversity has decreased, as breeds have been favored for beneficial characteristics, such as productivity. This results in increased vulnerability to disease or changes in the environment. Studies have shown that as animal diversity increases, resistance to disease decreases.⁵⁸

- Genetic diversity is necessary for resilience and health of a species; species contain unique genes and traits that allow climate adaptation, forage efficiency, hardiness, longevity, and maternal abilities that allow them to thrive in a variety of environments.^{59,60,61}

Human health – Lack of diversity in animal agriculture results in less diversity in human diets.

Human health - There is a link between the routine, non-therapeutic use of antibiotics in food animal production and antibiotic resistance in humans.⁶⁵ Use of antibiotics in livestock causes microbes to become resistant to drugs used to treat human illness, making some human illnesses harder to treat.⁶⁶

- Researchers at the University of Iowa found MRSA (Methicillin-resistant *Staphylococcus aureus*) present in 49% of swine and 45% of farm workers in their study population.⁶⁷
- University of Iowa researchers have linked transmission of MRSA between swine and humans. Once MRSA is introduced, it may spread between the animals and their caretakers, with the animals acting as reservoirs for the bacterium.⁶⁸

Human and environmental health - A food system that requires greater inputs of energy, food, and water to create calories than the calories that are gained is inherently unsustainable over the long-term and threatens long-term food security.⁷⁵

Production Challenges

Impacts on Public Health

Animal waste - U.S. industrial food animal producers generate more than 335 million tons of dry manure waste each year.⁷⁶

Social and economic health – Research in Iowa has suggested that there may be a 9% drop in home property values if a moderately sized (measured as 250,000 pounds animal weight capacity) new livestock feeding operation is located upwind and near a residence.⁷⁷

Environmental health - Disposal of animal waste by applying it to land can lead to soil saturation with nitrogen and phosphorus, with excess seeping into and contaminating streams and groundwater.^{78,79}

Air quality – Industrial food animal production facilities emit ammonia, hydrogen sulfide, carbon dioxide, organic dusts, bacterial endotoxins, and particles contaminated with many different microorganisms.⁸⁰

Human health - Workers and community members living near industrial food animal facilities have elevated rates of respiratory health conditions, including childhood asthma.^{81,82}

Nutritional quality – Meat from corn- and soy-fed animals is high in omega-6 fatty acids, whereas grass-fed and pastured animals are higher in beneficial omega-3 fatty acids.⁸³

- Meat from grain-fed cattle contains higher levels of total fat than meat from grass-fed cattle.

Human health - Diets that contain more omega-6 fatty acids in proportion to omega-3 fatty acids may be associated with higher risk of cardiovascular disease, cancer, and inflammatory and autoimmune diseases.⁸⁴

- Diets high in saturated fat are associated with increased risk of heart disease, stroke, and some cancers.

Fish kills - In 2011, there were 17 reported fish kills in Iowa, with a total of over 190,000 fish killed.⁸⁵

Environmental health – Sudden, large fish kills may be caused by the die-off of large algae blooms; the decay of water weeds after treatment with herbicide; the turnover of oxygen-poor bottom waters following a storm; run-off of livestock waste; pesticides; chlorine; gasoline; fuel oil; ammonia fertilizer; acids; or other toxic chemicals.⁸⁶

Pollinators – Honeybee populations have been declining for decades, but the rate has increased in recent years. Beekeepers once commonly experienced annual colony losses of 15-20%; in recent years there have been losses of up to 70% in Iowa.⁸⁷

- Scientists are still investigating this issue; hypothesized causes include landscape changes, viral diseases, and nutrition and human impacts, including pesticides.^{88,89}

Economic health – The USDA reports that bee pollination is responsible for \$15 billion in added crop value.⁹⁰

Human health – Approximately one-third of the food consumed in the US comes from plants that require pollination. If pollinators disappear from the food chain, the human diet will be much less diverse.⁹¹

Food System Sector – Transformation

Key Terms

- **Food transformation, or processing**, is the practice of converting raw agricultural products into food products intended for consumption by humans or animals. This includes butchering, cleaning, and packaging of meats, fish, and poultry; milling grains; and pressing oils. Also included is the preparation and packaging of value-added food products such as dried, frozen, canned, pickled, or otherwise preserved foods. Once a raw product has undergone processing to its final form, the product is packaged, labeled, and ready for sale to wholesale or retail markets. Transformation does not include home preservation such as freezing, canning, or drying. The transformation sector presents an opportunity to localize the food system beyond just fruits and vegetables, by connecting processing and packaging infrastructure to growers, local food businesses, and consumers.

Transformation Challenges

Nutritional-quality - While food processing methods such as canning, drying, pickling, or preserving can contribute to a sustainable food system by extending product shelf life, processing is often currently used by conventional food manufacturers as a way to add “filler” ingredients that raise profit margins while depleting a product’s nutritional value.

- According to the USDA, the average US diet consists of 49% of processed food.⁹²

Food safety - The more elaborate a supply-chain, the more vulnerable food is to contamination.

- In 2010, two Iowa egg producers were implicated in a national *Salmonella* outbreak. As a result, a recall was ordered for eggs labeled under 16 different brand names from food wholesalers, distribution centers, foodservice companies, and retail grocery stores in 23 states. The outbreak resulted in 1,939 cases of *salmonella* nationwide.⁹⁵

Occupational safety - In 2002, meat processing had the highest reported rate of occupational injuries and illnesses of any industry in the country.⁹⁸

Impacts on Public Health

Human health - Consumption of highly processed foods, which are often high in sodium, trans fats, saturated fats, and refined sugars, has contributed to higher levels of nutrition-related disease, especially among low-income communities.^{93,94}

Human and economic health - The CDC estimates that each year roughly 1 in 6 Americans contracts a food-borne illness.⁹⁶ In Iowa, there were 62 reported cases of food-borne illness in 2011.⁹⁷ Four outbreaks that affected Iowa residents were part of national outbreaks, originating with foods produced outside of Iowa.

- Centralized food processing by a small number of facilities increases the likelihood that any contamination will have widespread effects.
- Large-scale containment efforts have large negative economic impacts on producers and workers.

Human and economic health - The food-processing industry has one of the highest incidences of injury and illness in the nation, contributing to lost productivity and income.

- Nationally, immigrants make up between 20 and 50 percent of meatpacking workers.⁹⁹ Issues facing these workers include workplace safety, medical needs, housing, corporate control of labor, discrimination, abuse from supervisors, and isolation.¹⁰⁰

Transformation Challenges

Impacts on Public Health

Local industry - Iowa lost 50% of its fruit and vegetable canning, pickling, and drying facilities between 1997 and 2007, bringing the total number of facilities down to four.¹⁰¹

- In 2007, there were 10 poultry processing facilities in Iowa. Only 5 facilities employed less than 20 employees for local farmers' use.¹⁰²
- Nationally, meat and grain processing industries have become very concentrated with four companies controlling almost 85% of the beef packing industry; four companies controlling more than 66% of the pork packing market; and four companies controlling 80% of the soybean crushing business.¹⁰³
- In 1965, there were more than 550 small meat processors in Iowa. Today, there are less than 200.¹⁰⁴

Social and economic health – Loss of local processing facilities is the result of smaller processors unable to compete with larger processors, which translates into fewer jobs available for Iowans and less money in the local economy.¹⁰⁵

Natural resources - Food processing requires energy and water for cleaning, sorting, cooking, cold storage, packaging, and waste disposal. Between 1997 and 2002, energy use in the transformation sector outpaced all other food-related sectors. This sector accounts for about 10% of the food system's greenhouse gas emissions.¹⁰⁶

Environmental health – A food system, which heavily relies on large amounts of fossil fuels and water for processing, contributes to depletion of natural resources, and is inherently unsustainable.¹⁰⁷

Marketing to children - Total spending on food marketing to children ages 2-17 was \$1.79 billion in 2009. Spending on marketing of carbonated beverages (excludes water and juice) to this age group was over \$511 million.¹⁰⁸

- In 2011, preschoolers saw on average 11 food and beverage ads per day. Youth exposure to food advertising increased with age, and peaked at 15 ads per day for 12- to 14-year-olds.¹⁰⁹

Human health - From 1989 to 2008, calories from sugar sweetened beverages increased by 60% in children ages 6 to 11, from 130 to 209 calories per day, and the percentage of children consuming them rose from 79% to 91%.¹¹⁰

- Consumption of sugar sweetened beverages increases risk of obesity, diabetes, heart disease, and gout.¹¹¹ One study found that for each additional 12-ounce soft drink children consumed each day, the odds of becoming obese increased by 60% during 1½ years of follow-up.¹¹²

Food labels – Existing food label requirements may not provide sufficient information for consumers to make truly informed choices about the products that they purchase.¹¹³

Social and human health – Consumers have an interest in knowing more about the products that they purchase and the companies that they purchase from (e.g., where and how products are produced, whether animals were treated humanely, whether the product contains genetically modified organisms, whether workers are paid a fair wage and have safe working conditions, and whether products are produced in environmentally responsible ways).¹¹⁴

Food System Sector – Food Distribution & Retail

Key Terms

- **Food distribution** is the process of moving and storing food products among producers, processors, and consumers. **Food retail** includes the various outlets where individuals can access and purchase foods. These include mega stores, supermarkets, convenience stores, gas stations, corner markets, liquor stores, food cooperatives, restaurants, cafeterias, vending machines, farmers' markets, and community supported agriculture farms.
- **Food hub** is a business or organization that actively manages the aggregation, distribution, and marketing of source-identified food products primarily from local and regional producers to strengthen their ability to satisfy wholesale, retail, and institutional demand.¹¹⁵

Food Distribution Challenges

Distance food travels - Fresh produce purchased in Iowa has travelled an average of 1500 miles; locally produced food travels an average of 56 miles.¹¹⁶

- On average, non-local broccoli has traveled more than 90 times further than locally-sourced broccoli. Non-local carrots, sweet corn, garlic, onions, and spinach have traveled at least 50 times further than their locally-grown counterparts.¹¹⁷

Consolidation - Wholesale buyers often find it too costly to purchase products directly from numerous farms, and prefer to reduce transaction costs by buying from distributors.¹¹⁹

- There are very few regional food distribution networks in Iowa.¹²⁰
- Just five supermarket chains account for over 40% of retail food sales in the U.S.¹²¹ Only three supermarket chains account for almost 80% of retail food sales in Iowa.¹²²

Energy - Food distribution is heavily reliant on infrastructure such as roads, trucks, rail, air, and ships – each of which is dependent on fossil fuels.

- Transportation contributes 11% of the food system's greenhouse gas emissions in the U.S.¹²⁷

Impacts on Public Health

Human health - Most fruit and vegetables are bred for transportability, color, or standard size, rather than taste. They are often picked before they are ripe, reducing flavor and nutrient content. Many nutrients, and especially vitamin C, start to break down immediately after harvest.¹¹⁸

Social and economic health - Rural financial wealth leaks out of communities when local people lose ownership of farmland and food supply chains.¹²³

- Regional aggregation and distribution centers, or food hubs, can provide producers with increased opportunities. Hubs can support increased production, opportunities for local processing, infrastructure for local distribution, and demand through marketing, outreach, and capacity building.¹²⁴
- Retail consolidation has been associated with money moving out of rural communities.¹²⁵

Human health - Horizontal and vertical integration in the food system may lead to decreased food access for consumers and decreased diversity of available products.¹²⁶

Environmental health – A food system that heavily relies on large amounts of fossil fuels to transport and store products contributes to depletion of natural resources, and is inherently unsustainable.¹²⁸

Food Distribution Challenges

Food retailers - According to the CDC, 63.3% of the census tracts in Iowa have a healthy food retailer (supermarkets, larger grocery stores, warehouse clubs, and fruit/vegetable markets) located within ½ mile; the U.S. average is 72.0%.¹²⁹

- The number of Healthy Food Retailers per 100,000 Iowans declined from about 27 in 1997 to less than 23 in 2007.¹³⁰

Impacts on Public Health

Human and social health – Decreased availability of supermarkets and grocery stores may translate to decreased intake of healthful foods such as fruit and vegetables, especially within low-income neighborhoods.¹³¹

Food System Sector – Food Access & Consumption

Key Terms

- **Community food insecurity** may occur when there are inadequate resources from which people can purchase food, available food purchasing resources are not accessible to all community members, available food is not sufficient in quantity or variety, available food is not competitively priced and thus not affordable for all households, there are inadequate food assistance resources, there are no local food production resources, or locally produced food is not available to community members.¹³²
- **Food access** is the individual’s point of contact with food. This may include purchasing food at a grocery store, convenience store, restaurant, community supported agriculture farm, farm stand, or farmers’ market. It may also include accessing fresh food from a garden or orchard, acquiring food from emergency food assistance programs or using benefits supplied by federal food and nutrition programs (e.g., SNAP and WIC) to purchase food.
- **Food deserts** are areas in which supermarkets have closed in urban and rural locations, and **food swamps** are areas in which convenience stores, liquor stores and fast food restaurants become the only accessible outlets for food.
- **Food preservation**, such as freezing, canning, or drying, enables longer-term storage of food at the household level.
- **Health** is a state of complete physical, mental, and social wellbeing, and not merely the absence of disease or infirmity.¹³³ Individual health is a result of the ability to access food, as well as the nutritional quality, quantity, and safety of the food consumed.
- **Household food insecurity** is the limited or uncertain availability of nutritionally adequate and safe foods, or limited or uncertain ability to acquire foods in socially acceptable ways (without resorting to emergency food supplies, scavenging, stealing, or other coping strategies). In households with **very low food security**, eating patterns of one or more household members are disrupted and food intake reduced because the household lacked money or other resources for food.¹³⁴

Food Access & Consumption Challenges

Food access –Over the past decades, food deserts and food swamps have increased in prevalence.

- Iowa lost more than half (52.6%) of its grocery stores from 1976 to 2000, many of which were main street businesses in small rural towns across Iowa.¹³⁵
- Even where grocery services exist, produce offerings in low-income neighborhoods are often of poorer quality yet higher price compared to more affluent neighborhoods.¹³⁶

Impacts on Public Health

Human and social health - The greater distance an individual must travel to purchase fresh, healthy food, the greater the rates of diet-related chronic diseases.¹³⁷

- People tend to make food choices based on the food outlets available in their immediate neighborhoods.¹³⁸ Residents with poor supermarket access have increased exposure to high calorie foods with little nutritional value at convenience stores and fast food restaurants, intake of which contributes to increased risk of disease.
- Low-income and younger households in rural Iowa food deserts are less successful than others in avoiding food insecurity.¹³⁹

Environmental health – Diets high in processed and packaged foods require much more energy for production and waste management than fresh, locally grown diets.¹⁴⁰

Food Access & Consumption Challenges

Food insecurity - In 2011, 12% of Iowa households were identified as food insecure, with 4.7% of households rated as having very low food security.¹⁴¹

- In 2010, 19.5% of children in Iowa were food insecure. Among those children, 43% did not qualify for federal food nutrition programs (family income >185% of poverty level).¹⁴²
- In 2010, almost 40% of Iowans eligible for WIC did not participate.¹⁴³ Eight percent of Iowans eligible for SNAP did not participate.¹⁴⁴
- In 2011, 12% of Iowans received SNAP benefits, and almost 80,000 Iowans participated in WIC. Food costs for WIC in Iowa in 2011 totaled almost \$35 million.^{145,146,147}

Impacts on Public Health

Human, social and economic health – Food insecurity results in poor physical and mental health in adults and depression in women, overweight and weight gain, adverse health outcomes for infants and toddlers, behavior problems in preschool-aged children, lower educational achievement in kindergarteners, and depressive disorder and suicidal symptoms in adolescents.¹⁴⁸

- Participation in federal nutrition assistance programs has been shown to reduce food insecurity.^{149,150}
- Hunger is estimated to cost Iowans \$900 million annually.¹⁵¹ Costs include those for charity to help feed the hungry, mental health and medical care due to increased rates of illness, and costs associated with lost productivity.

Food waste – From 1998 to 2011, Iowa landfills saw an increase of 62% in food waste disposal.¹⁵²

Human and environmental health – To divert food waste from landfills, food could be collected and distributed to food pantries and food banks for distribution. This includes unpicked vegetables and fruit in fields and gardens; food discarded from processing facilities; near expired food from grocery stores; and unused inventory from restaurants, schools and hospitals.

- *Table to Table*, a food recovery organization in Iowa City, rescued over 1 million pounds of bread, bakery items, produce, dairy, and prepared foods from entering landfills in 2012. This food was used to create over 750,000 meals at the community organizations that they serve. Food was collected from grocery stores, dairies, food warehouses, schools, and restaurants.¹⁵³

Calorie intake - Compared to 1970, Americans are eating an additional 523 calories per day, and are consuming 1000% more refined sugars such as high fructose corn syrup.¹⁵⁴

- Agricultural subsidies have enabled food manufacturers to produce energy dense foods at a low cost. Cheaper foods are often high in calories, highly processed, and low in nutritional value.

Human and economic health - Increased calorie intake increases risk for overweight/obesity.

- Obesity rates increased by 10% for all U.S. children 10- to 17-years old between 2003 and 2007, but by 23% during the same time period for low-income children.¹⁵⁵
- Overweight and obesity increase risk for many diseases, including heart disease, diabetes, cancers, stroke, hypertension, high cholesterol, and liver and gallbladder diseases.¹⁵⁶
- Iowa's estimated medical costs attributable to obesity are more than \$1.2 billion.¹⁵⁷

Fruit and vegetable intake - Less than 14% of Iowa adults eat five servings of fruits and vegetables per day,¹⁵⁸ and less than 20% of Iowa adolescents eat five servings of fruits and vegetables per day.¹⁵⁹

- Among low-income Americans, median fruit consumption is less than 1 serving per day; median vegetable consumption is between $\frac{3}{4}$ and 1 serving per day.¹⁶⁰

Human health - Consumption of fruits and vegetables is directly linked to the prevention of diet-related chronic disease.^{161,162}

Food Access & Consumption Challenges	Impacts on Public Health
<p>Natural resources – Processed foods, foods transported long distances, and animal protein require a greater amount of resources (packaging, fossil fuels, water, waste) to produce than do whole foods, local foods, and plant-based sources of protein.^{163,164,165}</p>	<p>Environmental health – A food system which heavily relies on large amounts of fossil fuels and water for producing, processing, packaging, marketing, storing, and transporting food products contributes to depletion of natural resources, and is inherently unsustainable.¹⁶⁶</p>
<p>Sweetened beverage consumption - The prevalence of soft drink consumption among children increased 48% between 1978 and 1998.¹⁶⁷</p> <ul style="list-style-type: none"> In 2008, 12 to 18 year old males consumed an average of 273 calories from sugar-sweetened beverages each day; females averaged 171 calories per day.¹⁶⁸ Between 1965 and 2002, adults increased the number of calories consumed from sugar-sweetened beverages by an average of 222 calories per day.¹⁶⁹ 	<p>Human health - High intake of sugar-sweetened beverages in childhood is associated with increased risk of obesity and diabetes later in life.¹⁷⁰</p> <ul style="list-style-type: none"> One study found that for each additional 12-ounce soft drink children consumed each day, the odds of becoming obese increased by 60% during 1½ years of follow-up.¹⁷¹ Among adults, sugar-sweetened beverages increase the risk of obesity, diabetes, heart disease, and gout.¹⁷²
<p>Breastfeeding – Globally, about 79% of infants are breastfed for 12 months, compared to only 21.4% in the U.S. Less than 12% of infants in the U.S. are exclusively breastfed for the first 6 months of life.¹⁷³</p> <ul style="list-style-type: none"> Among 2012 WIC participants in Iowa, less than 25% of babies were breastfed at 3 months of age, and less than 18% were breastfed at 6 months of age.¹⁷⁴ Rates of breastfeeding initiation and exclusive breastfeeding at 3 and 6 months are lowest among low-income women.¹⁷⁵ As of 2007, only 13% of Iowa hospitals had comprehensive breastfeeding policies. Comprehensive breastfeeding policies in hospitals significantly increase initiation and duration of breastfeeding.¹⁷⁶ 	<p>Human health – Breastfeeding is associated with numerous health benefits for both child and mother. Benefits to the infant include reduced risk of mortality and morbidity, including reduced rates of ear infections, asthma, lower respiratory diseases, and lower risk of later development of obesity and diabetes. Benefits to mother include lower risk of diabetes, breast cancer, ovarian cancer and post-partum depression.¹⁷⁷</p> <p>Economic health - It has been estimated at least \$3.6 billion could be saved nationally if breastfeeding rates increased from current rates to those recommended by the U.S. Surgeon General.¹⁷⁸ This estimate reflects savings from reduced medical expenditures due to reduced childhood illness, lost wages of parents attending to those children, and prevention of premature deaths of infants.</p> <p>Environmental health - Breastfeeding benefits the environment by reducing materials and energy required to produce, package, transport, and market formula, and to dispose of associated waste.</p>
<p>Food handling practices - A national survey revealed that a high percentage of home food processors are using practices that put them at high risk for foodborne illness.¹⁷⁹</p> <ul style="list-style-type: none"> Only 3-5% of home food preservers recognize the Extension Service or USDA as their source of home food preservation information.¹⁸⁰ In Iowa, there were 62 reported cases of food-borne illness in 2011.¹⁸¹ Out of nine reported outbreaks, four occurred in private homes, at potlucks, and churches. Infectious agents included clostridium, E. coli, salmonella, and listeria.¹⁸² 	<p>Human health – Lack of proper methods of food preservation will increase risk of foodborne illness.</p>

Food System Sector – Waste Management

Key Terms

- **Externalized costs** are a cost or benefit not transmitted through prices that are incurred by a party who did not agree to the action causing the cost or benefit. General types of externalities associated with food include ecological effects, environmental quality, greenhouse gas emissions, animal welfare, social costs associated with labor, and public health effects.¹⁸³
- **Waste management** includes food waste and food-related packaging resulting from growing, processing, packaging, labeling, transporting, selling, purchasing, preparing, and consuming food. The process of waste management includes the collection, transportation, processing, recycling and disposal of food waste and food-related packaging across all sectors of the food system. This includes residential, commercial and industrial food wastes.

Food Waste Challenges

Landfill waste - About 46% of waste in Iowa landfills is organic matter, including wood, food, paper and yard wastes.¹⁸⁴

- According to a 2011 study by the Iowa Department of Natural Resources, 13.3% of waste in Iowa landfills is food waste.¹⁸⁵
- Although waste from food-related packaging is not calculated, the disposed paper component of the waste stream in 2011 in Iowa included more than 562,600 tons of materials that could be recovered through composting and recycling.¹⁸⁶

Methane production - Landfills are a source of both odorous and non-odorous gasses¹⁸⁸ and are the third largest source of human-related methane emissions in the nation.¹⁸⁹ The comparative impact of methane on climate change is over 20 times greater than carbon dioxide over a 100-year period.¹⁹⁰

Impacts on Public Health

Environmental health – Currently, many compostable, organic materials end up in landfills, where they are unable to degrade and replenish soil nutrients.¹⁸⁷

Environmental, human and social health – When compostable food waste and packaging materials end up in landfills, lack of oxygen prevents decomposition of otherwise biodegradable food waste.

- Living near municipal solid waste facilities increases risk of poor birth outcomes including low birth weight; respiratory conditions including bronchitis and shortness of breath; and cancers of the stomach, liver, and pancreas.^{191,192,193,194,195}
- Noise exposures related to municipal waste facilities have been shown to affect wellbeing and induce stress.¹⁹⁶

Food Waste Challenges

Vulnerable communities— Low resource communities (low levels of civic engagement, home ownership and disposable income) are more vulnerable to high concentrations of polluting facilities.¹⁹⁷

Manure storage - Manure storage facilities used by industrial animal feeding operations emit methane. Estimates of methane emissions from manure storage facilities were 65% higher than in 1990.²⁰³ It is estimated that one-third of the methane produced each year comes from agriculture, primarily through animals and manure storage units.²⁰⁴

- Other airborne emissions from animal agriculture include carbon dioxide, ammonia, dust, pathogens, and flies.²⁰⁵

Impacts on Public Health

Social and environmental health – Noise, odor, traffic, and visual pollution from landfills may act as visual repellants, preventing health-promoting amenities such as food stores, recreational facilities, and health care facilities from locating nearby.¹⁹⁸

- Many facilities that were formerly used for municipal solid waste disposal are now sources of groundwater contamination.^{199,200,201}
- Heavy truck traffic on roads leading to waste facilities may present safety concerns.²⁰²

Environmental health – Liquid or slurry manure applications to fields may result in nutrient overload of soils; effect ground and surface water quality; release methane, carbon dioxide and ammonia; and impact air quality.^{206,207}

Opportunities to Advance a Healthy and Sustainable Food System

How Does Public Health Advance a Healthy, Sustainable Food System?

Food system change requires multifaceted strategies that support human, environmental, social and economic health. The Spectrum of Prevention model outlines the multiple levels of intervention and guides public health practitioners beyond preventative education to making organizational, community and public policy changes.

The Spectrum of Prevention²⁰⁸ is a framework for a more comprehensive understanding of prevention that includes six levels for strategy development. These levels (Figure 4) are complementary and when used together produce a synergy that results in greater effectiveness than would be possible by implementing a single activity or linear initiative.

In the following pages, the Spectrum of Prevention model has been adapted to demonstrate the breadth of activities that local public health agencies and their partners could consider when developing food system plans to advance a healthy, sustainable food system. These are just a few examples and do not constitute an exhaustive list.

As local public health agencies and stakeholders begin planning activities that strengthen healthy and sustainable food systems, the following food system sector objectives may serve as a guide.

- **Production Objective.** Create an economically viable, sustainable system of crop and livestock production that preserves and enhances natural resources, promotes the health of producers, consumers, and communities while producing an adequate amount of diverse foods to allow all Iowans to eat a healthy diet.
- **Transformation Objective.** Create a sustainable food transformation system that produces safe, healthy food products; markets products in such a way that allows for informed consumer choice; and protects and promotes the health of individuals, workers, communities, and the environment.
- **Distribution & Retail Objective.** Promote a sustainable system of food distribution and retail that includes a diversity of locally owned retailers and food distribution networks.
- **Food Access & Consumption Objective.** Ensure that sustainable, safe, healthful, affordable and culturally appropriate food choices are the easiest choices for all Iowans, in order to protect and promote the health of all individuals and communities.
- **Waste Management Objective.** Create a sustainable food waste management system that conserves, protects, and regenerates natural resources, landscapes, and biodiversity to protect and promote the health of Iowa's landscape and citizens.



Figure 4. Spectrum of Prevention

Level 1. Individual Knowledge and Skills

Enhancing an individual's capability of health and safety, while preventing injury or illness through the food system

Examples of Public Health Action with Community Partners to Advance Healthy, Sustainable Food Systems

Production

- ✓ Disseminate information on the public health benefits of crop diversity
- ✓ Provide education and online resources on home gardening

Transformation

- ✓ Provide materials to consumers on proper hand washing and safe food handling

Distribution & Retail

- ✓ Develop a fact sheet on the public health benefits of regionally grown foods (e.g., increased flavor, nutrition, keeps food dollars within the community and agrobiodiversity)

Food Access & Consumption

- ✓ Promote increased consumption of fruits, vegetables and whole grains to benefit human and environmental health
- ✓ Provide information to consumers on farmers' markets, CSAs and U-pick farms within the community
- ✓ Encourage use of WIC fruit and vegetable cash value voucher, WIC Farmers' Market Nutrition Program and Senior Farmers' Market Nutrition Program coupons

Waste Management

- ✓ Develop a tip sheet for reducing food waste in the home

Level 2. Community Education

Reaching groups of people with information and resources to promote a healthy and safe food system

Examples of Public Health Action with Community Partners to Advance Healthy, Sustainable Food Systems

Production

- ✓ Educate growers and consumers on:
 - The human and environmental health impacts of pesticides and fertilizers
 - Integrated Pest Management (IPM) and alternative food production practices
 - Methods for decreasing soil erosion to ensure future food production
 - The links between a diverse agricultural economy and a safe, stable, healthy food system
- ✓ Promote the *Cultivate Iowa* campaign to faith-based organizations, businesses, prisons and community groups to encourage fresh produce donation to food banks and food pantries
- ✓ Provide business development assistance for small- and medium-scale agriculture operations
- ✓ Host field days and farm visits to connect consumers with agriculture

Transformation

- ✓ Provide food safety education and technical support to local and regional food processors
- ✓ Educate processors and food service workers on occupational safety risks and proper procedures to avoid injury
- ✓ Promote a community campaign to increase awareness of food safety concerns associated with improper home food preservation methods

Distribution & Retail

- ✓ Create a directory of farmers' markets, Community Supported Agriculture (CSA) farms, grocery stores and restaurants that carry regional foods (Note: some communities in Iowa provide a *Buy Fresh Buy Local Guide*)

Food Access & Consumption

- ✓ Host a farmers' market at the hospital or health department
- ✓ Develop and implement community-wide programs aimed at healthy eating and weight management
- ✓ Work with food pantries, grocers, farmers' market managers, Extension or community colleges to offer cooking demonstrations to consumers regarding preparation of whole foods

Waste Management

- ✓ Provide in-services to foodservice directors (schools, hospitals, colleges, universities) to reduce food waste by improving forecasting accuracy
- ✓ Develop a curriculum for school-aged children on reducing and composting food waste

Level 3. Provider Education

Informing providers who will transmit skills and knowledge about food systems to others*

Examples of Public Health Action with Community Partners to Advance Healthy, Sustainable Food Systems

Production

- ✓ Educate healthcare providers on the human and environmental health risks of antibiotic overuse in animal agriculture

Transformation

- ✓ Support and assist with continuing education of food inspectors

Distribution & Retail

- ✓ Convene local food retailers (grocers, convenience stores, restaurants) to address the economic and human health impacts of increasing availability of fresh healthy foods
- ✓ Conduct a feasibility study and market analysis for the establishment of a food hub in the community

Food Access & Consumption

- ✓ Provide technical and marketing assistance to convenience store operators to encourage increased availability of fresh healthy foods

Waste Management

- ✓ Host a forum on the human, environmental, social and economic impacts of food waste in the community. Attendees may include municipal landfills, waste haulers, natural resource agencies, food recovery programs and policymakers.

** Providers may refer to anyone working within a food system sector in addition to public health, healthcare and social service providers*

Level 4. Coalitions & Networks

Convening groups and individuals for broader food system goals and greater impact

Examples of Public Health Action with Community Partners to Advance Healthy, Sustainable Food Systems

General

- ✓ Form a food policy council that includes stakeholders from all segments of a food system who closely examine the operation of the food system at the community level and make recommendations for improving the food system through organizational, community and public policy changes

Production

- ✓ Work with agricultural partners to recruit and support beginning or transitioning farmers
- ✓ Support the development of farmer food cooperatives for supply purchasing, marketing and product sales

Transformation

- ✓ Establish a network of commercial kitchens available for value-added food processing. Provide assistance with:
 - Funding opportunities
 - Food-safety training
 - Licensing requirements

Distribution & Retail

- ✓ Connect institutional food buyers (from schools, hospitals, long-term care facilities, universities, restaurants, and correctional facilities) with farmers

Food Access & Consumption

- ✓ Convene a food access work group that addresses food security and health issues in the community
- ✓ Encourage development of food-buying cooperatives to save households money by pooling resources
- ✓ Organize local breastfeeding support groups

Waste Management

- ✓ Organize a community food-recovery network that diverts healthful and safe food from the landfills to food pantries and community organizations. Provide training on liability and food safety.^{209,210,211} The network may include community organizations (Boy Scouts, Girl Scouts, 4-H, Rotary Club), institutions (schools, hospitals) and retail (grocery stores, restaurants, convenience stores)

Level 5. Organizational Practices

Adapting regulations and policies within organizations that shape norms to improve the health and safety of the food system

Examples of Public Health Action with Community Partners to Advance Healthy, Sustainable Food Systems

General

- ✓ Encourage schools to incorporate gardening, food preservation, food preparation, healthy eating and food safety programs into education curriculum

Production

- ✓ Provide funding and business development assistance for specialty crop growers; women and minority-owned farms and beginning farmers. This may include support for growing season extension, cool storage, washing stations, on-farm processing, expansion, etc.
- ✓ Establish edible landscaping on city- and county-owned property and implement chemical-free pest management and lawn care
- ✓ Maintain an online list of community (public and private), school and workplace gardens
- ✓ Provide compost and water to community gardens
- ✓ Start and maintain a workplace food garden for employees

Transformation

- ✓ Support the development of small regional USDA-inspected processing facilities, including mobile processing units
- ✓ Research and report on the safety and social justice issues of workers in food production, processing, and food service industries

Distribution & Retail

- ✓ Develop point of purchase signage that identifies regionally produced food for cafeterias, grocery stores and restaurants
- ✓ Provide support and technical assistance to promote expansion of farmers' markets, CSAs, online food marketplaces, and other methods of direct farm-to-consumer sales
- ✓ Encourage schools, businesses, hospitals and government agencies to adopt procurement policies for the purchase of regionally grown and sustainably produced foods
- ✓ Promote development of a food hub or centrally located facility that aggregates, stores, processes, distributes and markets of regionally-produced food to retailers and institutional buyers
- ✓ Establish business incubators for cooperative, collectively-owned grocery stores
- ✓ Propose minimum healthy food and beverage options for school and community concession stands

Food Access & Consumption

- ✓ Launch a community garden "delivery" program to deliver produce to senior, disabled or rural residents who may lack transportation
- ✓ Assess, develop, and adopt strategies to increase the purchase of fruits and vegetables at farmers' markets by low-income lowans. For example:
 - Secure financial support to provide incentives for SNAP participants to purchase fruits and vegetables (e.g., *Double Up Bucks Program*)
 - Use public-private partnerships to purchase wireless EBT devices
 - Launch outreach initiatives targeted to farmers' market managers, vendors, and low-income lowans
- ✓ Locate farmers' markets at hospitals or public health agencies

Level 5. Organizational Practices

Adapting regulations and policies within organizations that shape norms to improve the health and safety of the food system

- ✓ Support school, workplace, and business policies that make healthy foods accessible at reasonable prices and set nutritional quality standards for food sold in vending machines
- ✓ Work with public and private businesses to develop policies that support breast-feeding

Waste Management

- ✓ Encourage schools, colleges and universities, hospitals, daycares and restaurants to decrease their use of disposable service ware (foam, plastic, paper) and replace with re-usable dishes and utensils
- ✓ Support college, university and hospital cafeterias that go trayless to reduce dishes used and food waste
- ✓ Encourage institutional food buyers to purchase bulk products for onsite preparation, rather than individually pre-packaged items
- ✓ Support policies in school, hospitals, and workplaces that provide composting and recycling opportunities. This may include working with waste management companies/departments to redesign/replace containers and bins to allow easier separation and collection of recyclable and compostable materials
- ✓ Expand recycling drop-off locations

Examples of Public Health Action with Community Partners to Advance Healthy, Sustainable Food Systems

Note: It is important for local public health agency staff involved with Level 6 initiatives to understand any possibly lobbying restrictions related to the program funding that supports their work.

Production

- ✓ Integrate fruit and vegetable production into municipal and county economic development plans
- ✓ Provide allowances and agreements for organizations to lease non-developable city-owned property for community gardens or urban farms
- ✓ Enforce land-use protections for urban agriculture, community gardens and farmers' markets
- ✓ Educate on the benefits of allowing residents to maintain food gardens on their property and keep chickens, ducks, rabbits, and beehives

Transformation

- ✓ Inform community leaders on the benefits of establishing of a food enterprise business park and providing financial incentives (grants, loans, tax incentives) to encourage the development of small- and mid-size food processors, especially food and vegetable processors
- ✓ Enforce workplace policies that provide living wages and reduce risk of occupational injury
- ✓ Educate on the benefits of policies that eliminate the marketing of unhealthy foods and beverages to children at schools and public places

Distribution & Retail

- ✓ Educate about standards for signage/labeling for grocery stores, restaurants, schools, colleges, and hospitals that provide consumers with more information regarding foods and beverages (how, where, and by whom products were produced)
- ✓ Educate on the benefits of establishing tax incentives for retailers who increase shelf space for fruits and vegetables in areas that do not have a grocery store or who locate in rural or urban food deserts. This may include redevelopment financing, technical assistance, and marketing services
- ✓ Inform about land use and zoning regulations that allow healthy food retail in mixed-residential and commercial buildings

Food Access & Consumption

- ✓ Inform on the benefits of municipal transportation policies that increase access to healthy food such as bus routes, pedestrian walkways and bike paths that connect to farmers' markets, food retail and food assistance programs
- ✓ Educate on the availability and benefits of a tax credit for food producers to donate excess harvest to food banks or food pantries

Waste Management

- ✓ Institute municipal curbside composting and recycling programs
- ✓ Provide incentives and technical assistance for farmers to install methane digesters

Appendix A. Principles of a Healthy, Sustainable Food System

A PDF can be accessed at <https://www.planning.org/nationalcenters/health/foodprinciples.htm>

PRINCIPLES OF A HEALTHY, SUSTAINABLE FOOD SYSTEM

In June 2010, the Academy of Nutrition and Dietetics (formerly American Dietetics Association), American Nurses Association, American Planning Association, and American Public Health Association initiated a collaborative process to develop a set of shared food system principles. The following principles are a result of this process and have been collectively endorsed by these organizations.

We support socially, economically, and ecologically sustainable food systems that promote health – the current and future health of individuals, communities, and the natural environment.

A healthy, sustainable food system is:

HEALTH-PROMOTING

- Supports the physical and mental health of all farmers, workers and eaters
- Accounts for the public health impacts across the entire lifecycle of how food is produced, processed, packaged, labeled, distributed, marketed, consumed and disposed

SUSTAINABLE

- Conserves, protects, and regenerates natural resources, landscapes and biodiversity
- Meets our current food and nutrition needs without compromising the ability of the system to meet the needs of future generations

RESILIENT

- Thrives in the face of challenges, such as unpredictable climate, increased pest resistance, and declining, increasingly expensive water and energy supplies

DIVERSE IN

- Size and scale—includes a diverse range of food production, transformation, distribution, marketing, consumption, and disposal practices, occurring at diverse scales, from local and regional, to national and global
- Geography—considers geographic differences in natural resources, climate, customs, and heritage
- Culture—appreciates and supports a diversity of cultures, socio-demographics, and lifestyles
- Choice—provides a variety of health-promoting food choices for all

FAIR

- Supports fair and just communities and conditions for all farmers, workers and eaters
- Provides equitable physical access to affordable food that is health promoting and culturally appropriate

ECONOMICALLY BALANCED

- Provides economic opportunities that are balanced across geographic regions of the country and at different scales of activity, from local to global, for a diverse range of food system stakeholders
- Affords farmers and workers in all sectors of the system a living wage

TRANSPARENT

- Provides opportunities for farmers, workers and eaters to gain the knowledge necessary to understand how food is produced, transformed, distributed, marketed, consumed and disposed
- Empowers farmers, workers and eaters to actively participate in decision-making in all sectors of the system

A healthy, sustainable food system emphasizes, strengthens, and makes visible the interdependent and inseparable relationships between individual sectors (from production to waste disposal) and characteristics (health-promoting, sustainable, resilient, diverse, fair, economically balanced, and transparent) of the system.



These principles should not be construed as endorsement by any organization of any specific policy or policies. The collaborative process was led by a Food Systems and Public Health Conference Work Team funded by the W.K. Kellogg Foundation.

References

- ¹ Iowa Department of Public Health. *Topical supplements to the 2009 Iowa chronic disease report*. 2011. Available at http://www.idph.state.ia.us/apl/common/pdf/health_statistics/chronic_disease_report_2011.pdf.
- ² National Prevention Council. *National Prevention Strategy*. Washington, DC: US Department of Health and Human Services, Office of the Surgeon General, 2011.
- ³ Tagtow A, Roberts S. *Cultivating Resilience: A Food System Blueprint that Advances the Health of Iowans, Farms and Communities*. February 2011. Available at www.IowaFoodSystemsCouncil.org/cultivating-resilience/.
- ⁴ Cornell University. *Discovering the Food System: A Primer on Community Food Systems*. Available at <http://www.discoverfoodsys.cornell.edu/primer.html>. Accessed March 24, 2013.
- ⁵ Garrett S, G Feenstra. 1999. *Growing a Community Food System*. Pullman, WA: Western Rural Development Center.
- ⁶ Gussow J, Clancy K. Dietary Guidelines for Sustainability. *J Nutr Ed*. 1986;18:1-5
- ⁷ Cornell University. Ibid.
- ⁸ Tagtow A, Roberts S. *Cultivating Resilience: A Food System Blueprint that Advances the Health of Iowans, Farms and Communities*. February 2011. Available at www.IowaFoodSystemsCouncil.org/cultivating-resilience/.
- ⁹ Tagtow A, Roberts S. Ibid.
- ¹⁰ American Public Health Association. *Toward a Healthy, Sustainable Food System*. Policy Statement.2007. Available at <http://www.apha.org/advocacy/policy/policysearch/default.htm?id=1361>
- ¹¹ American Public Health Association. Ibid.
- ¹² American Planning Association. *Principles of a Healthy, Sustainable Food System*. Available at <http://www.planning.org/nationalcenters/health/foodprinciples.htm>
- ¹³ FAO. 1999a. *Agricultural Biodiversity, Multifunctional character of Agriculture and Land Conference, Background Paper 1*. Maastricht, Netherlands. September 1999
- ¹⁴ USDA Agricultural Marketing Services. *Definition of Specialty Crops*. Available at <http://www.ams.usda.gov/AMSV1.0/scbgpdefinitions>. Accessed May 29, 2013.
- ¹⁵ United States Department of Agriculture. 2007 Census of Agriculture. Iowa Data. USDA National Agricultural Statistics Service, December 2009.
- ¹⁶ Swenson D. *The Economic Impact of Fruit and Vegetable Production in Southwest Iowa Considering Local and Nearby Metropolitan Markets*. Iowa State University, Leopold Center for Sustainable Agriculture. <http://www.leopold.iastate.edu/sites/default/files/pubs-and-papers/2010-01-economic-impact-fruit-and-vegetable-production-southwest-iowa-considering-local-and-nearby-metropoli.pdf>. Accessed March 24, 2013.
- ¹⁷ Swenson D. Ibid.
- ¹⁸ Gilchrist M, Greko C, Wallinga D, Beran G, Riley D, Thorne P. The potential role of concentrated animal feeding operations in infectious disease epidemics and antibiotic resistance. *Environ Health Perspect*. 2007;115:313–316.
- ¹⁹ Compiled by Michael Carolan. Iowa State University, Sociology Department; Updated by Andrew Benjamin, Leopold Center for Sustainable Agriculture, Iowa State University (2002) and US Agriculture Census, 2007. Table 33-Specified Crops by Acres Harvested. http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_1_State_Level/Iowa/st19_1_033_033.pdf.
- ²⁰ Slow Food USA. *Noble Fruits: A Guide to Conserving Heirloom Apples*. http://www.slowfoodusa.org/images/ark_products/SFUSA_Noble_Fruits_Brochure.pdf. Accessed March 23, 2013.
- ²¹ United States Department of Agriculture. 2007 Census of Agriculture. Iowa Data. USDA National Agricultural Statistics Service, December 2009.
- ²² Center for Integrated Agricultural Systems, University of Wisconsin Madison. *Toward a sustainable agriculture*. http://www.cias.wisc.edu/curriculum/modII/seca/modII_seca.htm. Accessed March 28, 2013.
- ²³ Johns T, Eyzaguirre P. Linking biodiversity, diet and health in policy and practice. *Proc Nutr Soc*. 2006;65:182-189.
- ²⁴ Davis D, Epp M, Riordan H. Changes in USDA food composition data for 43 garden crops, 1950-1999. *J Am Coll Nutr*. 2004;23:669-682.
- ²⁵ Halweil B. Still No Free Lunch: Nutrient Levels in the U.S. Food Supply Eroded by Pursuit of High Yields. The Organic Center; September 2007. www.organic-center.org. Accessed March 23, 2013.
- ²⁶ United States Department of Agriculture. 2007 Census of Agriculture. Iowa Data. USDA National Agricultural Statistics Service, December 2009.
- ²⁷ Pirog R, Paskiet Z. *A Geography of Taste. Iowa's Potential for Developing Place-Based and Traditional Foods*. Ames, IA:Leopold Center for Sustainable Agriculture; 2004.
- ²⁸ United States Department of Agriculture. 2007 Census of Agriculture. Iowa Data. USDA National Agricultural Statistics Service, December 2009.
- ²⁹ Swenson D. *The Economic Impact of Fruit and Vegetable Production in Southwest Iowa Considering Local and Nearby Metropolitan Markets*. Iowa State University, Leopold Center for Sustainable Agriculture. <http://www.leopold.iastate.edu/sites/default/files/pubs-and-papers/2010-01-economic-impact-fruit-and-vegetable-production-southwest-iowa-considering-local-and-nearby-metropoli.pdf>. Accessed March 24, 2013.
- ³⁰ Brook N, Regmi A, Jerardo A. U.S. Food Import Patterns, 1998-2007. United States Department of Agriculture, Economic Research Service. http://www.ers.usda.gov/media/157859/fau125_1_.pdf. Accessed March 23, 2013.
- ³¹ Brook N, Regmi A, Jerardo A. Ibid.
- ³² Pimentel D, Greiner A, Bashore T. Economic and environmental costs of pesticide use. *Arch Environ Contam Toxicol*. 1991;21:84-90.
- ³³ Iowa Department of Public Health. *Pesticide Facts*. http://www.idph.state.ia.us/eh/common/pdf/hseess/fs_pesticide.pdf. Accessed March 28, 2013.
- ³⁴ Pesticide Action Network North America Regional Center. *Disrupting the Balance: Ecological Impacts of Pesticides in California*. San Francisco: Autumn Press; 1999.
- ³⁵ Blair A, Zahm SH. Agricultural exposures and cancer. *Environ Health Perspect*. 1995;103(8):205–208.
- ³⁶ Eskenazi B, Bradman A, Castorina R. Exposures of children to organophosphate pesticides and their potential adverse health effects. *Environ Health Perspect*. 1999;107(3):409–419.
- ³⁷ McCauley LA, Lasarev MR, Higgins G, et al. Work characteristics and pesticide exposures among migrant agricultural families: a community-based research approach. *Environ Health Perspect*. 2001;109:533–538.
- ³⁸ Duffy M, Tegtmeier E. External costs of agricultural production in the United States. *Intnl J Agric Sustainability*. 2004;2(1):1-20.
- ³⁹ Environmental Working Group. *Fooling Ourselves*. <http://www.ewg.org/losingground/report/foolingourselves.html>. Accessed March 28, 2013.
- ⁴⁰ Environmental Working Group. Ibid
- ⁴¹ Howard A. *The Soil and Health. A Study of Organic Agriculture*. 2006. Lexington, KY:The University of Kentucky Press.
- ⁴² State News Service. *DNR Issues 2010 State of Environment Report. Washington, DC*: States News Service. April 20, 2010.

- ⁴³ Heffernan A, Galluzzo T, Hoyer W. Solution to Pollution: It Starts on the Farm. Iowa Policy Project. 2010. <http://www.iowapolicyproject.org/2010docs/100927-nutrients.pdf>. Accessed March 24, 2013.
- ⁴⁴ Heffernan A, Galluzzo T, Hoyer W. Ibid.
- ⁴⁵ Environmental Protection Agency. Future Climate Change. U.S. EPA. <http://www.epa.gov/climatechange/science/future.html#Precipitation>. Accessed March 28, 2013.
- ⁴⁶ National Gardening Association. The Impact of Home and Community Gardening In America. <http://www.gardenresearch.com/files/2009-Impact-of-Gardening-in-America-White-Paper.pdf>. Accessed March 23, 2013.
- ⁴⁷ Draper C, Freedman D. Review and analysis of the benefits, purposes, and motivations association with community gardening in the United States. *J Comm Practice*. 2010;18:458-492.
- ⁴⁸ Hendrickson M, Heffernan WD, Howard PH, Heffernan JB. Consolidation in food retailing and dairy. *Brit Food J*. 2001;103(10):715-728.
- ⁴⁹ United States Department of Agriculture, Economic Research Service. 2007 U.S. Census of Agriculture. http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_1_State_Level/Iowa/st19_1_001_001.pdf. Accessed March 22, 2013.
- ⁵⁰ United States Department of Agriculture, Economic Research Service. 2007 U.S. Census of Agriculture. Ibid.
- ⁵¹ Sources: 2007 Census of Agriculture, State Profile; http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/County_Profiles/Iowa/index.asp; 1997 and 2002 State Profiles: http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1,_Chapter_1_State_Level/Iowa/st19_1_002_002.pdf
- ⁵² Food and Water Watch. Economic Cost of Food Monopolies. 2012. <http://documents.foodandwaterwatch.org/doc/CostofFoodMonopolies.pdf>. Accessed March 26, 2013.
- ⁵³ Gundersen C, Offutt S. Farm Poverty and Safety Nets. *Am J Agric Econ*. 2005;87(4),885-899.
- ⁵⁴ Virginia Cooperative Extension. Beef Cattle Breeds and Biological Types. <http://pubs.ext.vt.edu/400/400-803/400-803.html>. Accessed March 26, 2013.
- ⁵⁵ American Livestock Breeds Conservancy. Cattle. <http://www.albc-usa.org/cpl/cattle.html>. Accessed March 26, 2013.
- ⁵⁶ American Livestock Breeds Conservancy. Why Study Rare Breeds? <http://www.albc-usa.org/EducationalResources/NATonline/rarebreeds.html>. Accessed March 26, 2013.
- ⁵⁷ American Livestock Breeds Conservancy. Ibid.
- ⁵⁸ Detilleux J. Genetic resistance and diseases. The 26th European Holstein and Red Holstein Conference, Prague 2005 Session 2. <http://www.whff.info/info/conferences/ehc2005/detilleux.pdf>. Accessed March 26, 2013.
- ⁵⁹ Thompson I, Mackey B, McNulty S, Mosseler A. *Forest Resilience, Biodiversity, and Climate Change. A synthesis of the biodiversity/resilience/stability relationship in forest ecosystems*. Secretariat of the Convention on Biological Diversity, Montreal. 2009. Technical Series no. 43, 67 pages. Available at <http://www.cbd.int/doc/publications/cbd-ts-43-en.pdf>.
- ⁶⁰ Awiti A. Biological diversity and resilience: lessons from the recovery of cichlid species in Lake Victoria. *Ecology and Society*. 2011; 16(1): 9. Available at <http://www.ecologyandsociety.org/vol16/iss1/art9/>
- ⁶¹ Sgro C, Lowe A, Hoffman A. Building evolutionary resilience for conserving biodiversity under climate change. *Evol Appl*. 2011;4(2):326-337. Available at <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3352557/>.
- ⁶² Pew Health Initiatives. Pew Campaign on Human Health and Industrial Farming. The Pew Charitable Trusts. <http://www.pewhealth.org/projects/pew-campaign-on-human-health-and-industrial-farming-85899367226>. Accessed March 22, 2013.
- ⁶³ *Antibiotics and food. Food and Environment Update*. Cambridge, MA: Union of Concerned Scientists;2006.
- ⁶⁴ *Antibiotic resistance. Federal Agencies Need to Better Focus Efforts to Address Risk to Humans from Antibiotic Use in Animals. Report to Congressional Requesters*. Washington, DC: General Accounting Office; April 2004.
- ⁶⁵ Testimony of Joshua M. Sharfstein, M.D. Antibiotic Resistance and the Use of Antibiotics in Animal Agriculture. United States Food and Drug Administration.
- ⁶⁶ Food and Drug Administration. *Facts about Antibiotic Resistance*. Washington, DC.
- ⁶⁷ Smith TC, Male MJ, Harper AL et al. Methicillin-Resistant *Staphylococcus aureus* (MRSA) Strain ST398 Is Present in Midwestern U.S. Swine and Swine Workers (MRSA in Swine and Caretakers). *PLoS ONE*. 2009;4(1):e4258.
- ⁶⁸ University of Iowa, College of Public Health. Sharing Staph. <http://cph.uiowa.edu/media/web-features/spotlights/040609-MRSA.html>. Accessed March 27, 2013.
- ⁶⁹ Worldwatch Institute. *Vital Signs 1998*. New York:W.W. Norton, 1998.
- ⁷⁰ Krouse L, Galluzzo T. Iowa's Local Food Systems: A Place to Grow. The Iowa Policy Project. February 2007. <http://www.iowapolicyproject.org/2007docs/070206-LocalFood.pdf>. Accessed March 24, 2013.
- ⁷¹ Pimentel, David and Marcia Pimentel. Sustainability of Meat-based and Plant-based Diets and the Environment. *Am J Clin Nutr*. 2003;78:660s-63s.
- ⁷² Pimentel D, Houser J, Preiss E, et al. Water resources: agriculture, the environment, and society. *BioScience*. 1997;47(2):97-106.
- ⁷³ Pimentel D, Pimentel M, eds. *Food, Energy and Society*. Niwot, CO:University of Colorado Press, 1996.
- ⁷⁴ Steinfeld H, Garber P, Wassenaar T, Castel V, Rosales M, de Haan C. *Livestock's Long Shadow*. Rome, Italy: Food and Agriculture Organization of the United Nations. 2006. www.virtualcentre.org/en/library/key_pub/longshad/A0701E00.htm. Accessed March 22, 2013.
- ⁷⁵ Kirschenman F. Distinguished Fellow, Leopold Center for Sustainable Agriculture, Iowa State University. The Future of Agriculture – Part 1. 2009. Cooking Up a Story Video. Available at <http://www.youtube.com/watch?v=8TDjIOsWtcA>.
- ⁷⁶ US Department of Agriculture. FY 2005 Annual Report: Manure and Byproduct Utilization National Program 206. www.ars.usda.gov/research/programs/programs.htm?np_code=206&docid=13337. Accessed March 22, 2013.
- ⁷⁷ Herriges JA, Secchi S, Babcock BA. *Living with Hogs in Iowa: The Impact of Livestock Facilities on Rural Residential Property Values*. *Land Economics*. 2005;81(4):530-545.
- ⁷⁸ Solomon E, Yaron S, Matthews K. Transmission of *Escherichia coli* O157:H7 from contaminated manure and irrigation water to lettuce plant tissue and its subsequent internalization. *Appl Environ Microbiol*. 2002;68(1):397-400.
- ⁷⁹ Burkholder J, Libra B, Wichman M. Impacts of waste from concentrated animal feeding operations on water quality. *Environ Health Perspect*. 2007;115(2):308-312.
- ⁸⁰ US Department of Agriculture. FY 2005 Annual Report: Manure and Byproduct Utilization National Program 206. www.ars.usda.gov/research/programs/programs.htm?np_code=206&docid=13337. Accessed March 22, 2013.

- 81 Donham KJ, Wing S, Osterberg D, Flora et al. Community health and socioeconomic issues surrounding concentrated animal feeding operations. *Environ Health Perspect*. 2007;115:317–320.
- 82 Mirabelli MC, Wing S, Marshall SW, Wilcosky TC. Race, poverty, and potential exposure of middle-school students to air emissions from confined swine feeding operations. *Environ Health Perspect*. 2007;114:591–596.
- 83 Daley CA, Abbott A, Doyle PS, Nader GA, Larson S. A review of fatty acid profiles and antioxidant content in grass-fed and grain-fed beef. *Nutr J*. 2010;9:10.
- 84 Simopoulos AP. The importance of the ratio of omega-6/omega-3 essential fatty acids. *Biomed Pharmacol*. 2002;56(8):365–379.
- 85 Iowa DNR. Fishkill Database. <https://programs.iowadnr.gov/fishkill/search.aspx?std=mod>. Accessed March 27, 2013.
- 86 Virginia Cooperative Extension. Fish kills: their causes and prevention. Virginia Tech. <http://pubs.ext.vt.edu/420/420-252/420-252.html>. Accessed March 27, 2013.
- 87 "Researchers take novel approach to honey bee plight." Western Farm Press [Online Exclusive] 20 June 2012. *Business Insights: Essentials*. http://bi.galegroup.com.proxy.lib.iastate.edu/essentials/article/GALE%7CA293852760/88e509fa8d38cc7d6c5ac27e73015763?u=iastu_main. Accessed March 27, 2013.
- 88 "Researchers take novel approach to honey bee plight." Western Farm Press. Ibid.
- 89 Roulston TH, Goodell K. The Role of Resources and Risks in Regulating Wild Bee Populations. *Annu Rev Entomol*. 2011;56:293–312
- 90 Agricultural Service, United States Department of Agriculture. Honey Bees and Colony Collapse Disorder. <http://www.ars.usda.gov/News/docs.htm?docid=15572>. Accessed March 27, 2013.
- 91 Food and Agriculture Organization of the United Nations. Biodiversity for a world without hunger. Pollinators page. Available at <http://www.fao.org/biodiversity/components/pollinators/en/>.
- 92 Mentzer Morrison R, Buzby JC, Wells HF. Guess Who's turning 100? Tracking a Century of American Eating. United States Department of Agriculture, Economic Research Service. *Amber Waves*. 2010; 8(1):12–19. <http://ageconsearch.umn.edu/bitstream/122141/2/01TrackingACentury.pdf>. Accessed March 21, 2013.
- 93 Caprio S, Daniels S, Drewnowski A, et al. Influence of Race, Ethnicity, and Culture on Childhood Obesity: Implications for Prevention and Treatment: A consensus statement of Shaping America's Health and the Obesity Society. *Diabetes Care*. 2008; 31:2211–2221.
- 94 Drewnowski A. Obesity, diets, and social inequalities. *Nutr Rev*. 2009;67:S36–S39.
- 95 Center for Disease Control and Prevention. Investigation Update: Multistate Outbreak of Human Salmonella Enteritidis Infections Associated with Shell Eggs. Center for Disease Control and Prevention. <http://www.cdc.gov/salmonella/enteritidis/index.html>. Accessed March 21, 2013.
- 96 Centers for Disease Control and Prevention. CDC Estimates of Food Borne Illness in the United States. Centers for Disease Control and Prevention. <http://www.cdc.gov/foodborneburden/2011-foodborne-estimates.html>. Accessed March 18, 2013.
- 97 Iowa Department of Public Health. Iowa Surveillance of Notifiable and Other Diseases, Annual Report 2011. Iowa Department of Public Health. <http://www.idph.state.ia.us/IDPHChannelsService/file.ashx?file=183BEA63-682C-433D-814A-AC86AD004C4C>. Accessed March 21, 2013.
- 98 United States Bureau of Labor Statistics. Table SNR02. Highest incidence rates of nonfatal occupational injury and illness cases with days away from work, restricted work activity, or job transfer, private industry, 2002. www.bls.gov/iif/oshwc/osh/os/ostb1223.pdf. Accessed March 18, 2013.
- 99 Passel JS. 2006. The Size and Characteristics of the Unauthorized Migrant Population in the U.S. Estimates Based on the March 2005 Current Population Survey. Pew Hispanic Center.
- 100 Midwest Coalition for Human Rights. Always Working Beyond the Capacity of Our Bodies: Meat and Poultry Processing Work Conditions and Human Rights in the Midwest, A Report by the Midwest Coalition for Human Rights. The University of Minnesota, Human Rights Program in the Institute of Global Studies. 2012. <http://www.midwesthumanrights.org/resources/Meatpacking%20Report%20v5.pdf>. Accessed March 21, 2013.
- 101 2007 Economic Census, Manufacturing, Iowa Data, available at http://factfinder.census.gov/servlet/IBQTable?_bm=y&-geo_id=04000US19&-fds_name=EC0700A1&-ds_name=EC0731A1&-lang=en38.
- 102 US Census Bureau, Sector 31: EC0731A1: Manufacturing: Geographic Area Series: Industry Statistics for the States, Metropolitan and Micropolitan Statistical Areas, Counties, and Places: 2007.
- 103 Hendrickson M, Heffernan W. Concentration of Agricultural Markets. Columbia, MO: University of Missouri; 2007. <http://www.foodcircles.missouri.edu/consol.htm>. Accessed March 18, 2013.
- 104 Personal correspondence. Arion Thiboumery, Iowa State University to Angie Tagtow; email dated March 20, 2008.
- 105 Swenson D. Exploring small-scale meat processing expansions in Iowa. A technical report submitted to the Leopold Center for Sustainable Agriculture. 2011. Available at <http://www.leopold.iastate.edu/sites/default/files/pubs-and-papers/2011-04-exploring-small-scale-meat-processing-expansions-iowa.pdf>.
- 106 Canning P, Charles A, Huang S, Polenske K, Waters A. Energy Use in the U.S. Food System. United States Department of Agriculture, Economic Research Service. 2010.
- 107 Kirschenmann F. Ibid
- 108 Federal Trade Commission. Marketing Food to Children and Adolescents: A Review of Industry Expenditures, Activities, and Self-Regulation. 2008. <http://www.ftc.gov/os/2008/07/P064504foodmktgreportappendices.pdf>. Accessed March 21, 2013.
- 109 Yale Rudd Center for Food Policy and Obesity. Where children and adolescents view food and beverage ads on TV: Exposure by channel and program. March, 2013. http://www.yaleruddcenter.org/resources/upload/docs/what/reports/Rudd_Report_TV_Ad_Exposure_Channel_Program_2013.pdf. Accessed March 27, 2013.
- 110 Lasater G, Piernas C, Popkin BM. Beverage patterns and trends among school-aged children in the US, 1989–2008. *Nutr J*. 2011;10:103.
- 111 Harvard School of Public Health. Sugary Drinks and Obesity Fact Sheet. Harvard School of Public Health. <http://www.hsph.harvard.edu/nutritionsource/sugary-drinks-fact-sheet/>. Accessed March 21, 2013.
- 112 Ludwig DS, Peterson KE, Gortmaker SL. Relation between consumption of sugar-sweetened drinks and childhood obesity: a prospective, observational analysis. *Lancet*. 2001;357:505–8.
- 113 Silverglad B, Ringel Heller I. Food Labeling Chaos. The Case for Reform. Center for Science in the Public Interest. 2010. Available at http://www.cspinet.org/new/pdf/food_labeling_chaos_report.pdf.
- 114 Howard P, Allen P. Beyond organic: consumer interest in new labeling schemes in the Central Coast of California. *International J Cons Studies*. 2006;30(5):439–451.
- 115 National Good Food Network. Regional Food Hub Resource Guide. April 2012. Available at <http://ngfn.org/resources/food-hubs/food-hubs>.

- 116 Pirog R, Benjamin A. Checking the food odometer: Comparing food miles for local versus conventional produce sales to Iowa institutions. <http://www.leopold.iastate.edu/sites/default/files/pubs-and-papers/2003-07-checking-food-odometer-comparing-food-miles-local-versus-conventional-produce-sales-iowa-institution.pdf>. Accessed March 20, 2013.
- 117 Pirog R, Benjamin A. Ibid.
- 118 Kalt W. Effects of production and processing factors on major fruit and vegetable antioxidants. *J Food Sci.* 2005;70:R11–R19.
- 119 Agricultural Marketing Service, United States Department of Agriculture. Regional Food Hub Resource Guide. April 2012. <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5097957>) Accessed March 20, 2013.
- 120 Agricultural Marketing Service, United States Department of Agriculture. Working List of Food Hubs. <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5091437>. Accessed March 27, 2013.
- 121 Hendrickson M, Heffernan WD, Howard PH, Heffernan JB. Consolidation in food retailing and dairy. *Brit Food J.* 2001;103(10):715-728.
- 122 Iowa Grocery Industry Association. Email correspondence with Peggy Sellner. April 25, 2013. The largest retailers in Iowa are Hy-Vee, Wal-Mart, and Fareway.
- 123 Kelly M, Ratner S. Keeping wealth local: Shared ownership and wealth control for rural communities. For the Ford Foundation's Wealth Creation in Rural Communities. November 2009. <http://www.yellowwood.org/Keeping%20Wealth%20Local.pdf>. Accessed March 20, 2013.
- 124 Center for Resilient Cities. Green Jobs in a Sustainable Food System. http://www.resilientcities.org/Resilient_Cities/FOOD_SYSTEMS_files/Green%20Jobs%20in%20a%20Sustainable%20Food%20System.pdf. Accessed March 27, 2013.
- 125 Gilchrist MJ, Greko C, Wallinga DB, Beran GW, Riley DG, Thorne PS. The potential role of concentrated animal feeding operations in infectious disease epidemics and antibiotic resistance. *Environ Health Persp.* 2007;115:313–316.
- 126 Hendrickson M, Heffernan WD, Howard PH, Heffernan JB. Consolidation in food retailing and dairy. *Brit Food J.* 2001;103(10):715-728.
- 127 Weber CL, Matthews HS. Food-miles and the Relative Climate Impacts on Food Choices in the United States. *Environ Sci Technol.* 2008;42:3508-3513. <http://pubs.acs.org/doi/pdfplus/10.1021/es702969f>. Accessed March 20, 2013.
- 128 Kirschenmann F. Ibid
- 129 Centers for Disease Control and Prevention. State Indicator Report on Fruits and Vegetables, 2009. <http://www.cdc.gov/nutrition/downloads/StateIndicatorReport2009.pdf>. Accessed March 20, 2013.
- 130 Centers for Disease Control and Prevention. Ibid.
- 131 Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention and Health Promotion. Division of Nutrition, Physical Activity and Obesity. *Healthier Food Retail: Beginning the Assessment Process in Your State or Community.* 2012. Available at <http://www.cdc.gov/obesity/downloads/hfrassessment.pdf>.
- 132 United States Department of Agriculture. USDA Community Food Security Assessment Toolkit. http://www.ers.usda.gov/media/327643/efan02013a_1.pdf. Accessed March 21, 2013.
- 133 Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19-22 June 1946; signed on 22 July 1947 by the representatives of 61 States (Official Records of the World Health Organization, no.2, p. 100); and entered into force on 7 April 1948.
- 134 Andersen SA. Core Indicators of Nutritional State for Difficult to Sample Populations. *J Nutr.* 1990;120:1557S-1600S.
- 135 Stone KE, Artz GM. *Trends for Iowa Retail Businesses. Iowa Retail Trade Data by Industry, FY76-FY2000.* Ames, IA: Iowa State University, University Extension; 2001.
- 136 Chung C, Myers SL. Do the poor pay more for food? An analysis of grocery store availability and food price disparities. *J Consum Aff.* 1999;33: 276–96.
- 137 Gallagher M. *Examining the Impacts of Food Deserts on Public Health in Chicago.* Chicago, IL: Mari Gallagher Research & Consulting Group; 2006. <http://www.lasallebank.com/about/stranded.html>. Accessed March 20, 2013.
- 138 Furey, S., Strugnell, C., McIlveen, H. An investigation of the potential existence of “Food Deserts” in rural and urban areas of Northern Ireland. *Agric Human Values.* 2001;18,447–457.
- 139 Morton LW, Bitto EA, Oakland MJ, Sand M. Solving the Problems of Iowa Food Deserts: Food Insecurity and Civic Structure. *Rural Sociol.* 2005;70(1):94-112.
- 140 Carlsson-Kanyama A, Ekstrom M, Shanahan H. Food and life cycle energy inputs: Consequences of diet and ways to increase efficiency. *Ecol Econ.* 2003;1-15.
- 141 United States Department of Agriculture, Economic Research Service. http://www.ers.usda.gov/data-products/state-fact-sheets/state-data.aspx?StateFIPS=19&StateName=Iowa#Pb8fb78f9eccd7460097aaefc5f4730262_2_39i0. Accessed March 21, 2013.
- 142 Feeding America. Map the Food Gap. Food Insecurity in Your County. <http://feedingamerica.org/hunger-in-america/hunger-studies/map-the-meal-gap.aspx>. Accessed March 28, 2013.
- 143 United States Department of Agriculture, Food and Nutrition Service. National and State-Level Estimates of Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Eligibles and Program Reach, 2010. <http://www.fns.usda.gov/Ora/menu/Published/WIC/FILES/WICEligibles2010Vol1.pdf>. Accessed March 28, 2013.
- 144 Cunningham K, Sukasih A, Castner L. Estimates of State Supplemental Nutrition Assistance Program Participation Rates in 2008-2010 for All Eligible People and the Working Poor, February 2013. United States Department of Agriculture, Food and Nutrition Service. <http://www.fns.usda.gov/ora/MENU/Published/snap/FILES/Participation/Techpartrate2008-2010.pdf>. Accessed March 28, 2013.
- 145 Congressional Budget Office. The Supplemental Nutrition Assistance Program – Infographic. Congressional Budget Office. <http://www.cbo.gov/publication/43174>. Accessed March 20, 2013.
- 146 United States Department of Agriculture, Food & Nutrition Service. WIC Program: Total Participation. USDA, Food & Nutrition Service. <http://www.fns.usda.gov/pd/26wifypart.htm>. Accessed March 21, 2013.
- 147 United States Department of Agriculture, Food & Nutrition Service. WIC Program: Food Cost. USDA, Food & Nutrition Service. [http://www.fns.usda.gov/pd/24wicfood\\$.htm](http://www.fns.usda.gov/pd/24wicfood$.htm). Accessed March 21, 2013.
- 148 Position of the American Dietetic Association: Food Insecurity in the United States. *J Am Diet Assoc.* 2010;110:1368-1377.
- 149 Ratcliffe C, Mckernan SM, Zhang S. How Much Does the Supplemental Nutrition Assistance Program Reduce Food Insecurity? *Am J Agric Econ.* 2011;93(4):1082-1098.
- 150 [Metallinos-Katsaras E](#), [Gorman KS](#), [Wilde P](#), [Kallio J](#). A longitudinal study of WIC participation on household food insecurity. *Matern Child Health J.* 2011;15(5):627-33.

- 151 Brown L, Shepherd D, Martin T, Orwat J. The Economic Cost of Domestic Hunger. Estimated burden to the U.S. The Sodexo Foundation; 2007. http://www.sodexofoundation.org/hunger_us/newsroom/studies/hungerstudies/costofhunger.asp. Accessed March 21, 2013.
- 152 Iowa Food Waste Reduction Project. The Food Waste Impact Page. Available at <http://iowaenviroassist.org/index.cfm/services/food-waste/>. Accessed July 29, 2013.
- 153 Table to Table. <http://www.table2table.org/home.html>. Accessed March 28, 2013.
- 154 Bray G, Joy-Nielsen S, Popkin B. Consumption of high-fructose corn syrup in beverages may play a role in the epidemic of obesity. *Am J Clin Nutr*. 2004;79(4):537-543.
- 155 Singh GK, Siahpush M, Kogan MD. Rising social inequalities in US childhood obesity, 2003-2007. *Ann Epidemiol*. 2010;20(1):40-52.
- 156 National Institutes of Health. Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in adults. The Evidence Report. 1998. http://www.nhlbi.nih.gov/guidelines/obesity/ob_gdlns.pdf. Accessed March 25, 2013.
- 157 Trogdon JG, Finkelstein EA, Feagan CW, Cohen JW. State- and payer-specific estimates of annual medical expenditures attributable to obesity. *Obesity*. 2012;20(1):214-20.
- 158 Iowa Department of Public Health. Health in Iowa Annual Report from the Behavioral Risk Factor Surveillance System. 2011. Available at <http://www.idph.state.ia.us/brfss/common/pdf/2011BRFSSannual.pdf>. Accessed July 29, 2013.
- 159 Iowa Consortium for Substance Abuse Research and Evaluation. 2012 Iowa Youth Survey. State of Iowa Results. 2013. Available at http://www.iowayouthsurvey.iowa.gov/images/2012_State/IYS_State_Report_2012.pdf. Accessed July 29, 2013.
- 160 Leung CW, Ding EL, Catalano PJ, Villamor E, Rimm EB, Willett WC. [Dietary intake and dietary quality of low-income adults in the Supplemental Nutrition Assistance Program](#). *Am J Clin Nutr*. 2012;96(5):977-989.
- 161 Steinmetz KA, Potter JD. Vegetables, fruit, and cancer prevention: a review. *J Am Diet Assoc*. 1996;96(10):1027-1040.
- 162 Willett WC. Diet and health: what should we eat? *Science*. 1994;264(5158):532-538.
- 163 Reijnders L, Soret S. Quantification of the environmental impact of different dietary protein choices. *Am J Clin Nutr*. 2003;78(3):6645-6685.
- 164 Canning P, Charles A, Huang S, Polenske K, Waters A. Energy Use in the U.S. Food System. United States Department of Agriculture, Economic Research Service. 2010.
- 165 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.
- 166 Kirschenmann F. Ibid.
- 167 French SA, Lin BH, Guthrie JF. National trends in soft drink consumption among children and adolescents age 6 to 17 years: Prevalence, amounts, and sources, 1977/1978 to 1994/1998. *J Am Diet Assoc*. 2003;103(10):1326-1331.
- 168 Center for Disease Control and Prevention. NCHS Data Brief, Consumption of Sugar Drinks in the United States, 2005-2008. August 2011. <http://www.cdc.gov/nchs/data/databriefs/db71.htm>. Accessed March 26, 2013.
- 169 Duffey KJ, Popkin BM. Shifts in patterns and consumption of beverages between 1965 and 2002. *Obesity*. 2007;15(11):2739-2747.
- 170 Lasater G, Piernas C, Popkin BM. Beverage patterns and trends among school-aged children in the US, 1989-2008. *Nutr Journal*. 2011;10:103.
- 171 Ludwig DS, Peterson KE, Gortmaker SL. Relation between consumption of sugar-sweetened drinks and childhood obesity: a prospective, observational analysis. *Lancet*. 2001;357:505-8.
- 172 Harvard School of Public Health. Sugary Drinks and Obesity Fact Sheet. <http://www.hsph.harvard.edu/nutritionsource/sugary-drinks-fact-sheet/>. Accessed March 21, 2013.
- 173 Weimer J. The economic benefits of breastfeeding: A review and analysis. U.S. Department of Agriculture Economic Research Service. <http://www.ers.usda.gov/publications/fanrr13/fanrr13.pdf>. Accessed March 25, 2013.
- 174 Email correspondence with Nancy Anderson, WIC Director, Operation Threshold, Waterloo, Iowa. March 27, 2013.
- 175 [Position of the American Dietetic Association: Promoting and Supporting Breastfeeding](#). *J Am Diet Assoc*. 2009;109(11):1926-1942.
- 176 Centers for Disease Control and Prevention. (2011). *Maternity practices in infant nutrition and care in Iowa*. Atlanta, GA. http://www.cdc.gov/breastfeeding/pdf/mPINC/states/mPINC_2007_iowa.pdf. Accessed March 25, 2013.
- 177 [Position of the American Dietetic Association: Promoting and Supporting Breastfeeding](#). *J Am Diet Assoc*. 2009;109(11):1926-1942.
- 178 Weimer J. The economic benefits of breastfeeding: A review and analysis. United States Department of Agriculture, Economic Research Service. <http://www.ers.usda.gov/publications/fanrr13/fanrr13.pdf>. Accessed March 25, 2013.
- 179 College of Family and Consumer Science. TREND STATEMENT – Home Food Preservation. University of Georgia. <http://www.fcs.uga.edu/ext/trendstatements/preservation.pdf>. Accessed March 25, 2013.
- 180 College of Family and Consumer Science. Ibid.
- 181 Iowa Department of Public Health. Iowa Surveillance of Notifiable and Other Diseases, Annual Report 2011. Iowa Department of Public Health. <http://www.idph.state.ia.us/IDPHChannelsService/file.ashx?file=183BEA63-682C-433D-814A-AC86AD004C4C>. Accessed March 26, 2013.
- 182 Iowa Department of Public Health. Ibid.
- 183 Institutes of Medicine. 2012. *Exploring health and environmental costs of food: Workshop summary*. Washington, DC: The National Academies Press.
- 184 Iowa Department of Natural Resources. Composting and Organics. <http://www.iowadnr.gov/Environment/LandStewardship/WasteManagement/CompostingOrganics.aspx>. Accessed March 21, 2013.
- 185 MSW Consultants. 2011 Iowa Statewide Waste Characterization Study. Iowa Department of Natural Resources. <http://www.iowadnr.gov/Portals/idnr/uploads/waste/wastecharacterization2011.pdf>. Accessed March 21, 2013.
- 186 MSW Consultants. Ibid
- 187 MSW Consultants. Ibid.
- 188 ATSDR. Atlanta, GA: Agency for Toxic Substances and Disease Registry; 2001. Landfill Gas Primer: An Overview for Environmental Health Professionals. <http://www.atsdr.cdc.gov/HAC/landfill/html/intro.html>. Accessed March 26, 2013.
- 189 US Environmental Protection Agency. Landfill Methane Outreach Program. The Basic Information page. Available at <http://www.epa.gov/lmop/basic-info/>. Accessed July 29, 2013.
- 190 US Environmental Protection Agency. Climate Change. The Overview of Greenhouse Gases page. Available at <http://epa.gov/climatechange/ghgemissions/gases/ch4.html>. Accessed July 29, 2013.
- 191 Elliott P, Briggs D, Morris S. Risk of adverse birth outcomes in populations living near landfill sites. *Brit Med J*. 2001;323:363-368.
- 192 Goldberg M, Al-Homsi N, Goulet L, Riberdy H. Incidence of cancer among persons living near a municipal solid waste landfill in Montreal, Quebec. *Arch Environ Health*. 1995;50:416-424.

-
- ¹⁹³ Goldberg M, Goulet L, Riberdy H, Bonvalot Y. Low birth weight and preterm births among infants born to women living near a municipal solid waste landfill in Montreal, Quebec. *Environ Res.* 1995;69:37–50.
- ¹⁹⁴ Goldberg M, Siemiatyck J, DeWar R, Desy M, Riberdy H. Risks of developing cancer relative to living near a municipal solid waste landfill site in Montreal, Quebec, Canada. *Arch Environ Health.* 1999;54:291–296.
- ¹⁹⁵ Hertzman C, Hayes M, Singer J, Highland J. Upper Ottawa Street landfill site health study. *Environ Health Perspect.* 1987;75:173–195.
- ¹⁹⁶ Passchier-Vermeer W, Passchier W. Noise exposure and public health. *Environ Health Perspect.* 2000;108(suppl 1):123–131.
- ¹⁹⁷ Mohai P, Pellow D, Roberts JT. Environmental Justice. *Ann Rev Environ Resour.* 2009;34:405–430.
- ¹⁹⁸ Norton JM, Wing S, Lipscomb HJ, Kaufman JS, Marshall SW, Cravey AJ. Race, wealth, and solid waste facilities in North Carolina. *Environ Health Perspect.* 2007;115(9):1344–1350.
- ¹⁹⁹ North Carolina Division of Waste Management. *Report to the North Carolina General Assembly on the Inactive Hazardous Sites Program.* Raleigh, NC: NC Department of Environment and Natural Resources; 2003.
- ²⁰⁰ United States, Environmental Protection Agency. Safer Disposal for Solid Waste: The Federal Regulations for Landfills. 1993. <http://www.epa.gov/garbage/safedis/safedis.pdf>. Accessed March 26, 2013.
- ²⁰¹ Christenson SC, Cozzarelli IM. The Norman Landfill Environmental Research Site. What Happens to the Waste in Landfills. U.S. Geological Survey Fact Sheet. 2003. U.S. Geological Survey. <http://pubs.usgs.gov/fs/fs-040-03/>. Accessed March 26, 2013.
- ²⁰² Eyles J, Taylor S, Johnson N, Baxter J. Worrying about waste: living close to solid waste disposal facilities in southern Ontario. *Soc Sci Med.* 1993;37:805–812.
- ²⁰³ US Environmental Protection Agency. Inventory of US Greenhouse Gas Emissions and Sinks: 1990–2011. Agriculture - Chapter 6. 2013. Available at <http://epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2013-Chapter-6-Agriculture.pdf>. Accessed July 29, 2013.
- ²⁰⁴ Iowa State University Extension. Gaseous emissions from animal agriculture. 2003. <http://www.extension.iastate.edu/Publications/PM1935.pdf>. Accessed March 26, 2013.
- ²⁰⁵ Iowa State University Extension. Ibid.
- ²⁰⁶ Food and Agriculture Organization. Environmental Impact of Animal Manure Management Systems. Chapter 2 Manure management and effects on the environment. Available at <http://www.fao.org/wairdocs/lead/x6113e/x6113e05.htm>. Accessed July 29, 2013.
- ²⁰⁷ Iowa State University Extension. Ibid.
- ²⁰⁸ Prevention Institute. Spectrum of Prevention: Developing a Comprehensive Approach to Injury Prevention. Available at <http://preventioninstitute.org/component/jlibrary/article/id-105/127.html>.
- ²⁰⁹ Food Recovery Committee, Conference for Food Protection. Comprehensive Guidelines for Food Recovery Programs. March 2007. <http://www.foodprotect.org/media/guide/food-recovery-final2007.pdf>. Accessed March 28, 2013.
- ²¹⁰ United States Department of Agriculture. Let's Glean! United We Serve Toolkit. http://www.usda.gov/documents/usda_gleaning_toolkit.pdf. Accessed March 28, 2013.
- ²¹¹ US Department of Agriculture. Food and Nutrition Services. Best practices for food recovery and gleaning in the National School Lunch Program. Available at <http://www.fns.usda.gov/fdd/gleaning/gleanman.PDF>. Accessed March 28, 2013.