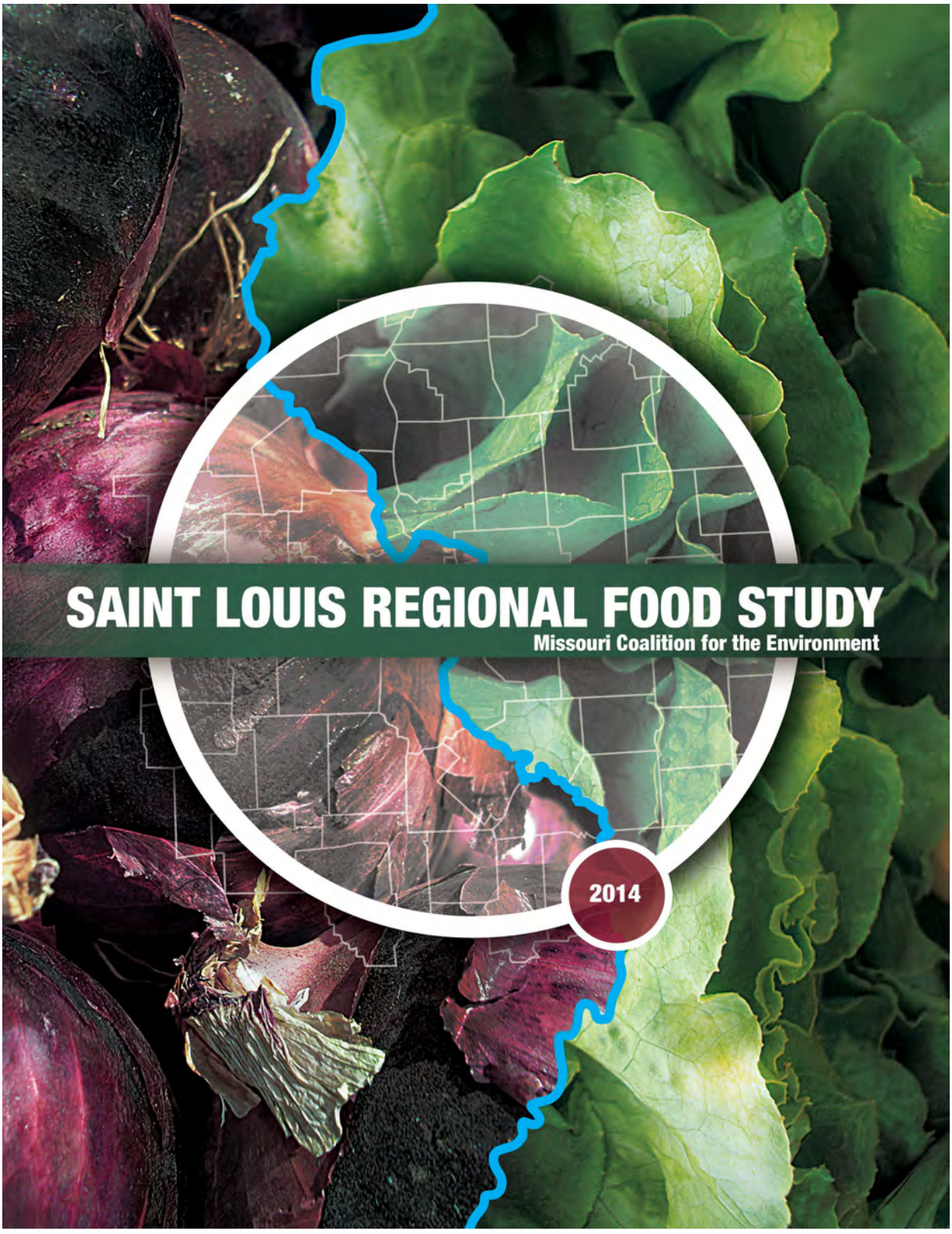
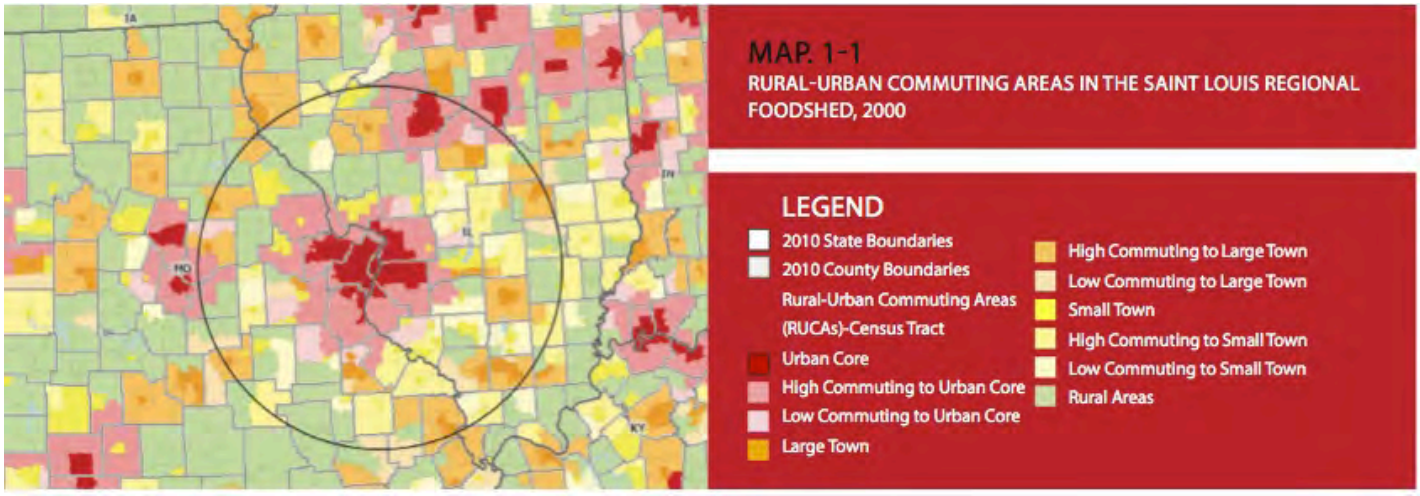
The Saint Louis Regional Food Study
Abridged Report



Chapter 1. The People of the Saint Louis Regional Foodshed

Within the 100-mile radius of Saint Louis, more than 4 million people (4,074,725) live in 59 counties across two states with the nation's most powerful river running between. The "urban core" of the region contains the Missouri counties of Saint Louis City, Saint Louis County, St. Charles, and Jefferson, and the Illinois counties of Monroe, St. Clair, and Madison. These urban core counties are home to 62% of the region's population. We've defined this 100-mile radius as our "Foodshed" to better understand the relationship between our land, our environment, our food, our health and our economy.



The Saint Louis Regional Foodshed contributed to the food system in 2007 with 48,864 farms, 221 Community Supported Agriculture operations (CSAs),[1] and employed 45,217 in the farm industry and 23,978 people as hired farm labor.[2] For a region that identifies with agriculture, less than 2% of the workforce is employed in the sector.

While only a small portion of the population is employed in the agriculture industry, the industry's contribution to the economy affects everyone because everyone spends money on food. Much of the money we spend on food, or our "food dollar," leaves our region, benefiting production, manufacturing, packaging, processing, and transportation industries hundreds and even thousand miles away. While our dollars exit the region, our potatoes and other foods journey thousands of miles to reach our tables.

Still, locally produced, fresh foods usually taste better and have more nutrients than those that have traveled thousands of miles. What are the impacts of what we eat on our health? Can localization of our food system improve our nutritional status? By providing a snapshot of where we are, we hope to inspire readers to find the answers to these questions.

Chapter 2. What We Eat & Our Health

In the Saint Louis Regional Foodshed, we mirror national trends in health which are linked to what we eat. National trends in food consumption have moved toward more and more convenience foods – processed, pre-made, and often containing a number of non-food additives, as well as more salt, fat and sugar. As a result, we overconsume sugars and meats while underconsuming vegetables, whole fruits, and whole grains.

PER CAPITA CONSUMPTION OF MAJOR FOOD GROUPS FROM 1950s & 2009

Food Product	USDA recommended adult consumption (lbs/person/year)	1950-1959 Averaged annual consumption per capita (lbs/person/year)	2009 Estimated annual consumption per capita (lbs/person/year)	2009 Estimated Total Consumption by Foodshed Population (lbs.)
Total Grain Products	136.9 half of which should be of whole grains	155.4	194.5	792,534,012.5
Total meat (beef, veal, lamb & mutton, pork, chicken, turkey, fish & shellfish)	114 -136.85 (5 - 6 ounces of protein per day)	138.2	190.9	777,865,002.5
Total Caloric sweeteners	32.2*	109.6	130.7	532,566,557.5
Vegetables (total)	375 - 547.5 (2-3 cups per day)	338.8	390.9	1,592,810,002.5
Fruits (total)	273.75 - 365 (1.5 - 2 cups per day)	248.7	257.0	1,047,204,325.0
Added fats and oil (fat content only)	22.81 (6 teaspoons per day)	44.6	78.6	320,273,385.0
All dairy products	547.5 (3 cups per day)	703	607.1	473,765,547.5

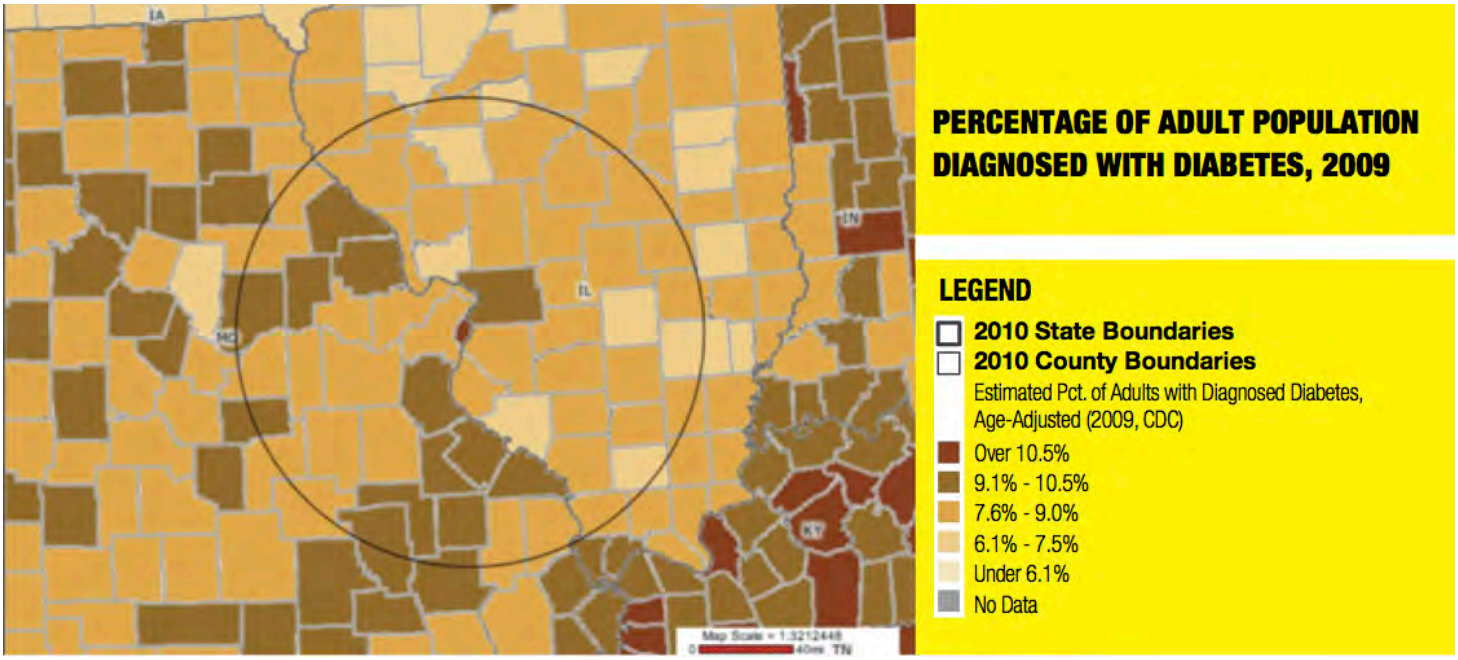
Overall, we are eating more food than previous generations and still getting less nutrition. As our food choices have moved toward convenience over freshness and quality, the food on our tables today has fewer nutrients than foods our grandparents ate. Food also loses nutrients with every mile it travels from the field and with every step it undergoes in processing. Foods that are ultra processed have little to offer our bodies except for (often excessive) calories.

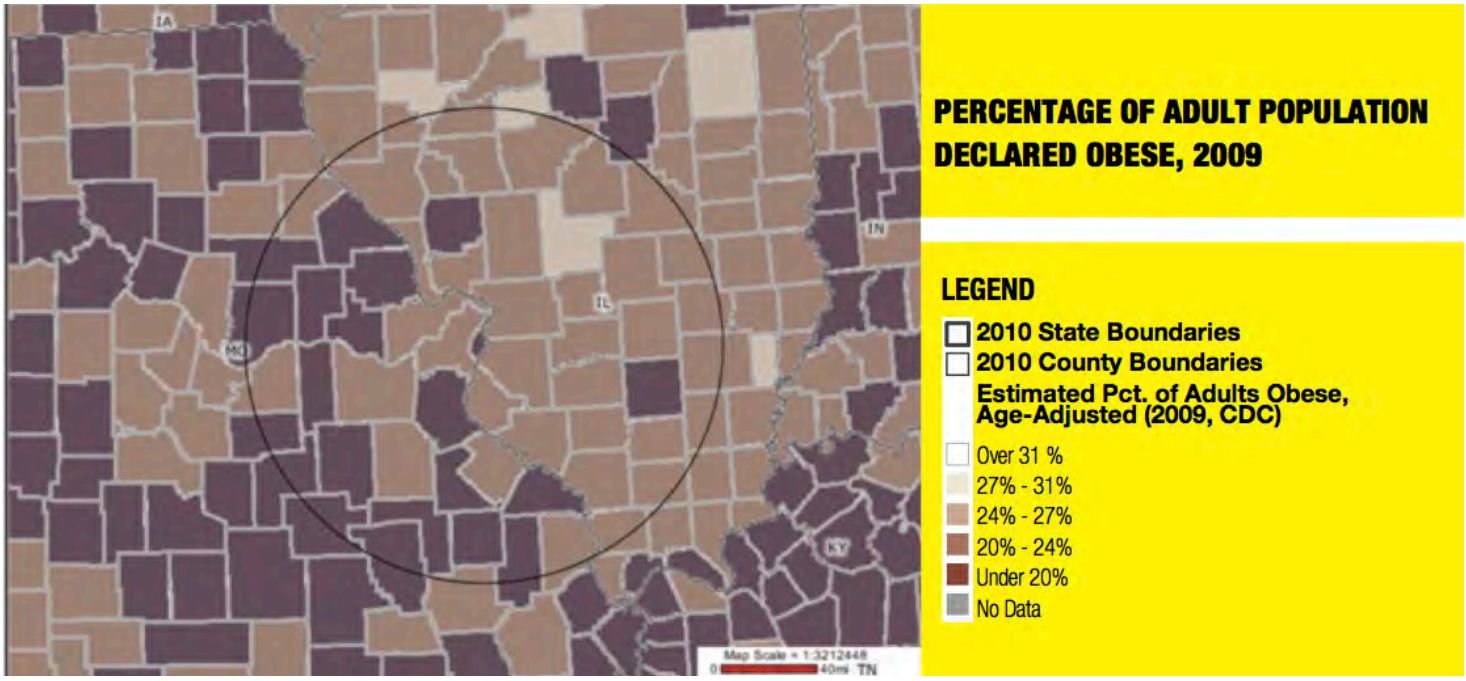
We over-consume the suggested limit of added caloric sweeteners by 300%, which is found in sugary deserts, candies, and sodas. Residents in the Saint Louis Regional Foodshed consumed between 65 and 70 gallons of soda and soft drinks per person per year in 2006- a staggering figure. Americans also over-consume the recommended amount of added fats and oils by 245%. In the 1950's, Americans consumed on average 44.6 pounds of added fats and oils which is nearly twice the recommended 22.81 pounds per year; by 2009, we consumed even more - 78.6 pounds of added fats and oils each year.

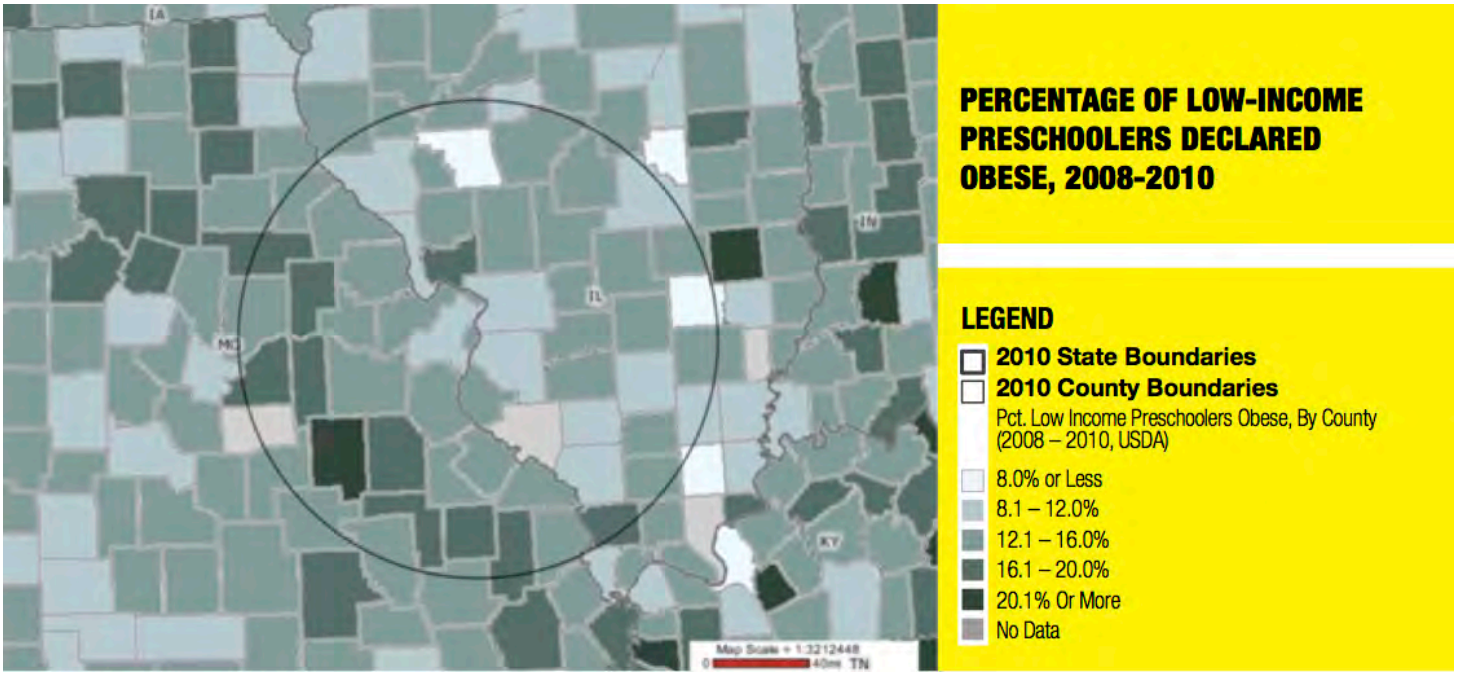
We eat a lot of meat. In the 1950's Americans consumed 138.2 pounds of meat per person per year (including fish); by 2009 that figure was at 190.9 pounds. In the Saint Louis Regional Foodshed, that equates to more than 777 million pounds of meat per year.

In the Foodshed we eat the recommended servings of vegetables, however it is likely that potatoes comprise the majority of those vegetable options in the form of processed potato products rather than leafy greens and other colorful vegetables, especially when price is a factor. Price may play a role in consumer choices for varieties of vegetables. For most of the Saint Louis Regional Foodshed, leafy green vegetables were 60% more expensive than starchy vegetables in 2006.

Our rates of obesity and diabetes reflect our consumption. In 2009, 9.5% of the Foodshed's population were diabetic. The highest percentage of adults diagnosed with diabetes was in St. Louis City at 11.8%. Overall, 30.4% of the total Foodshed population is obese. The Missouri portion of the Foodshed had higher rates of diabetes, adult obesity, and child obesity.



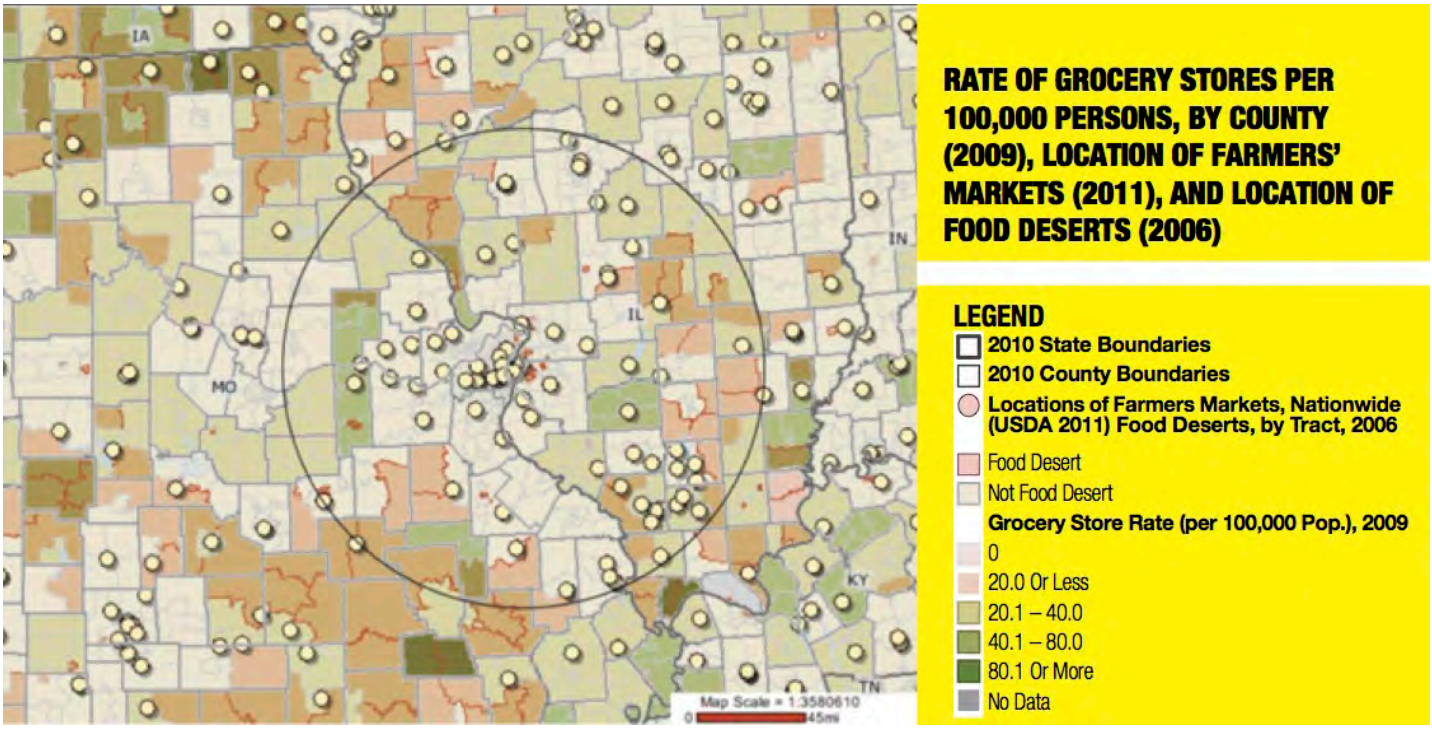




The highest rates of obesity and diabetes also coincide with areas that have few fresh food grocery stores. In these areas, convenience stores or fast-food restaurants are often the sole purveyors of food items. Issues of limited food access and no true consumer choice are at the center of the problem of "food deserts", which are defined as "urban neighborhoods and rural towns without ready access to fresh, healthy, and affordable food."[3]

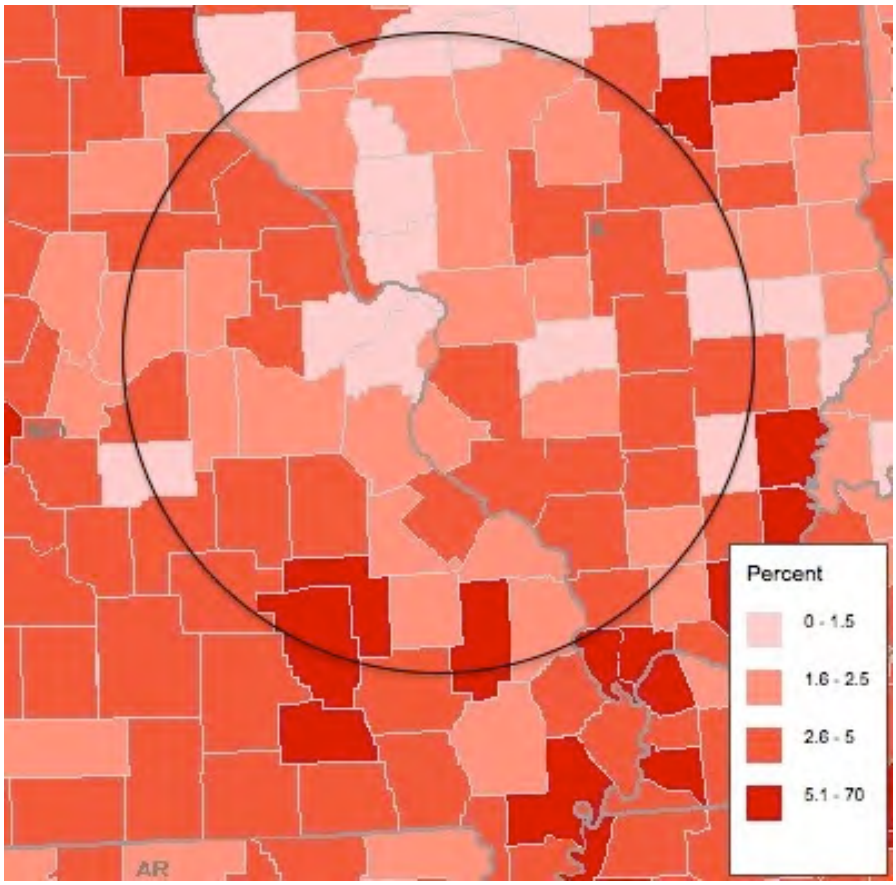
A Food Desert Tract is an area where "over 33% of the population or over 500 people have low access to healthy food.[4] "Low access to food" is a term used by the USDA and "is determined by estimating the number of people in the census tract that lives more than one mile from a

supermarket or large grocery store (urban tracts) or more than 10 miles from a supermarket or large grocery store (rural tracts)."[5] In 2006, 125-food desert tracts were distributed over 35 counties. Nearly half a million people (483,243) or 12% of the Saint Louis Regional Foodshed population, lived in those 125 food desert tracts.[6]



The location of grocery stores is still only part of the complex food puzzle. Where a greater number of the population live at or near the poverty line, even if grocery stores are accessible people may think fresh food costs more per serving. That may persuade individuals to choose inexpensive foods that are processed, contain additives, and are chemically contaminated over fresh, more nutritious foods. The hours of operation of stores or farmers' markets or stores that provide the healthiest food may limit the ability for some working individuals to access healthy food. Vehicle access also plays an important role in access to healthy food especially in rural areas.

Percentage of Households with No Car & Low Access to a Food Store, 2010



The health data suggest that our nutritional needs in the Saint Louis Regional Foodshed are not being well met. In order to provide greater access to healthy food we must encourage the opening of new grocery stores and farmers markets in food deserts, while we also encourage existing grocery stores throughout the Foodshed to provide healthier food, and particularly locally sourced food in order maximize nutrition.

In Chapter 3 we pose these questions: What are we spending on food? What would the economic benefits be if we restructured our food system to grow more food in our region? Can we increase food access and create jobs in communities that lack both? What are some examples of local food initiatives that are underway?

Chapter 3. The Food Economy

Food is big money. According to the USDA's Economic Research Service, the Saint Louis Regional Foodshed and its four million residents spent about $17.2 billion on food in 2011.[7]

Because food typically does not travel directly from farmer to consumer, most of the $17.2 billion spent on food in our Foodshed does not reach the farmers and ranchers that produce it. It circulates through the global food system through a network of processors, transporters and marketers. Farmers and ranchers thousands of miles away produce most of the food we

consume and they only receive about 15.8 cents of every food dollar.

Our region emphasizes production of corn, soybeans, and wheat, and we import much of our fruits and vegetables from states thousands of miles away - California and Florida - and countries across the globe - Mexico, Chile, Argentina, the Netherlands, and China. The countries from which we import fruits and vegetables often have different food safety regulations than the U.S., allowing foreign farmers to use chemicals on their crops that are banned in the U.S. Further, our dependence on imports from thousands of miles away requires dependence on fossil fuels; as fossil fuel prices rise, so does our grocery bill.

Meanwhile, a handful of nations buy our region's agricultural products. Missouri's largest agriculture trading partners are Mexico, China, Indonesia, Turkey, Japan, and Taiwan, as of 2012, according to Foreign Trade Commission of the U.S. Census Bureau;[8] Illinois' top agriculture buyers are Taiwan, China, Mexico, Indonesia, and Vietnam.[9]

Obtaining food from local sources places more consumer dollars directly into the hands of farmers, rather than in the hands of "middlemen" industries. When we produce and consume food locally, more of the consumer food dollar reaches producers in the Foodshed, sustaining families here. Returning food production to the region and redistributing the consumer food dollar to local industries most directly involved in the local food system may help us respond to unemployment and energize our local economy with money we already spend.

To return food production to our region, we will need more consumers- including hospitals, institutions, universities, and businesses - to commit to buying local food even if it costs more at first. We will need to help consumers understand the benefits of higher quality food and we need to document those economic and health benefits. At the same time, we must ensure that affordability and access includes systems that reach low income families who have much to gain from more nutritious fare.

We will also need to build the infrastructure to support harvesting, storage, processing, packaging, and distribution, to recapture exported dollars, and create a food system that supports families in our region. Some individuals and businesses in the region are already creating the projects to deliver more local food. We feature several examples in this chapter.

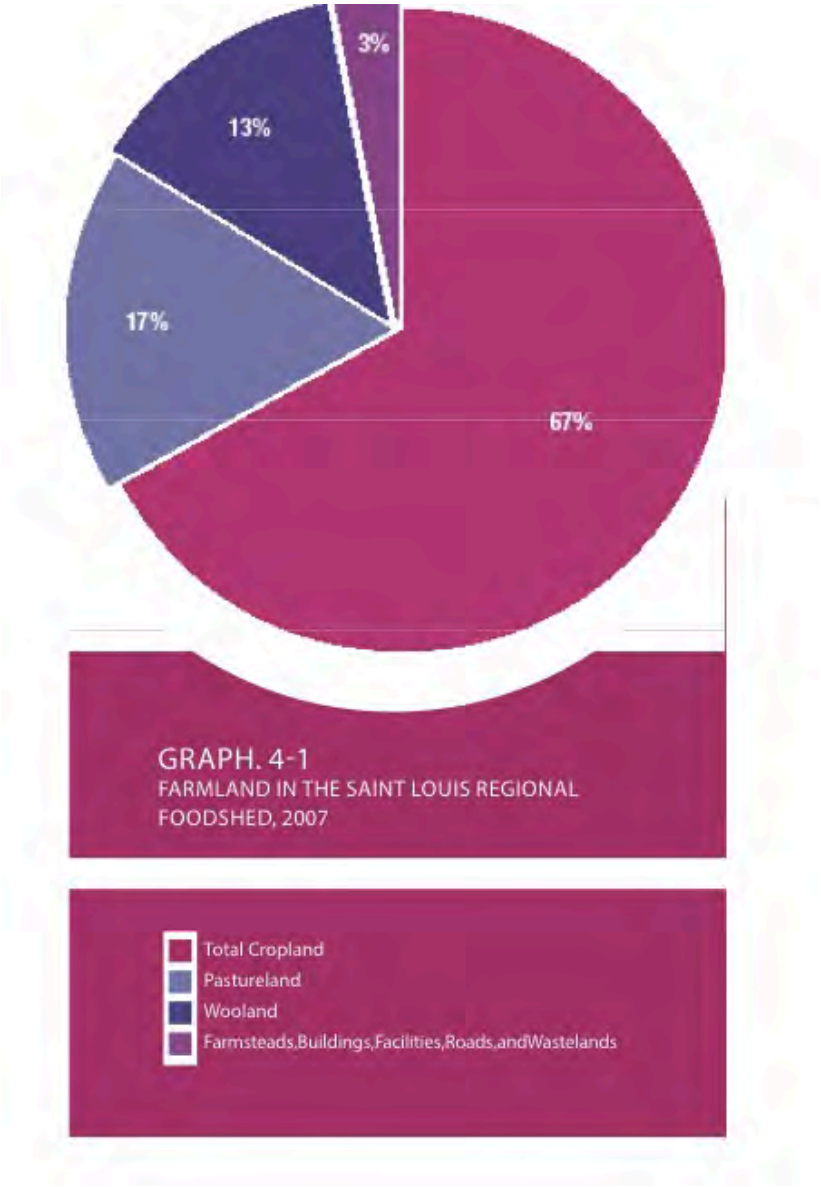
While we examine whether an increase in corner grocery stores and farmers markets would help the people of the Saint Louis Regional Foodshed have increased access to healthier food, we must also consider our land's capacity to produce more nutritious crops. In the next chapter we ask: Where are our good soils for growing food? How many farms are in our Foodshed? How are we using our agricultural land?

Chapter 4. Land

Land Acres & Types of Land

The total land area of the Saint Louis Regional Foodshed is 21,372,876.8 acres[10] and approximately 64% (13,710,166 acres) of which is considered "land in farms."[11] The Saint Louis Regional Foodshed has approximately 14,699,865 acres in farmland which includes "cropland"

(9,863,989 acres); “pastureland” (2,427,737 acres), “woodland” (1,903,607 acres); and “farmsteads, buildings, facilities, roads, and wastelands” (504,532 acres).[12]

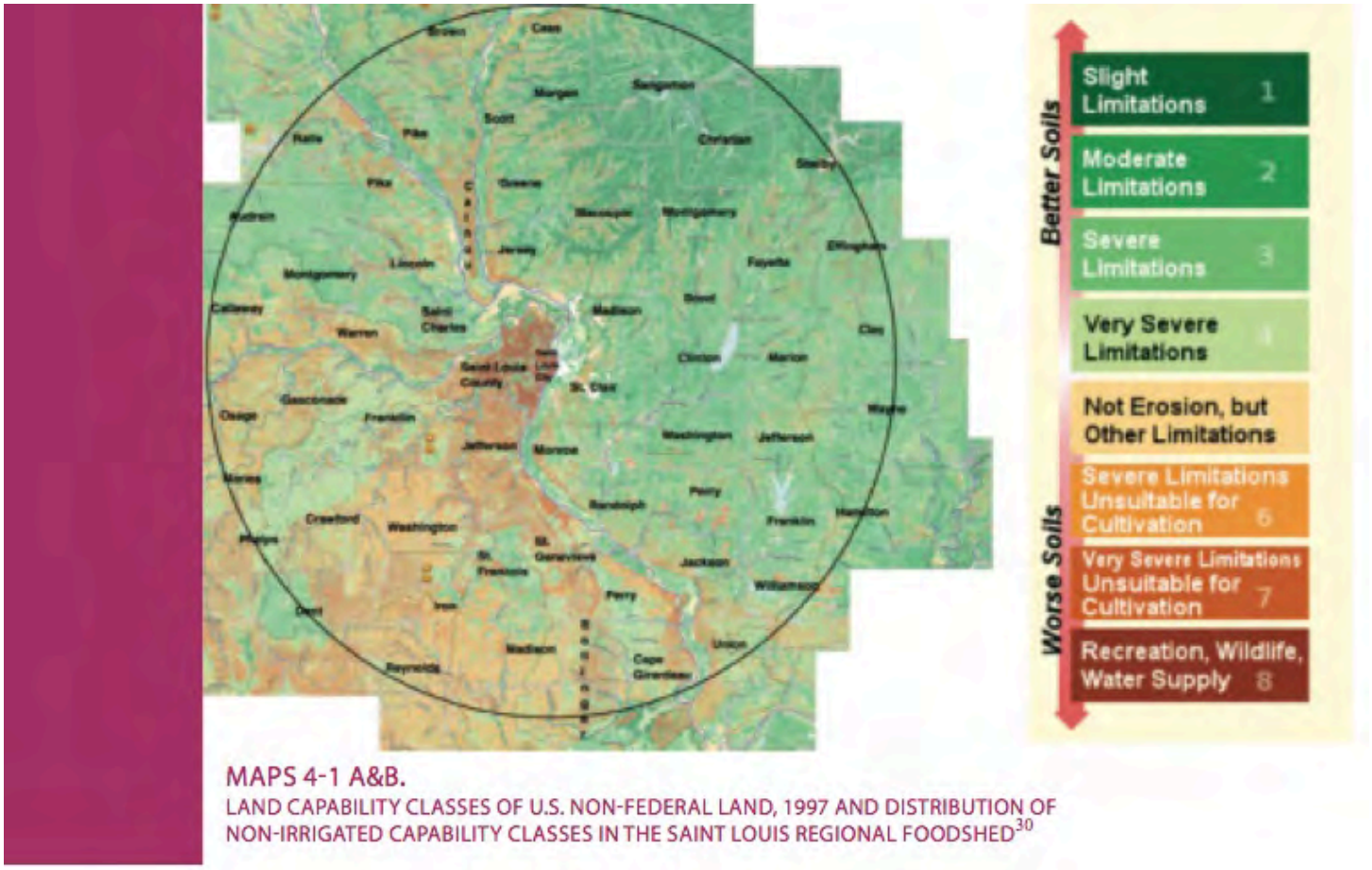


Soil Types and Soil Conservation

In order for agricultural land to be highly productive, its soil must provide crops with proper nutrients. The Saint Louis Regional Foodshed is fortunate to have high quality soils. The best soils for food production are “level, deep, well-drained and easy to work”[13] with and have few constraints as to their use.[14] Often these are in fertile floodplains where centuries of river flooding have deposited rich silt.

The Saint Louis Regional Foodshed has land reflecting a range of soil types. Most of the Missouri portion of the Foodshed is limited in its agricultural capability, while the Illinois portion is predominantly in the better soil classes. Because of the Foodshed’s high quality soils that can

maintain a variety of crop species, these resources can be used to increase crop diversity on existing farmland.



MAPS 4-1 A&B.
LAND CAPABILITY CLASSES OF U.S. NON-FEDERAL LAND, 1997 AND DISTRIBUTION OF NON-IRRIGATED CAPABILITY CLASSES IN THE SAINT LOUIS REGIONAL FOODSHED[30]

MAP 4-2. MAJOR LAND RESOURCE AREAS OF THE SAINT LOUIS REGIONAL FOODSHED[50]

LEGEND

95B—Southern Wisconsin and Northern Illinois Drift Plain

98—Southern Michigan and Northern Indiana Drift Plain

105—Northern Mississippi Valley Loess Hills

108A and 108B—Illinois and Iowa Deep Loess and Drift

110—Northern Illinois and Indiana Heavy Till Plain

113—Central Claypan Area

114B—Southern Illinois and Indiana Thin Loess and Till Plain

115A, 115B, and 115C—Central Mississippi Valley Wooded Slopes

120A—Kentucky and Indiana Sandstone and Shale Hills and Valleys

131A—Southern Mississippi Valley Alluvium

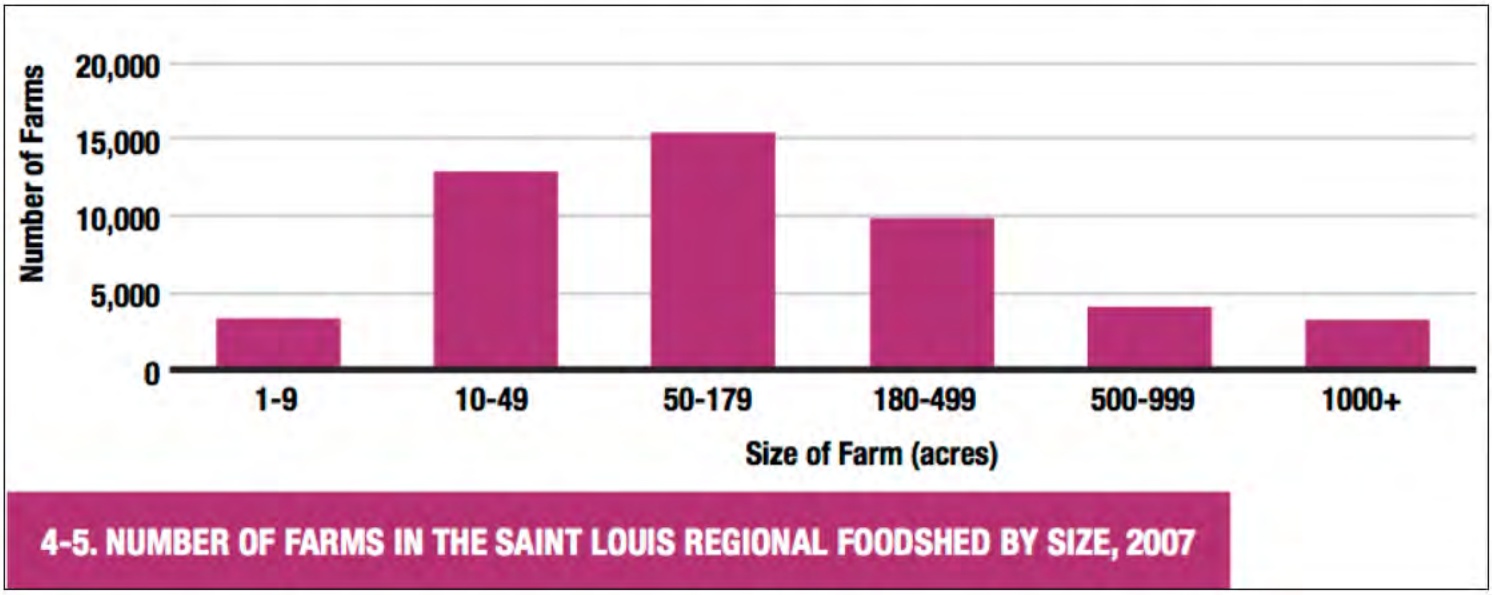
134—Southern Mississippi Valley Silty Uplands

The best soils for agriculture also appeal to developers. As the region's population has increased, urban development has expanded onto some of the region's best soils for crop production. The Illinois counties of Madison, St. Clair, and Monroe and the Missouri counties of Saint Louis City, Saint Louis County, St. Charles, Warren, Montgomery, and Callaway all contain urban development along with one of the region's best soil types. Except for Montgomery and Callaway County, all of these counties are either part of the region's Urban Core or have a high number of individuals commuting to the Urban Core.

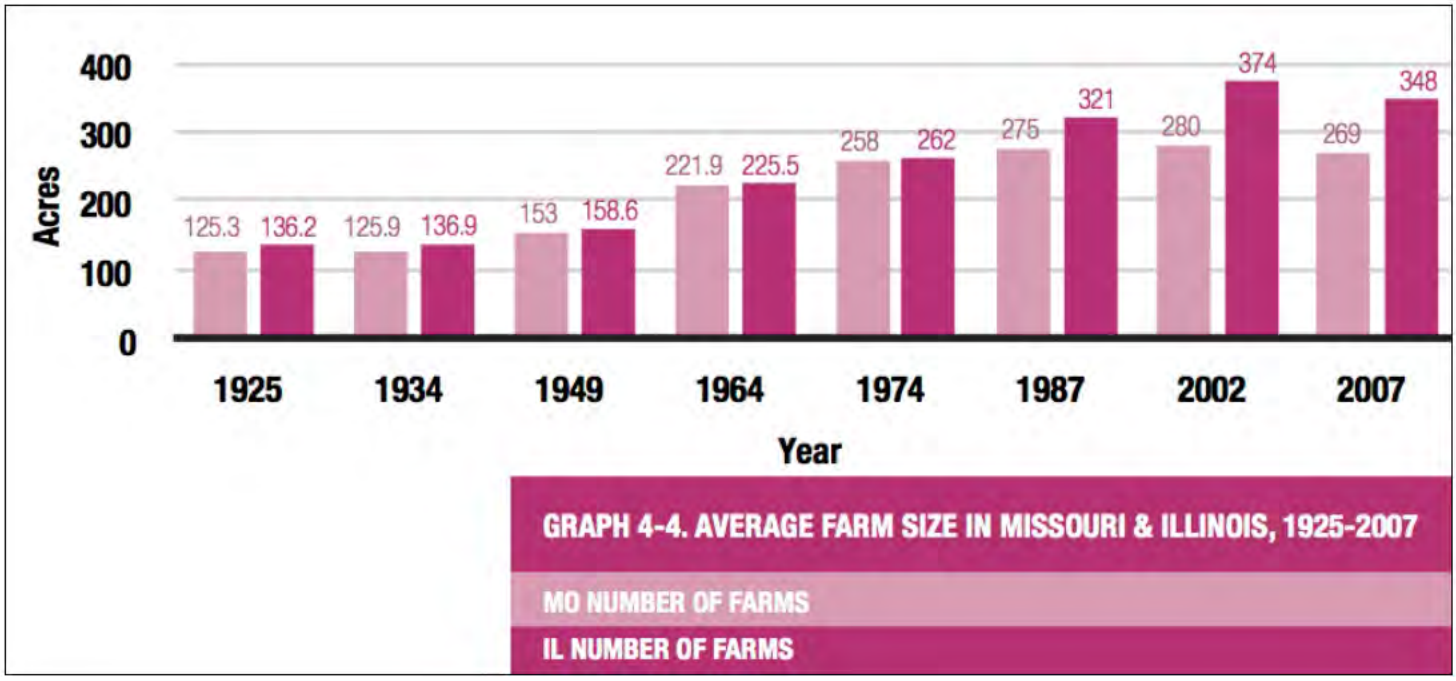
The Saint Louis Regional Foodshed may need to consider farmland preservation strategies in these urban and commuter areas in order to increase local food production. We encourage planning for urban development that includes conservation of the good soil we have for food production.

While this chapter illustrates that the Saint Louis Regional Foodshed contains soil classes well suited for plant growth, if particular areas of the region have soil contaminated with pollutants or degraded by intensive agriculture practices, soil restoration and remediation practices must be implemented before using those soils for local food production. More detailed research is needed on the extent of soil degradation, restoration strategies, and soil contamination both on the already existing agricultural land and in urban areas that might be used to expand food

production.We have experienced an increase in urban development and a decrease in land in farms in the Saint Louis Regional Foodshed, while our population has increased (from 2,471,317 in 1910 to 4,074,725 in 2010).[15] In a span of eighty-two years, from 1925 to 2007, the number of farms in the Saint Louis Regional Foodshed has decreased from 137,770 in 1925[16] to 48,864 in 2007,[17] while the average farm is now larger from 134 acres[18] in 1925 to 284 acres,[19] in 2007.[20]



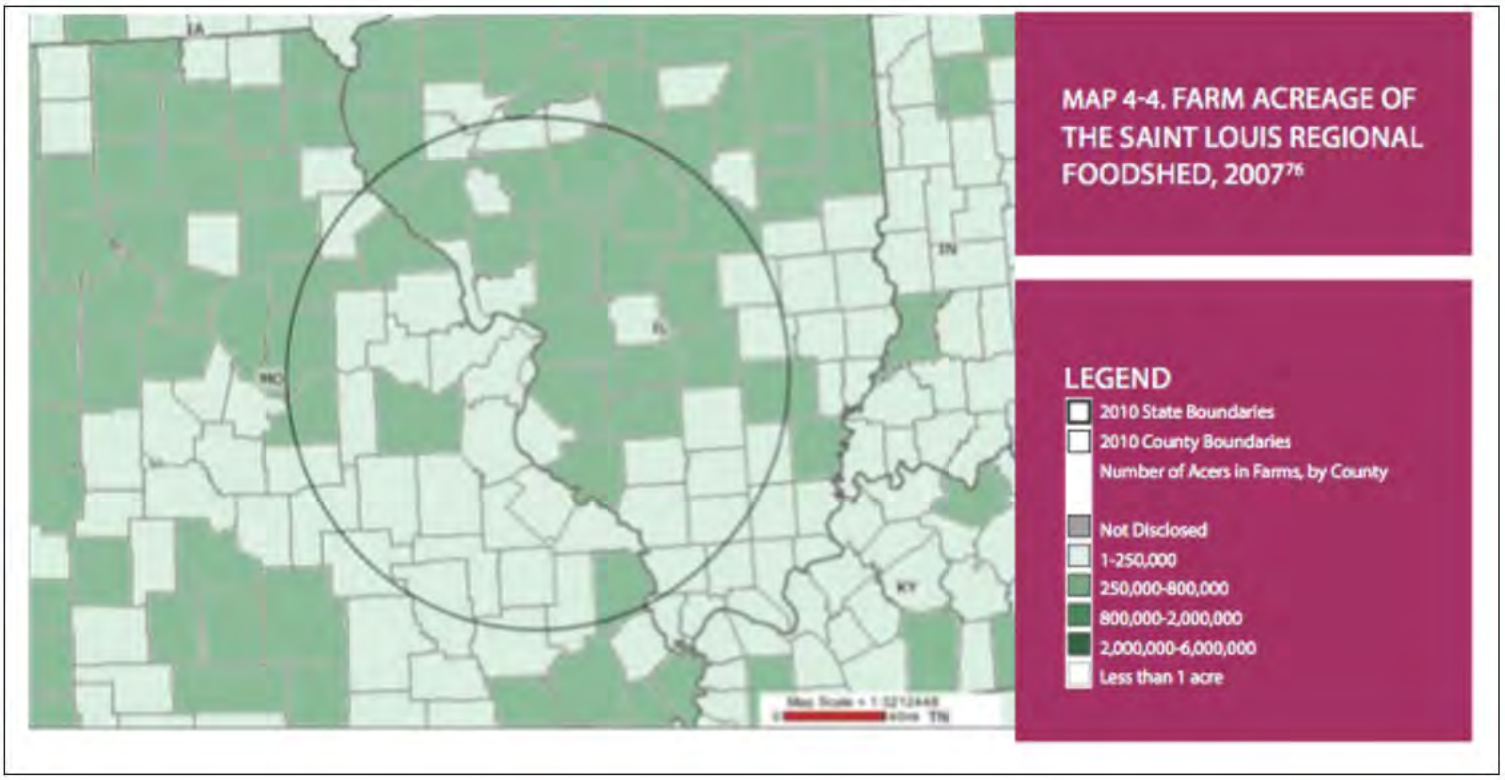
4-5. NUMBER OF FARMS IN THE SAINT LOUIS REGIONAL FOODSHED BY SIZE, 2007



GRAPH 4-4. AVERAGE FARM SIZE IN MISSOURI & ILLINOIS, 1925-2007

MO NUMBER OF FARMS

IL NUMBER OF FARMS



This prompts our next questions: What are our farmers growing now? Where does our food come from?

Chapter 5. What We Grow

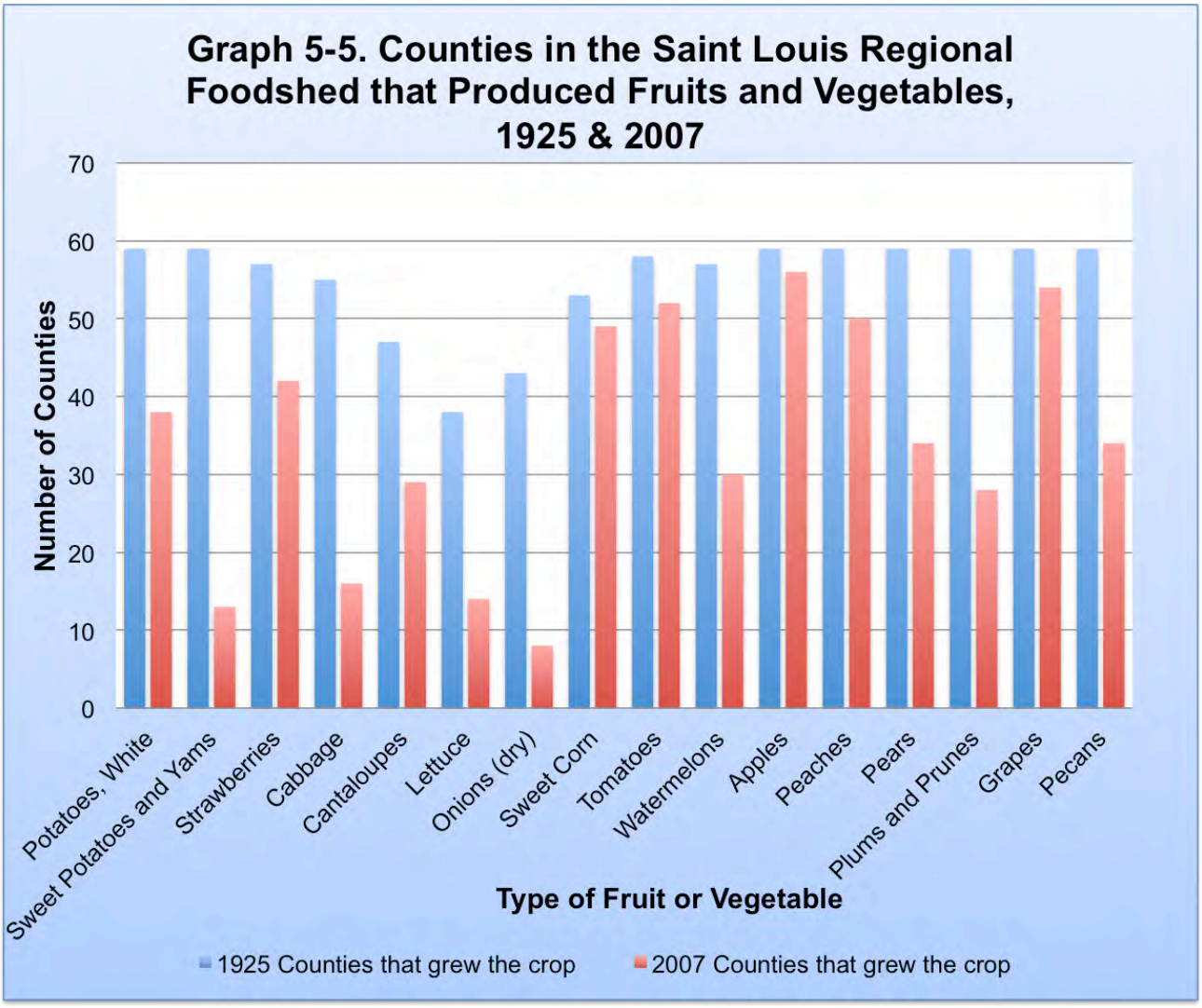
As the number of farms decreased and the average farm size increased, farms began to grow only one or two crops rather than maintain the diversity found on earlier farms.[21] Grains began to dominate while fewer and fewer acres were dedicated to fruits and vegetables.

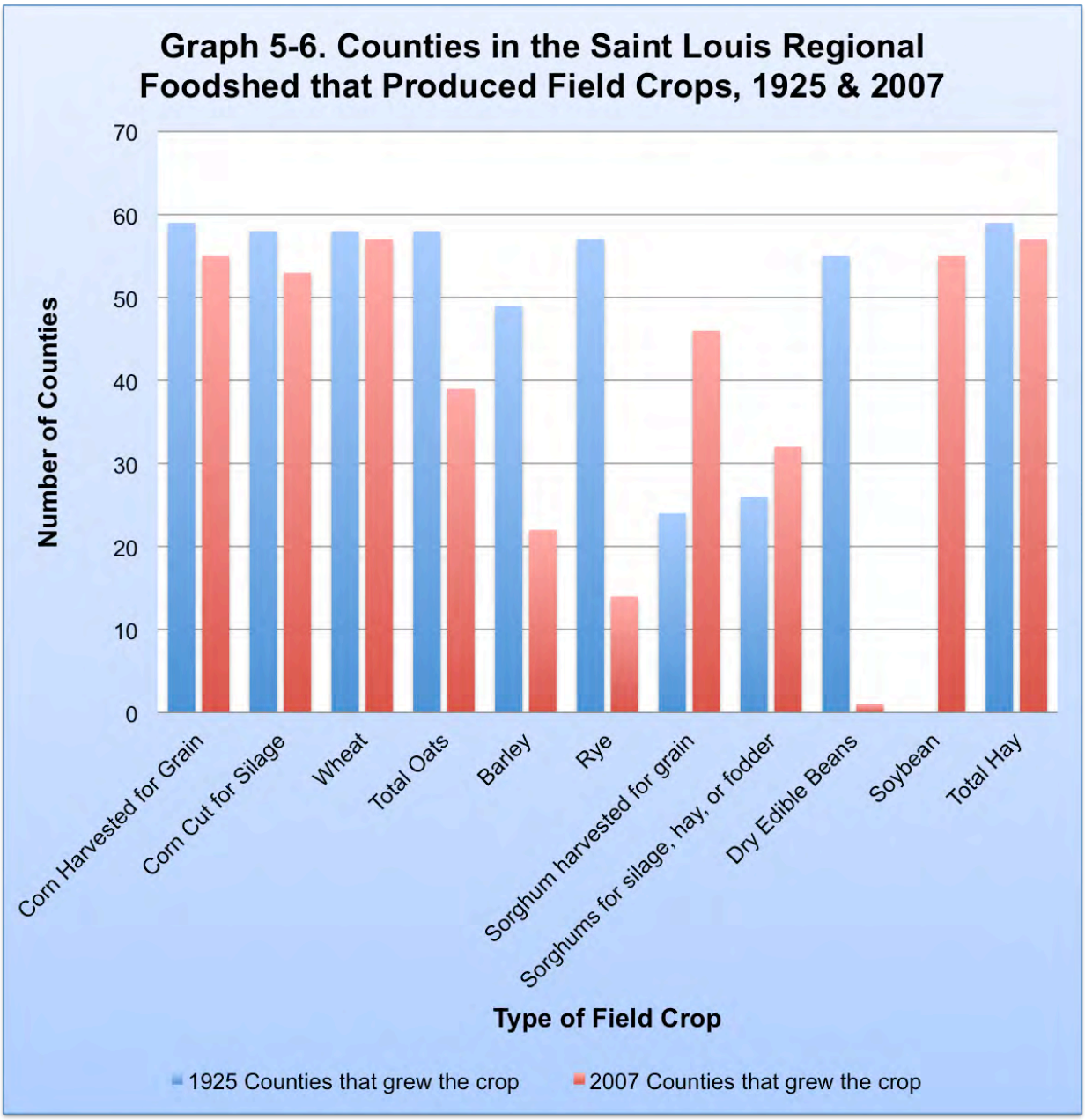
Specialization and mechanization of farming helped fuel development of larger farms while advances in crop breeding and fertilizer drove increased grain yields. In addition, U.S. farm policy has discounted the importance of producing local fruits and vegetables as farmers focused their attention on designating most of their land to only a few commodity field crops aimed ostensibly at export.

Farmers in the Saint Louis Regional Foodshed have followed the national pattern growing fewer "food table" crops like fruits and vegetables and more "food system" crops. "Food Table" crops are common nuts, fruits and vegetables which reach our tables in nearly the same form they had in the field. "Food system" crops consist of corn, soybean, hay, wheat and other grain and forage that go into processed food and livestock feed. In addition to animal feed, "food system" crops are used to make food additives like soy lecithin or oil, or sweeteners like corn syrup used in processed foods.

While county level data on acreage of fruits and vegetables is incomplete, Graph 5-5[22] displays the number of counties that produced particular fruits and vegetables in 1925 and 2007. It shows

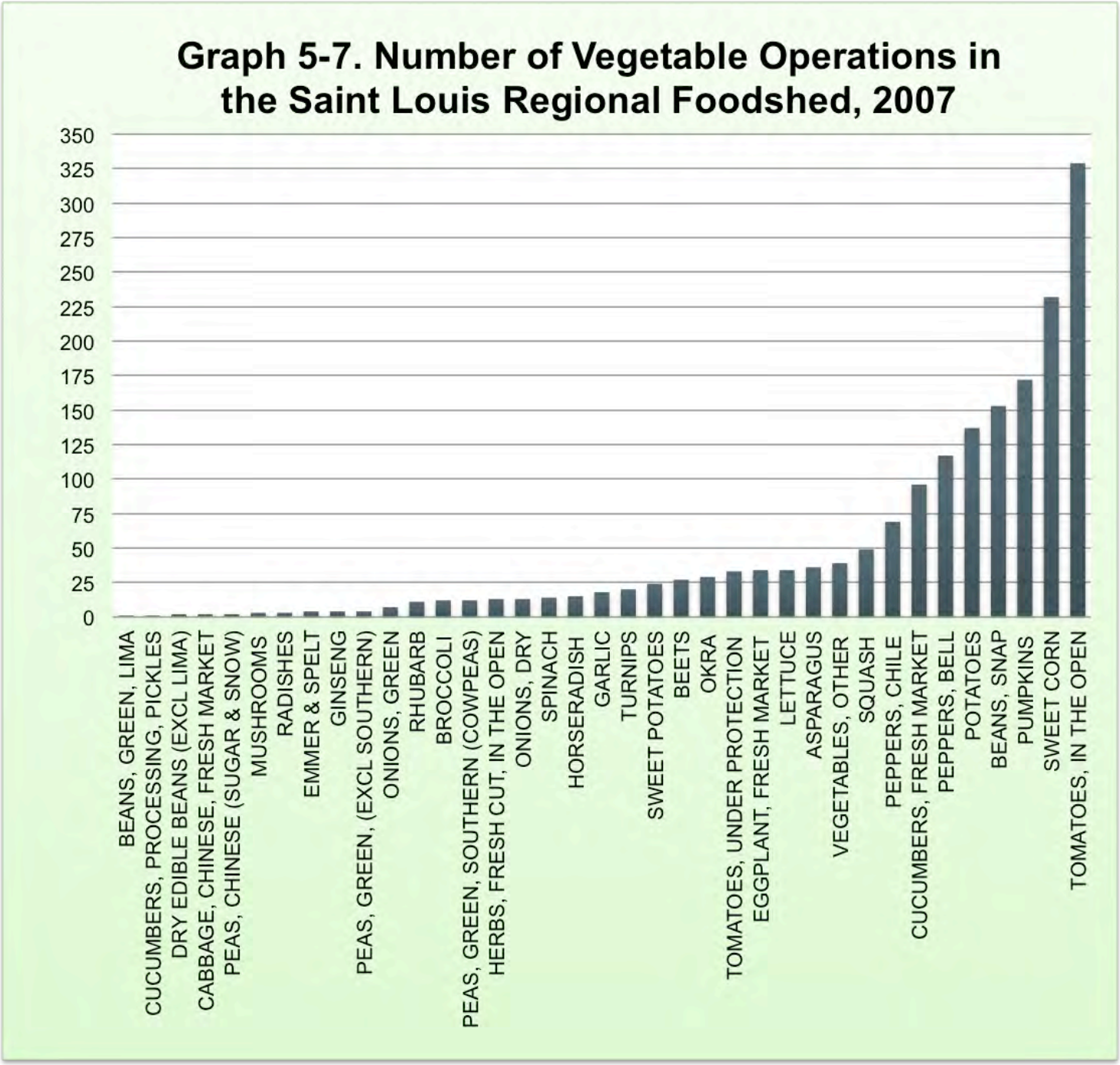
that many Saint Louis Regional Foodshed counties once grew many more varieties of crops than they do today. Likewise, Graph 5-6[23] illustrates the number of counties that have produced particular field crops in 1925 and 2007.





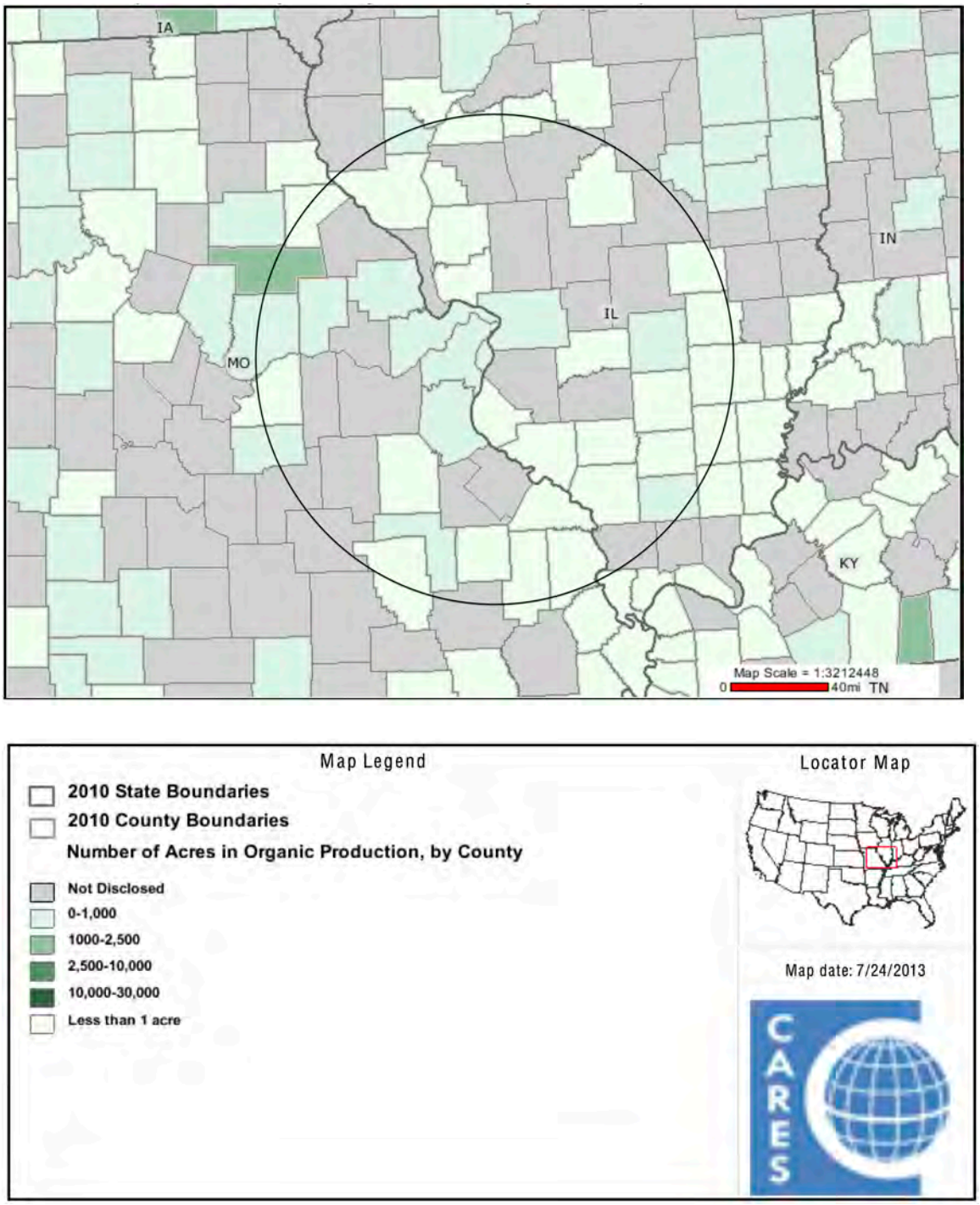
In every fruit and vegetable category reported, the number of counties producing those fruits and vegetables decreased between 1925 and 2007 (Graph 5-5). More than 9.3 million acres, or 94% of the region's total cropland, produced "Food System" crops in 2007.[24] "Food Table" crops made up a mere 0.1% of the reported cropland acreage in 2007[25] This imbalance mirrors our overconsumption of grain products, sweeteners and processed foods.

Fortunately, some farmers in the region recognize the importance of fruit and vegetable production. In 2007, 1,172 operations in the Saint Louis Regional Foodshed harvested vegetables. Of those operations, nearly 50% (585 operations) did not disclose their acreage and 37% (431 operations) harvested vegetables on less than five acres.[26]

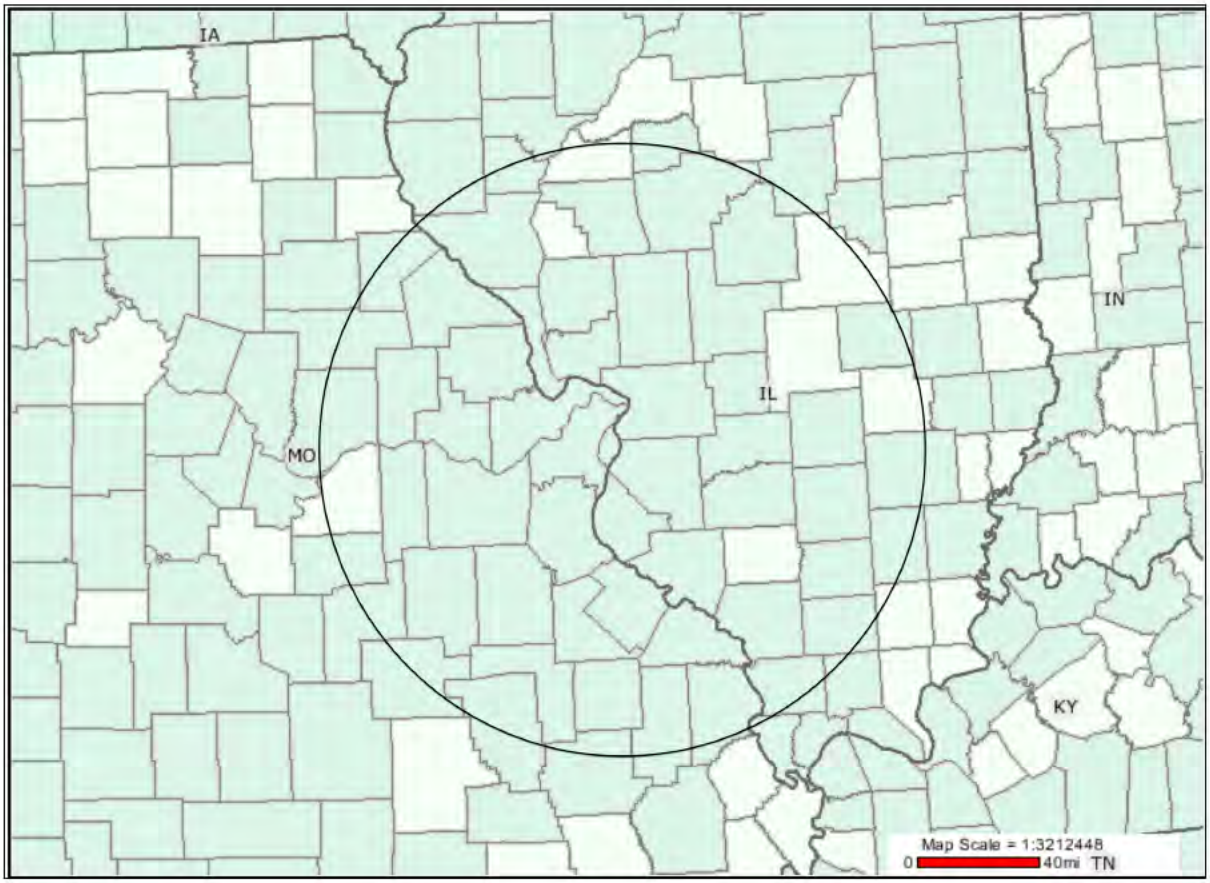


In addition, some small farms are producing organic crops. Thirty-seven counties in the Saint Louis Regional Foodshed produced organic crops on 2,588 acres (Map 5-1), yet data was withheld from 20 counties, meaning organic production is occurring on more acreage than disclosed.[27] Our region is also producing fruit. Regional orchards made up 6,142 acres. (Map 5-2).[28]

Map 5-1. Acreage Designated to Organic Crop Production, 2007



Map 5-2. Acreage Designated to Orchards, 2007



Map Legend

2010 State Boundaries

2010 County Boundaries

Number of Acres in Orchards, by County

- Not Disclosed
- 1-10,000
- 10,000-50,000
- 50,000-100,000
- 100,000-500,000
- Less than 1 acre

Locator Map

Map date: 7/24/2013

CARES

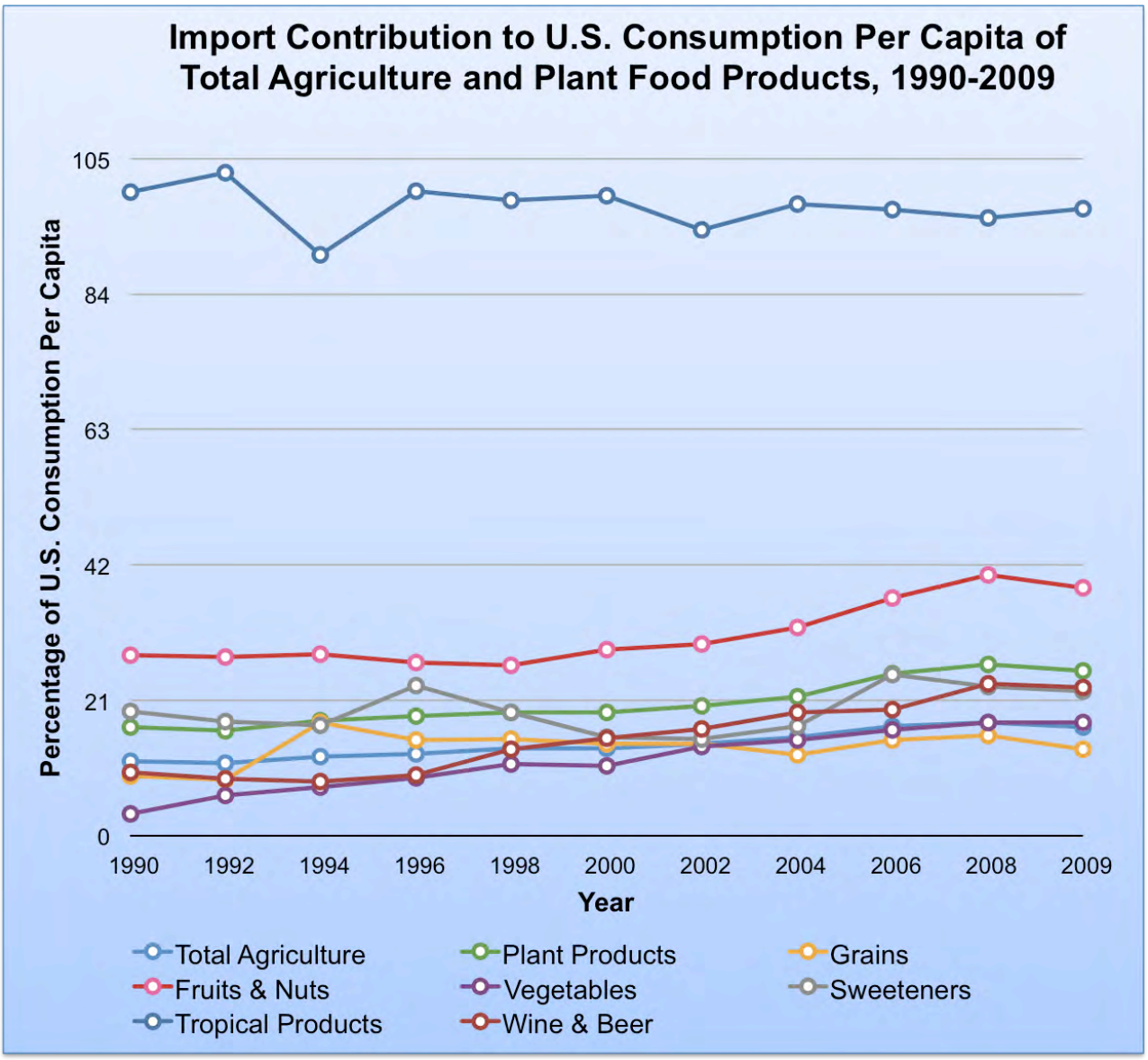
As an increased emphasis has been placed on soybean and crops for grain, so too has our consumption of processed grain increased via processed food. The push toward grains accelerated in the 1970s when President Nixon appointed Earl Butz as Secretary of Agriculture

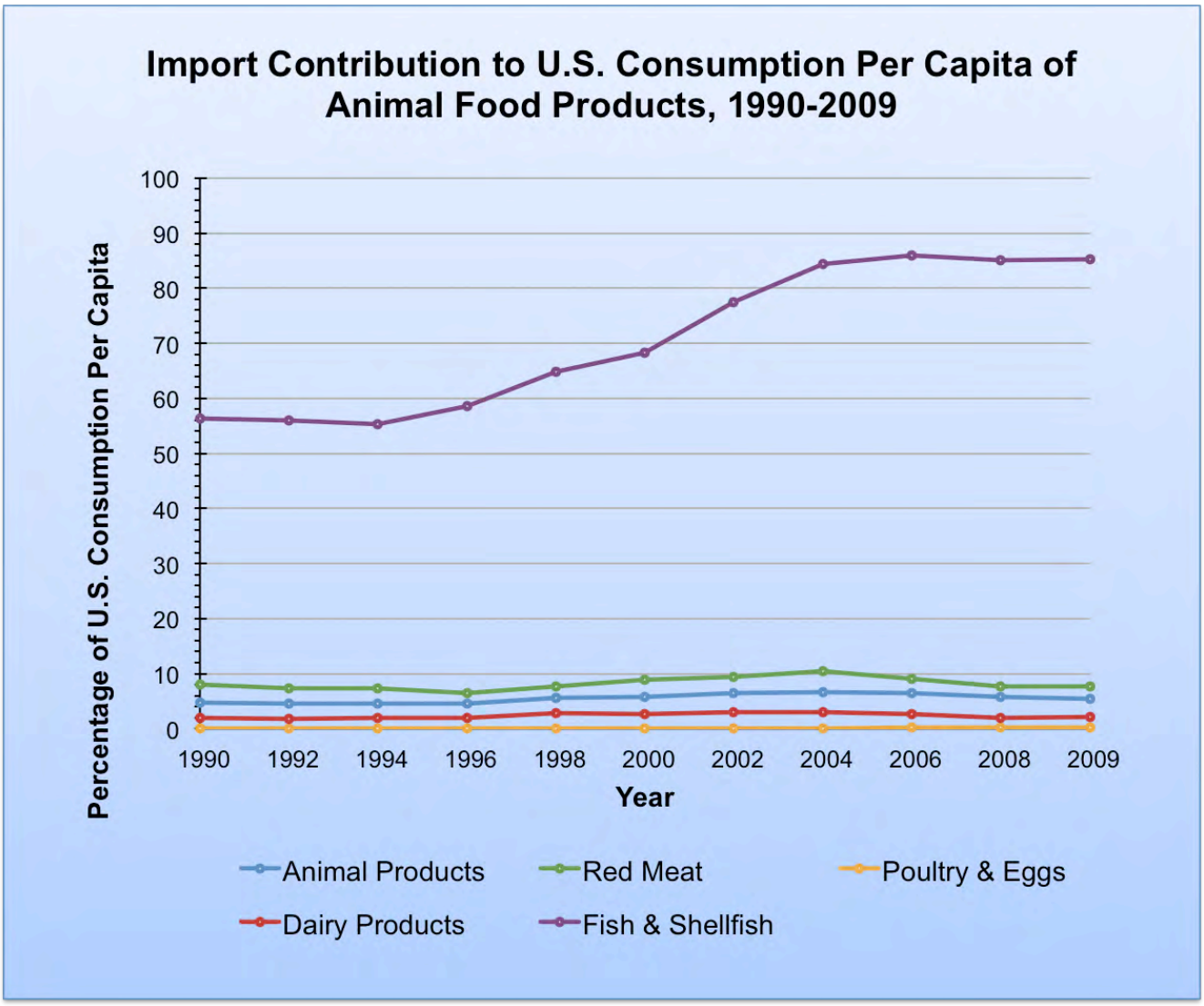
who told farmers to "get big or get out … adapt or die," in the belief that bigger farms were more productive.[29]

There appears to be a link between diet trends and the crop production trends. The average American consumes more than the recommended amount of grain (but not enough whole grain), more than the recommended amount of protein from meat alone, and more than the suggested limit for added sugar. In addition, the average American consumes the recommended amount of fruit, but mostly from non-fresh sources, and consumes less than the recommended amount of vegetables. Our meat overconsumption is also linked to the increase in grain and forage crops because abundant grain helps keep feed cheap for grain-based meat production. Other portions of our corn and soy production are used to make food additives found in food products from soda to salad dressing.

Across America, our best farmland is dedicated to increased production of top commodity crops used in the nation's processed foods and to feed livestock. With fewer acres producing fruits and vegetables locally, Americans import more and more of the fruits and vegetables essential for good health. Since 1990, the contribution of imports to the U.S. food supply has increased in almost every category year round – both plant food products and animal food products.

Except for tropical products, all of our plant-based imports have increased between 1990 and 2009: grains (9.3% to 13.4%), fruits and nuts (28 to 38.5%), vegetables (3.4 to 17.5%), sweeteners (19.3 to 22.4%), tropical products (99.8 to 97.2), wine and beer (9.9 to 23%). Except for red meat (8.1 to 7.7%), our animal-based imports have increased as well: poultry (0% to 0.3%), dairy products (1.9 to 2.2%), and fish and shellfish (56.3 to 85.2%).


Import Contribution to U.S. Consumption Per Capita of Total Agriculture and Plant Food Products, 1990-2009
Percentage of U.S. Consumption Per Capita
105
84
63
42
21
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2009
Year
Total Agriculture
Plant Products
Grains
Fruits & Nuts
Vegetables
Sweeteners
Tropical Products
Wine & Beer



Impact on Nutrition

While U.S. farm policy has continued to stress increased yields, studies have found an inverse relationship between yields and nutrient content in the crops grown. Thus, in addition to our industrialized agriculture system prioritizing grain crops, which we over-consume and which do not provide us with the variety of essential nutrients we need for healthy bodies, it may also be reducing the nutrient concentration in the few fruits and vegetable grown by stressing maximum production per acre.

Unfortunately, the Farm Bill and U.S. food policy as does not incentivize fruit and vegetable farms or small, organic farms equally with industrial, conventional farms, and thus does not promote the production of fruits and vegetables. With farm policies instead incentivizing farmers to grow corn, wheat and soybeans, predictably fewer farms in the Saint Louis Regional Foodshed and across the country produce fruits and vegetables than in 1925.

Nevertheless, the data show that we in the Saint Louis Regional Foodshed have the potential to

grow a substantial portion of our fruit and vegetable diets – and even that of some of our trade partners – with a portion of the 9.8 million acres of cropland in our region if we reprioritize the fruits and vegetables needed for a balanced diet and grow them in a manner that ensures they possess the micronutrients needed for good health. Using John Jeavon's minimum and maximum biointensive production estimates for the fruits and vegetables with the Saint Louis Regional Foodshed's total reported acreage in 2007 and the Foodshed's estimated total consumption of specific fruits and vegetables in 2009, we, the residents of the Saint Louis Regional Foodshed, can produce our estimated fruit and vegetable annual consumption on between 11,048.6 and 39,123 acres of cropland (less than 1% of our cropland) if we employ organic biointensive farming methods. Appendix E lays out the calculations used to determine this range. Of course this does not include fruits and vegetables like citrus fruits or avocados that do not grow in our region.

With so few of our region's nine million acres of cropland needed to produce the fruits and vegetables we currently eat, and 94% of our cropland being designated to forage and grain crops, fruit and vegetable self-sufficiency seems within our grasp. Other hurdles, like seasonality, preservation, storage and access to farmland remain. Nevertheless, sufficient cropland exists to address much more of our fruit and vegetable needs. We encourage further research to help reveal the economic and health impacts of supplying more of our fruits, vegetables, grains, meat and dairy needs from local foodshed sources.

In order to have food that is more nutritious, is produced in a way does not degrade our environment, and increases food self-sufficiency, the Saint Louis Regional Foodshed will need to work with farmers, consumers, and policymakers to ensure structures and incentives are in place to grow and purchase fruits and vegetables grown on multi-crop small scale farms.

Animal based products like meat, dairy, and eggs also play a critical role in our diets. In the next chapter we examine their role in the Saint Louis Regional Foodshed.

Chapter 6. What We Raise

Residents of the Saint Louis Regional Foodshed, like most Americans, eat a lot of meat. We also raise a lot of livestock. Americans today consume 50 pounds more meat per capita than their 1950s counterparts. We exceed the recommended daily protein intake with meat alone not counting other protein sources.[30]

Despite our eating habits, the Saint Louis Regional Foodshed's total pastureland (supporting grazing livestock) decreased 53% over 82 years. Though we have fewer pasture acres and fewer farms, we are raising more beef and pork than in the past, but have fewer dairies in our region.

Most of America's livestock production does not occur on pasture anymore. "Since the 1950s (poultry) and the 1970s–1980s (cattle, swine), most animals are now produced for human consumption in concentrated animal feeding operations (CAFOs)"[31] or confinements known as Animal Feeding Operations (AFOs). Hogs and poultry raised in confinements spend their entire lives indoors, packed in expansive buildings. Cattle typically spend the first few months of their lives on pasture, before being shipped to feedlots to be fattened on grain prior to slaughter.

In the past 40 years, meat production has followed an "integration" model where one company,

the “integrator”, controls the product throughout the process. In these systems, a corporation like Tyson owns the chickens, turkeys, or hogs while a farmer, under contract, owns the barns, the waste, and any animals that die prematurely in an AFO.

The Saint Louis Regional Foodshed is home to dairy, poultry, and hog CAFOs. The data show it is also home to operations not recorded as CAFOs where animals are raised under contract. Table 6-1 displays the number of counties, or the name of the single county, in the Saint Louis Regional Foodshed that raised and delivered livestock commodities under production contracts in 2007.

Table 6-1. Counties with Commodities Raised and Delivered Under Production Contracts, 2007[32]

Type of Producer	Number of Counties	Number of Operations
Contracted Cattle Producers	9 counties	12
Contracted Broilers Producer	Bollinger, MO	1
Contracted Egg Producer	Williamson, IL	1
Contracted Hog Producers	35 counties	144
Contracted Turkey Producers	4 counties	46

In 2007, every county in the Foodshed had farmers who raised hogs and pigs, cattle and calves, beef cows, and layers (hens); 52 counties had farmers who raised milk cows, and 51counties (of 58) had farmers who raised broilers (chickens for meat).[33]

Producers in the region are also raising livestock outside the CAFO system. Though most of the region’s cattle are finished at feedlots outside the region, the Saint Louis Regional Foodshed is home to four American Grassfed Association (AGA) certified farms that offer an alternative to feedlot cattle. The AGA certification is focuses on four main concepts:

> Diet — Animals are fed only grass and forage from weaning until harvest.Confinement — Animals are raised on pasture without confinement to feedlots.Antibiotics and hormones — Animals are never treated with antibiotics or growth hormones.Origin — All animals are born and raised on American family farms.[34]

See Appendix B for a list of some of the producers of pasture raised livestock in the Missouri portion of the Saint Louis Regional Foodshed.[35] The region also supports pasture-based hog producers. Also, for information on the meaning of various meat product labels, see Appendix C.

The 2009 national per capita consumption data for meat (lbs.) from various livestock animals and the extrapolated total pounds of meat consumed in the Saint Louis Regional Foodshed suggest we consume more than 236 million pounds of beef; 228 million pounds of chicken, 189 million pounds of pork, 64 million pounds of fish and shellfish and more than 54 million pounds of turkey.

Table 6-2. Number of Pounds Consumed in 2009, by Livestock Type[36]

Livestock Type	2009 Estimated U.S. Annual Per Capita Consumption (lbs.)	2009 Estimated Total Foodshed Consumption (lbs.)
Beef	58.1	236,741,522.5
Veal	0.3	1,222,417.5
Lamb and Mutton	0.7	2,852,307.5
Pork	46.6	189,882,185
Chicken	56	228,184,600
Turkey	13.3	54,193,842.5
Fish and Shellfish	15.8	64,380,655

Our report examines in more detail four major groups of livestock produced in the Saint Louis Regional Foodshed - beef cows, milk cows, hogs and pigs, and chickens.

Consolidation in the meat industry has reduced markets where independent farmers can sell animals. Fewer markets and fewer slaughter houses make the meat business a meat packer's market. Failures to restrict monopolies in the food industry have resulted in a lack of competition which severely impacts farmers. For example, three companies control 90% of the beef industry; four companies control 66% of the pork industry; and four companies control 60% of the poultry industry.[37] Wenonah Hauter, with Food and Water Water Watch, recently published Foodopoly, a book which explores this issue in depth. People concerned about the well being of food and farmers, need to also promote fair and competitive markets.

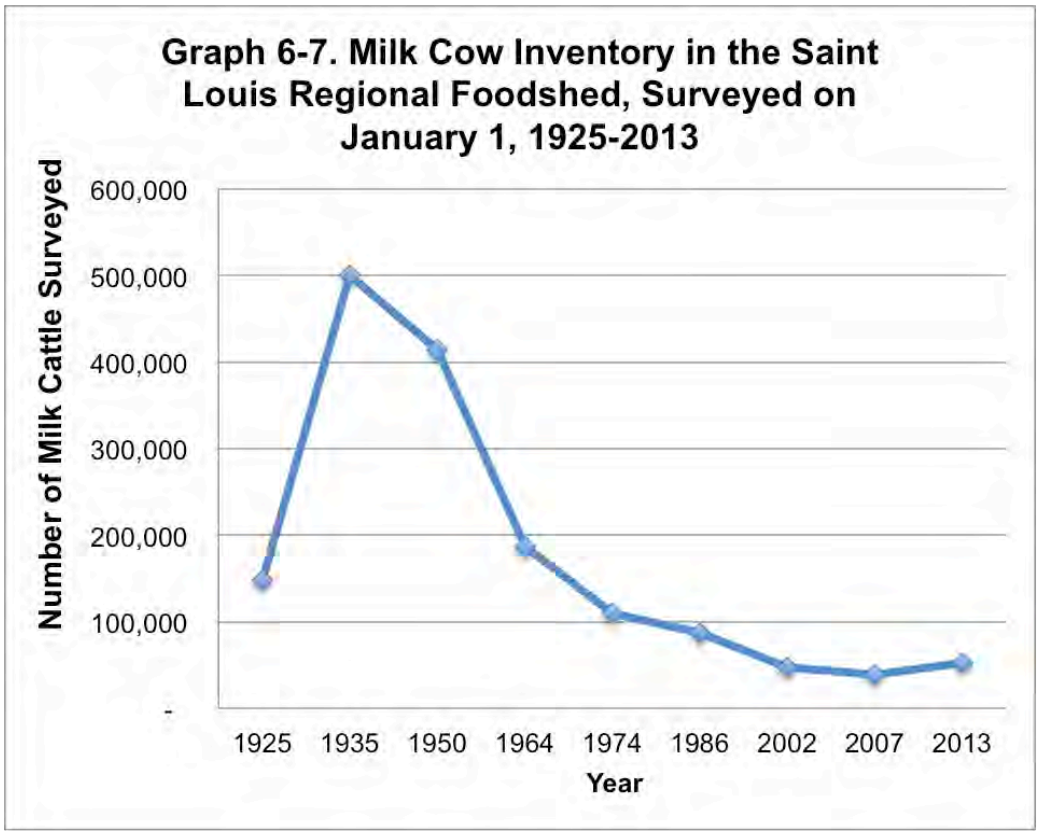
Dairy Production

Consumers in the Saint Louis Regional Foodshed have few opportunities to drink local milk and enjoy local dairy products. Since 1954, the number of farms with milk cows and overall milk cow inventory has plummeted in Missouri and Illinois, from 1,550,000 dairy cows and 250,000 dairy farms in 1954 to 200,000 dairy cows and 3,800 dairy farms in 2007. Producers in the Saint Louis Regional Foodshed reported 871 operations in 2007.[38] In the 2007 Census of Agriculture, 53 of the 58 counties reported having milk cow inventory.

The Saint Louis Regional Foodshed's estimated annual milk production was approximately 1,184,731,776 pounds in 2009, far below our estimated total consumption of all dairy products by the Saint Louis Regional Foodshed which was more than two billion (2,473,765,547.5) pounds.

Graph 6-7 displays surveyed inventory data from USDA for the Saint Louis Regional Foodshed between 1925 and 2013.[39] The inventory data is collected from a survey conducted on January

1st of each year.



Hog Production

In the 2007 Census of Agriculture, all 58 counties in the Saint Louis Regional Foodshed reported having farms that raise hogs and pigs, and 53 of those counties disclosed a total inventory of 1,619,063 hogs and pigs.[40] Thus, the Saint Louis Regional Foodshed produces a substantial number of hogs and pigs each year.

Although the economic impact of our food system is beyond the scope of this study, it is important to note the role Missouri plays in national and potentially global supply. In 2010, Missouri ranked in the top six of pork producing states. In addition, 96% of the 3.4 million feeder pigs raised in Missouri went to "Iowa, Illinois, Kansas and Minnesota."[41] Also, in 2011 the United States was the third largest global pork producer and 22% of its production went to exports.[42]

Poultry Productions

According to the 2007 Census of Agriculture, 52 of the 58 counties in the Saint Louis Regional Foodshed reported having inventory of "broilers and other meat-type chickens," and only 38 counties of which disclosed a total inventory of 10,223 such chickens.43 Saint Louis Regional Foodshed farmers raise meat-type chickens, but most of them raise only a small number.

Only three counties - Bollinger, Missouri, Fayette, Illinois, and Osage, Missouri - ranked "broilers

and other meat-type chickens" as their one of their top five livestock commodities in 2007.[44] The Missouri portion of the Saint Louis Regional Foodshed had one Class IC CAFO with "Broiler, Fryer, and Roaster Chickens" in Bollinger County in 2012.45 A Class IC CAFO houses between 125,000-374,999 broilers.46 The Saint Louis Regional Foodshed's current poultry production would, at most, meet less than 2% of our estimated annual chicken consumption.

Eggs

Eggs are a key ingredient throughout the food system in processed foods and fresh foods. However, the data on our Foodshed's egg consumption and production is unavailable. The layer data, (65,269 in the Foodshed) representing laying hens, help indicate production. We note this is a topic for future research.

Health Implications of Livestock We Raise

Many people have begun to examine the health implications of eating so much meat and, in particular, meat produced in an industrialized system. Because animals in confinement eat grains and specially formulated feed mixes that contain hormones, antibiotics and other additives, industrial scale production processes pose risks for consumers including exposures to pathogens, antibiotics,[47] and growth hormones.[48]

Concerns are emerging that animals raised in confinements are less nutritious than their pastured counterparts. Compared to pasture-raised cattle, dairy and meat products from CAFOs are higher in fat and lower in "the omega-3 fatty acids often lacking in our diets."[49] Omega-3 fatty acids are important for good health. In contrast to CAFO meat, pastured livestock may offer more nutritional benefits.

Furthermore, many believe the eggs of pastured chickens have a higher nutritional quality as well. One producer claims, "Pastured eggs have one-third less cholesterol, one-fourth less saturated fat, two-thirds more vitamin A, two times more omega-3 fatty acids, three times more vitamin E, seven times more beta-carotene, four to six times as much vitamin D as typical supermarket eggs."[50] More data is needed comparing nutritional quality of various livestock production methods. For Missouri nutrition researchers interested in the best production methods for nutritional outcomes in our region, research opportunities abound.

Pollutions

AFOs generate pollution. Employees of CAFOs and feedlots are at risk due to pollution emissions on site from particle pollution, methane, ammonia, and hydrogen sulfide gas. "The prevalence of occupational respiratory diseases (occupational asthma, acute and chronic bronchitis, organic dust toxic syndrome) in CAFO workers can be as high as 30%."[51] This pollution is mainly a result of CAFOs housing large numbers of animals, which create extraordinary quantities of animal waste on small areas of land.[52]

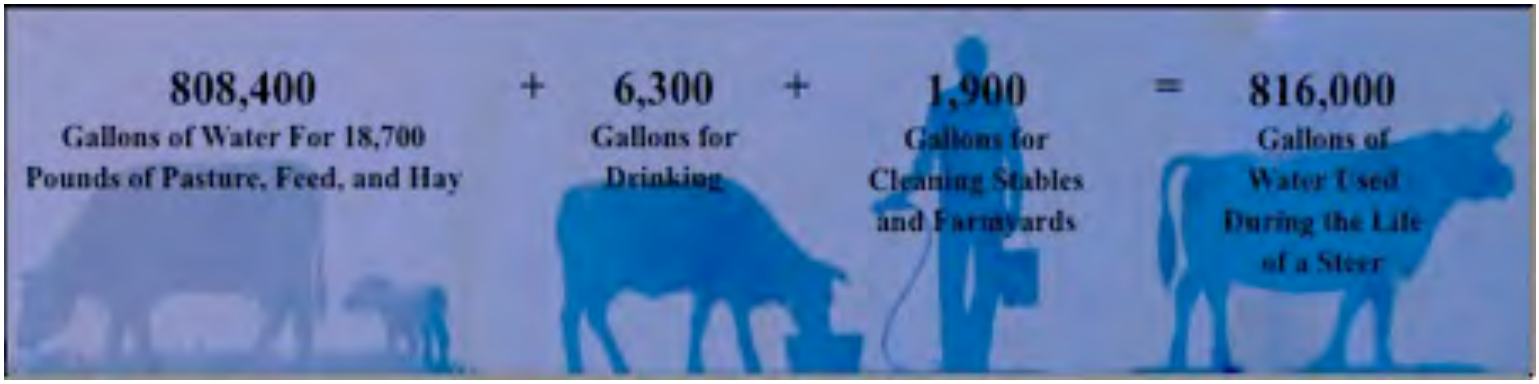
All confined animal operations produce waste which can be the equivalent in volume to sewage produced by a small city. Based on a 2005 report, animals in U.S. CAFOs (hog, poultry, dairy and

feedlots) produced approximately 335 million tons of dry matter manure waste annually.[53] Most CAFO waste in the U.S. is land-applied to adjacent farmland, which poses risks to water sources.

Grain and Water

Confined livestock consume an enormous amount of grain and require significant supplies of water. “Cattle eat about 10 percent of U.S. corn production; other animals eat 60 percent.”[54] CAFO hogs and poultry are among those animals fed a grain-based diet.

The freshwater resources required to produce livestock in industrial systems is greater than the amount required for livestock produced in grazing production systems. The production of one pound of beef requires 1,857 gallons of water.[55] Of all meat, one pound of chicken requires the least amount of water, with 469 gallons.[56] To compare, one pound of eggs and yogurt, both products of animals, require 400 gallons and 138 gallons of water, respectively.[57]



In contrast, apples and strawberries, which are both consumed regularly in the Foodshed and can be produced on the Foodshed’s land, require only 84 and 33 gallons of water, respectively. Fruits are frugal water users compared to the 109 gallons of water required by corn and 240 gallons of water required by soybean, our two largest commodities which are used to produce a significant amount of livestock feed.[58]

The drought of 2012 underscored the need for careful water stewardship. As water resources increasingly become a concern across the globe, including most of the Western U.S., conservation and thoughtful water resource use is vital to sustain any community, regardless of size. The Saint Louis Regional Foodshed can be an example for the nation of a forward-thinking region that addresses problems before they get worse by considering wise use of our water resources.

Considerations

Relying on industrial scale CAFOs for our supply of meat poses proven risks to human health, the environment, and animal welfare. How can the alternatives to CAFOs be affordable? What infrastructure would be needed to keep animals in the region from farm to fork?What are the optimal levels of pasture-based beef production that enables farmers to prosper while protecting soil health and water quality? What are the grazing, feed, and breeding systems that work best in our region?

Can crop and livestock production be integrated to maximize benefits and minimize harms? What animals are best suited for co-existing with what crops? Would decreasing our meat consumption allow us to raise the livestock we eat on open pasture and provide those animals with a grass-fed diet until slaughter?

What would be the impact of decreased meat consumption on water supplies in areas where our meat is produced? What would be the impact on our disease rates? How much of our food economy is tied to livestock? How much of our money spent on livestock-based food can we capture in our Foodshed?

We look forward to exploring these questions with residents of the Saint Louis Regional Foodshed.

Chapter 7. Food Safety in the Food System

Safe and environmentally conservative food production excludes the use of Genetically Modified (GM) seeds, only uses "(least toxic) chemical pesticides as a last resort," and applies only as much fertilizer as can be absorbed by soil and vegetation.[59] To contrast, industrialized farming relies heavily on pesticides and chemical fertilizers, and increasingly employs expensive patented GM seeds to expand large monoculture production. These practices and food inputs cause several short and long-term human health and environmental problems, as the industrial farming system continually emphasizes economic efficiency over human and ecosystem health. Added health and medical expenses result, while ecosystem losses escalate.

Pesticides

Over the course of the last half-century, the use of chemical pesticides has skyrocketed in conjunction with the adoption of industrial agriculture methods. The use of genetically engineered (or genetically modified (GM)) crops has further contributed to the increased use of pesticides because of the ability of GM crops to withstand the lethal effect specific pesticide applications. The increased use of industrial scale no-till farming methods to reduce soil loss has also increased the use of chemical herbicides for weed control.

Long-term health effects of pesticide exposures can range from higher risk of cancer to "disruption of the body's reproductive, immune, endocrine, and nervous systems."[60] Pesticides can contaminate our food through residual amounts on or in fruits, vegetables, and meat, in contaminated drinking water, and in air that has remains from pesticide spraying.[61] Pesticides can also "bioaccumulate" or concentrate in organisms as they travel up the food chain because the chemicals remain in the organisms that eat them.[62] When we eat foods "found higher on the food chain (more meat, milk, cheese, and eggs and fewer plant foods)," we are increasing our consumption of pesticides and the risks associated with them.[63]

Pesticides in the environment have fueled the increase of pesticide-resistant weeds and insects, to which farmers often respond with more or different pesticides. The arms race with nature is thus, endless.David Pimentel, a Cornell entomologist, estimates that roughly "0.1% of applied pesticides reach the target pests, leaving the bulk of the pesticides (99.9%) to impact the environment."[64] Various fauna and flora, including bird and insect populations which have

important and advantageous roles within the ecosystem, suffer pesticide impacts.[65] One specific example of this is the drastic decrease in nature's vital pollinators, honeybees, in the last two to three decades due to the direct and indirect effects of pesticides.[66] Researchers have explored a possible correlation between pesticides and developmental abnormalities in amphibians.[67] When studying this, researchers discovered "frogs with extra legs growing from their abdomens and backs, stumps for hind legs, or fused hind legs."[68] Amphibians and birds often prey on insects. Further, many species, both insect and plant, are becoming resistant to the chemicals sprayed on them.[69]

The possible risks of pesticides are farther-reaching than we know or understand. The known health and environmental impacts alone levy a high price for killing 'pests' on our low-nutrient yielding, monocropped fields. Right now, scientists cannot tell us every harm we risk for by eating from the current food supply, and as new pesticides are introduced, scientific knowledge will continue to lag behind. By shifting to an agricultural system that does not heavily rely on harmful chemical additives, we can alleviate costs for farmers while making safer food and avoiding the known and unknown risks of pesticides.

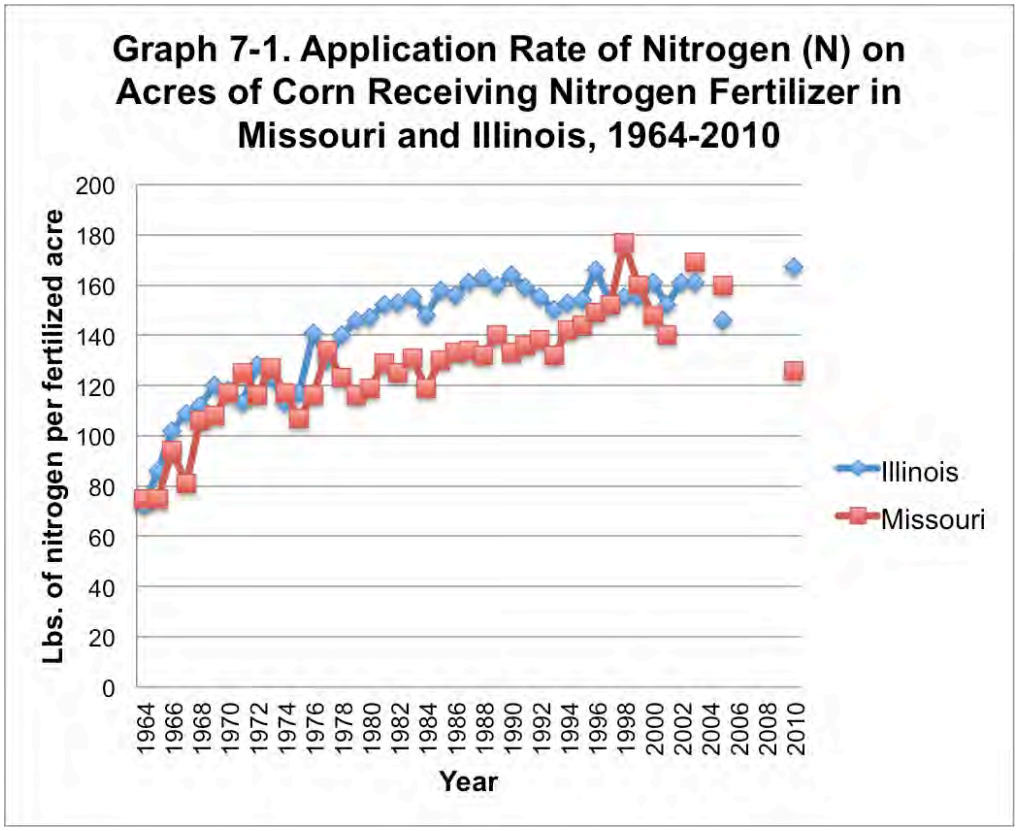
Organic and Chemical Fertilizers

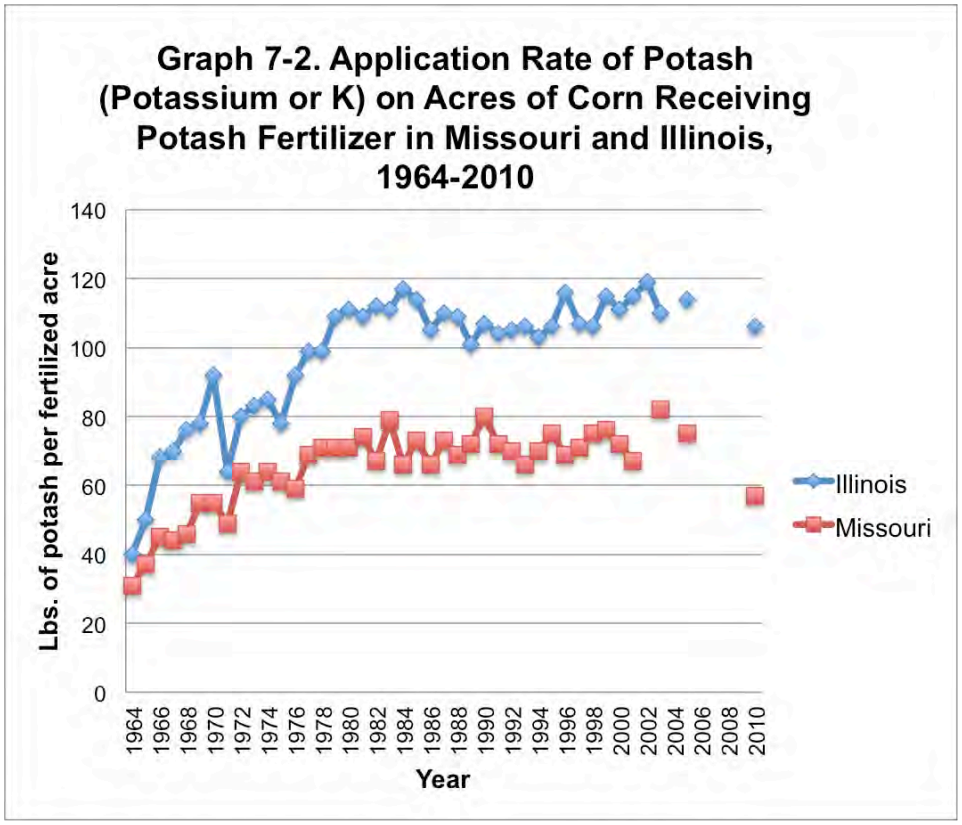
The three most important macronutrients for plant health are nitrogen (N), phosphorus (P), and potassium (K). Farmers use livestock manure as a source of all three[70] or they may rely on chemical fertilizers or judicious use of cover crops and careful crop rotations. In any system, balancing the needs of the crop with the nutrients available in manure and other crop amendments requires careful attention to soil.

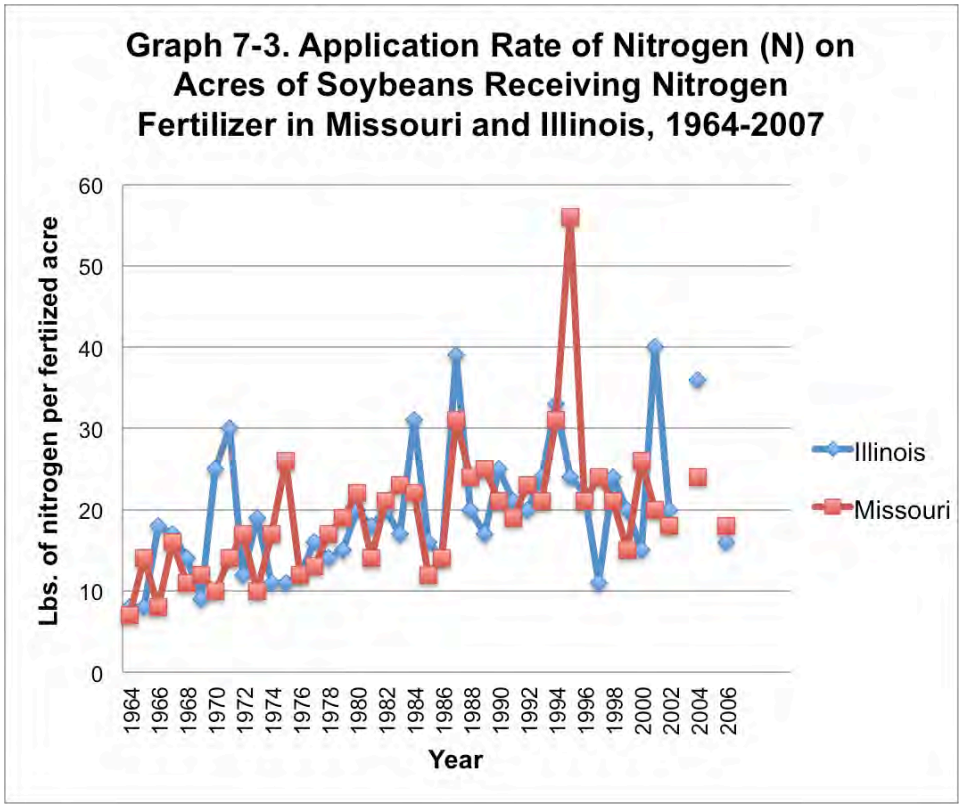
Livestock in confined operations produce quantities of manure in amounts far greater than can be regularly applied on cropland. When producers apply more manure on cropland fields than crops will use, they risk water contamination.[71] Excessive nutrients can become water pollutants if crop fields cannot use the over-abundant manure fast enough because precipitation and wind may carry manure into nearby water bodies. This manure contamination can harm drinking water quality for livestock and the animals that rely on those water bodies, while risking fish kills and algal blooms.

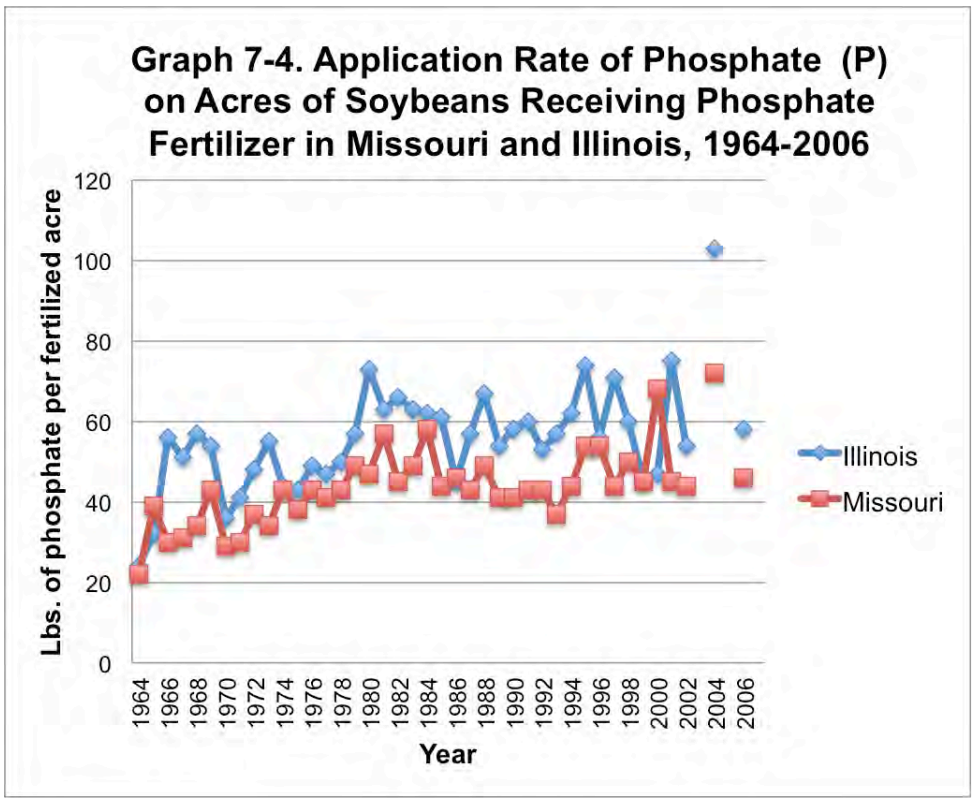
Unlike manure, chemical fertilizers can be custom blended to match the exact needs of crop and address specific soil deficiencies.[72] However, over-application of chemical fertilizer poses the same threats as manure because it can run off into nearby water bodies and cause harm to water quality and ecosystem health. Appropriate formulations and applications depend on timely soil tests. The USDA is now promoting the "4 Rs" to guide fertilizer applications – right source, right rate, right time, and right place. Fertilizer also poses other, lesser-known threats including increasing soil acidity until it begins to impede plant growth. Research indicates that chemically fertilized plots also show less biologic activity in the soil food web (the microscopic organisms that make up the soil ecosystem) than do plots fertilized organically with manure or other biologic sources of fertility.[73]

In Missouri and Illinois the data show increased application of nitrogen fertilizer per acre over the last half-century.[74] as illustrated by Graphs 7-1 to 7-4.[75]


Graph 7-1. Application Rate of Nitrogen (N) on Acres of Corn Receiving Nitrogen Fertilizer in Missouri and Illinois, 1964-2010
Lbs. of nitrogen per fertilized acre
200
180
160
140
120
100
80
60
40
20
0
1964 1966 1968 1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010
Year
Illinois
Missouri


Graph 7-2. Application Rate of Potash (Potassium or K) on Acres of Corn Receiving Potash Fertilizer in Missouri and Illinois, 1964-2010
Lbs. of potash per fertilized acre
140
120
100
80
60
40
20
0
1964 1966 1968 1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010
Year
Illinois
Missouri


Graph 7-3. Application Rate of Nitrogen (N) on Acres of Soybeans Receiving Nitrogen Fertilizer in Missouri and Illinois, 1964-2007
Lbs. of nitrogen per fertilized acre
60
50
40
30
20
10
0
1964 1966 1968 1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006
Year
Illinois
Missouri


Graph 7-4. Application Rate of Phosphate (P) on Acres of Soybeans Receiving Phosphate Fertilizer in Missouri and Illinois, 1964-2006
Lbs. of phosphate per fertilized acre
120
100
80
60
40
20
0
1964 1966 1968 1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006
Year
Illinois
Missouri

Foodborne Pathogens

The industrial food production process is linked to high numbers of food-borne illnesses annually, plaguing dinner tables across the country. “CDC estimates that each year roughly 1 in 6 Americans (or 48 million people) get sick, 128,000 are hospitalized, and 3,000 die of foodborne diseases.”[76] CDC states that four of the “top five pathogens contributing to domestically-acquired foodborne illnesses resulting in hospitalization,” are most commonly transmitted to humans by consumption or ingestion of contaminated meat.[77]

The massive scale of slaughtering and processing operations amplified the public health impacts of contamination. As a result, “[a] single animal infected with E. coli 0157:H7 can contaminate 32,000 pounds of ground beef.”[78]

By eliminating the conditions in which harmful bacteria thrive (such as industrialized feedlots) and deconstructing the assembly line-like processing and manufacturing of food, fewer Americans would be at risk for food-borne pathogen exposure. Further, the geographical distribution of outbreaks would significantly decrease if one contaminated product was not processed with millions of similar products and then distributed throughout the nation.

Antiobiotics and Growth Hormones

Antibiotic use in livestock production is another area prompting greater concern as its effects become more broadly recognized. Half a century ago, farmers began to see the astounding growth in livestock as a result of penicillin and tetracycline use and began to add “the drugs to feed and water, with no prescriptions or signs of sickness in the animals.”[79] Today, approximately 80% of antibiotics made in the U.S. are used in animal production to boost growth,[80] even though studies show that their use allows for growth of resistant strains of microbes.[81] Further, “nonmedical use[82] of antibiotics in animal agriculture may be threatening the effectiveness of antibiotics in treating human disease by creating selective pressure for the emergence of antibiotic-resistant bacteria.”[83]

Growth hormone use in livestock production is also a major health concern and in particular, the use of recombinant bovine growth hormone (rBGH) in dairy. rBGH is the man-made version of the naturally-occurring Bovine growth hormone or bovine somatotropin (BST), which “promotes growth and cell replication.”[84] rBGH is often used “to increase milk production in cows.”[85] Although U.S. dairy farms have used this synthetic hormone since the FDA first sanctioned it in 1993,[86] many countries do not allow its use because of the possibility for adverse human health effects.[87]

Genetically Modified Organisms

The regional agriculture biotechnology company, Monsanto, originally a chemical company, was the “first to genetically modify a plant cell,” and is now the leader in the crop biotech industry.[88]

This industry relies primarily on genetically modifying two main characteristics within an organism: Bacillus thuringiensis (Bt), which allows for insect resistance, and herbicide tolerance (HT).[89] Bt and HT are predominantly “engineered into four commodity crops (corn, cotton, soybeans, and

canola)."[90] Conveniently, Monsanto also produces the chemicals that can be sprayed onto these genetically engineered crops, helping Monsanto dominate the industry. Roundup Ready® (or Roundup® resistant) crops can be sprayed with Monsanto's chemical, Roundup®, from the time the crop pokes through the soil until the crop begins to flower.[91]

As a result of Monsanto lobbying efforts beginning in 1986 and the subsequently passed regulations governing GM organisms, "the dangers of genetically modified foods would be determined by the manufacturers, not the government, and testing would occur only when the companies wanted to. And consumers were not to be notified if their food contained genetically modified organisms . . . ."[92] Today, approximately 85% of American corn and 91% of American soybeans are genetically engineered and estimations conclude that roughly 70% of all processed foods are comprised of genetically engineered products.[93] This is occurring without any labeling to notify the consumer that a food product is genetically modified. Farmers seeking seed that are not genetically modified often have difficulty finding the non-GE seed at their local seed store.

Since GM foods have only recently been integrated into the food supply, health risks, such as new food allergens, are not completely understood and can arise quickly without warning.[94] Genetically engineered food "may be harmful to immune systems and vital organs."[95] GM food poses other risks to animals, the environment, and specifically to humans, including "higher risks of toxicity, allergenicity, antibiotic resistance, immune-suppression and cancer."[96] Additional concerns are decreased nutrient content in food items and elevating toxins to hazardous levels in foods that normally have none or innocuous amounts.[97] Environmental concerns of GM crop production include contamination of wild/non-GM varieties and insect resistance. Insect resistance would require more pesticide, which would increase the risks for food and water contamination from pesticide runoff.

GM seeds also pose concerns for the farmers. Under the contract that GMO-using farmers must sign with their seed company, such as Monsanto, there is almost always a clause that bans farmers from saving their seeds to plant in the next planting season.[98] Ultimately, farmers must buy seed from the company year after year, forcing a dependent relationship between the farmer and the seed company.

Overall, the risks associated with the consumption of genetically engineered organisms are not fully understood. However, financial and contractual risks associated with purchasing genetically engineered organisms are pretty clear and substantial. While U.S. policy continues to allow these organisms to infiltrate our food system and does not require GM-containing food to be labeled, numerous countries have recognized these risks and have taken action to restrict their use, including mandatory labeling requirements and approval of far fewer GM varieties than the United States.[99]

Fossil Fuels

Our food system depends on fossil fuels in every step of the food supply chain. Pesticides and fertilizers are fossil fuel-based and fossil fuels are required to power industrial machinery. In addition, "The food production system also accounts for 17% of all fossil fuel use in the United States, and the average U.S. farm uses 3 kcal of fossil energy in producing 1 kcal of food energy."[100] All this energy expense is for little gain when "produce can travel an average of 1500 miles just to reach our homes, only to lose its flavor and be quick to mold."[101]

Producing and consuming food locally decreases the food sector's energy use simply by limiting the supply chain to local farmers and merchants. With fewer miles to travel and less need for packaging, the food industry consumes less energy while subsequently reducing the price mark-ups associated with the energy use of middlemen industries.[102] Energy independence and security requires that we examine the role of fossil fuels on our food.

Food Safety Conclusion

By transitioning to a locally based, low-chemical food system, present industrial agriculture could be transformed into farming that creates a healthier environment, safer food, and a food system less vulnerable to distribution disruptions. Environmental benefits include biodiversity – pollinators, birds, reptiles and amphibians regaining their role in farm ecosystems. A local food system would provide another level of defense against food-borne illness.

Consumers regain the power to choose stronger relationship with the food producer (i.e. if a community does not want genetically engineered food or pesticides, they can influence their local grower to provide non-genetically engineered or organic food). This provides a safety net for consumers that is unavailable within the industrialized system, since consumers in industrialized agriculture are currently disconnected from most aspects of food production.

By shifting the Saint Louis Regional Foodshed's agricultural framework to a local system in which farmers minimize chemical inputs and employ crop rotation, cover crops, and more diversified operations, and deliver food that is fresher and more nutrient-dense, the health risks associated with industrial food production may decrease.

CONCLUSION & RECOMMENDATIONS

After reviewing the data about our current food system and the impact it has our economy, our health and safety, and our environment we conclude the industrialized agriculture system does not promote human or environmental health of the Saint Louis Regional Foodshed. It is evident that the Saint Louis Regional Foodshed as well as the rest of the nation is in a state of food/nutrient insecurity. Our ecosystems are imperiled. Our health is at stake.

We are convinced by the juicy sweetness of a locally grown peach that we can do better than the high-milage, tasteless fruits and vegetables of uncertain origin that line most grocery stores today. We reject claims of "feeding the world" and embrace the concept of feeding our neighbors. We spend $17 billion on our food. For our money, we deserve nutrition, a fair living for our farmers, and good tasting food close by.

We have the farmland and the farmers; the ranchers and the resources, the soil and the water. We have the power to change our current food system by paying attention to where our food is grown, supporting local agriculture, starting a backyard or community garden, voicing our opinion to our local and state politicians, and collaborating with others in our communities who value nutritious, chemical-free and healthy food. Together we can create the local food system that best serves the people of the Saint Louis Regional Foodshed.

MCE hopes that this Study is informative, useful, and motivating. We hope it encourages you to think about your health, your family's health, your community and our food system. We hope it gets you talking with your neighbors, family, local restaurant owners, government officials, and entrepreneurs about making people of the Saint Louis Regional Foodshed healthier, more mindful of our food choices, more connected, and more self-sustaining. We hope it inspires you to grow local food to help feed families and create jobs.

Looking Ahead

Moving forward, the following areas of study can help us grow a more self-sufficient local food system in our region and in our individual counties:

1. Assess the current policies in Missouri and Illinois that promote or hinder small-scale farms and local agriculture. Examples:

- Illinois Food Farm & Jobs Act which created the Food Farm & Jobs Council (**http://foodfarmsjobs.org/**)
- * Missouri's "Urban Agriculture Act"* Woodbury County, Iowa's tax incentives to encourage young farmers and organic farms.

2. Assess local zoning ordinances and propose ordinance amendments that promote urban agriculture based on city-by-city agriculture capability determinations.

- Municipal Food Innovation Districts. (See Michigan's Guide at **http://regionalfoodsolutions.com/2013/11/18/822/**)
- Alton, Illinois "Food Hub" development with the Alton Area Business Development

Association in Madison County, IL.
- See the 2010 study assessing fruit and vegetable production capacity in Detroit: www.agdevjournal.com/attachments/137_JAFSCD_Assessing_Food_Supply_Capacity_Detroit_Nov-2010.pdf

3. Calculate how much of the region's food dollars leave the region; Calculate the economic impact of each dollar spent on local food.

4. Identify financing needs and opportunities for food producers, distributors and retailers.

5. Train lenders to make good food and farm loans.

6. Determine ways to increase fruit and vegetable production, and particularly, through USDA and Missouri Dept. of Agriculture cost-share programs.

7. Increase awareness and development of farm to buyer programs like "Farmplicity", which links growers with chefs through an on-line platform developed at Washington University (see www.farmplicity.com).

8. Identify solutions to increase use of local food in schools, childcare programs, hospitals, and institutions as in Maplewood School District in suburban St. Louis or at Madison Medical Center in Fredericktown, (Madison County) Missouri.

9. Assess local farm labor/training needs and challenges; identify problems, innovative partnerships and potential solutions.

10. Conduct soil testing on the region's cropland to determine if pollutants are a hindering factor in production potential. Also conduct soil testing on urban land to determine the capacity for urban areas to develop urban agriculture efforts.

11. Calculate the area's production potential of specific fruits and vegetables using season extending mechanisms, such as hoop houses.

12. Assess local food infrastructure for processing, warehousing and distribution; identify needs and solutions.

[1] See Nat'l Agric. Statistics Serv., U.S. Dep't of Agric., 2007 Census of Agriculture - Missouri - State and County Data 251-65 (2009) **http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1**,_Chapter_2_County_Level/Missouri/mov1.pdf [hereinafter 2007 Census of Agriculture - Missouri]; Nat'l Agric. Statistics Serv., U.S. Dep't of Agric., 2007 Census of Agriculture - Illinois - State and County Data 333-45 (2009) **http://www.agcensus.usda.gov/Publications/2007/Full_Report/Volume_1**,_Chapter_2_County_Level/Illinois/ilv1.pdf [hereinafter 2007 Census of Agriculture - Illinois].
[2] Id.
[3] Ctr. Applied Research & Envtl. Sys., supra note 26.
[4] Id. (emphasis added).
[5] Id.
[6] Ctr. Applied Research & Envtl. Sys., supra note 26 (select "Food Environment" menu and follow "Access to Food" hyperlink; then select info button beside "Locations of Farmers' Markets, Nationwide (USDA 2011)") (last visited July 14, 2013).
[7] See Food Expenditures: Overview, USDA ERS (May 21, 2013), **http://www.ers.usda.gov/data-products/food-expenditures.aspx#26636** (follow "Table 13. Per Capita Food Expenditures" hyperlink) [hereinafter Table 13. Per Capita Food Expenditures]. Table 13. Per Capita Food Expenditures was last updated October 1, 2012.
[8] Int'l Trade Admin., U.S. Dep't of Commerce, 2012 NAICS 11 - Agriculture and Livestock Products Exports from Missouri, TradeStates Express, **http://tse.export.gov/TSE/MapDisplay.aspx** (Select "State Export Data" and follow hyperlink; select "Global Patterns of a State's Exports" and follow hyperlink; select "Missouri from drop down menu under "State/U.S. Region" title; click "change" button under "Products" section; expand "All Non-Manufactured Goods" option of the Merchandise Classification System, select "Agriculture and Livestock Products" option and then click the "Update" button; once window closes, click the "Go" button and follow hyperlink for data table) [hereinafter Agriculture and Livestock Products Exports from Missouri].
[9] U.S. Department of Commerce, International Trade Administration, 2012 NAICS 11 - Agriculture and Livestock Product Exports from Illinois, TradeStates Express, **http://tse.export.gov/TSE/MapDisplay.aspx** (Select "State Export Data" and follow hyperlink; select "Global Patterns of a State's Exports" and follow hyperlink; select "Illinois" from drop down menu under "State/U.S. Region" title; click "change" button under "Products" section; expand "All Non-Manufactured Goods" option of the Merchandise Classification System, select "Agriculture and Livestock Products" option and then click the "Update" button; once window closes, click the "Go" button and follow hyperlink for data table) [hereinafter Agriculture and Livestock Product Exports from Illinois].
[10] U.S. Census Bureau, Population, Housing Units, Area, and Density: 2010 - County -- Census Tract, supra note 25.
[11] See 2007 Census of Agriculture - Missouri, supra note 33, at 359-73; 2007 Census of Agriculture - Illinois, supra note 33, at 347-58.
[12] 2007 Census of Agriculture - Missouri, supra note 33 at 359-88; 2007 Census of Agriculture - Illinois, supra note 33, at 346-71.
[13] Nat'l Cooperative Soil Survey, U.S. Dep't of Agric., Soil Survey of Osage County, Missouri 56 (1999) **http://soildatamart.nrcs.usda.gov/manuscripts/MO151/0/Osage_MO.pdf.**
[14] See From the Ground Down, supra note 23, at 14.
[15] See Richard L. Forstall, U.S. Bureau of the Census, Illinois Population of Counties by Decennial Census: 1900 to 1990 (1995), **http://www.census.gov/population/cencounts/il190090.txt;** Richard L. Forstall, U.S. Bureau of

the Census, Missouri Population of Counties by Decennial Census: 1900 to 1990 (1995), **http://www.census.gov/population/cencounts/mo190090.txt;** County Totals: Annual Population Estimates, supra note 24.
[16] See 1925 Census of Agriculture – Missouri, supra note 342, at 904-15; 1925 Census of Agriculture – Illinois, supra note 342, at 492-503.
[17] See 2007 Census of Agriculture - Missouri, supra note 33, at 359-73; 2007 Census of Agriculture - Illinois, supra note 33, at 346-58.
[18] See 1925 Census of Agriculture – Missouri, supra note 351, at 904-15; 1925 Census of Agriculture – Illinois,
supra note 351, at 492-503.
[19] See 2007 Census of Agriculture - Missouri, supra note 33, at 359-73; 2007 Census of Agriculture - Illinois, supra
note 33, at 346-58.
[20] The average farm size for the Saint Louis Regional Foodshed was calculated by averaging the reported "average
farm sizes" for each county.
[21] Dimitri et al., supra note 340.
[22] See 1925 Census of Agriculture -- Illinois, supra 9, at 534-47 (provides total acres for specific fruits and vegetables in all Illinois counties for the year 1925); 1925 Census of Agriculture -- Missouri, supra 9, at 949-63 47 (provides total acres for specific fruits and vegetables in all Missouri counties for the year 1925); 2007 Census of Agriculture: Illinois, supra note 8, at 594-637 (provides total acres for specific fruits and vegetables in all Illinois counties for the year 2007); 2007 Census of Agriculture: Missouri, supra note 8, at 594-637 (provides total acres for specific fruits and vegetables in all Missouri counties for the year 2007).
[23] See 1925 Census of Agriculture -- Illinois, supra 9, at 534-47 (provides total acres for particular field crops in all Illinois counties for the year 1925); 1925 Census of Agriculture -- Missouri, supra 9, at 949-63 (provides total acres for particular field crops in all Missouri counties for the year 1925); 2007 Census of Agriculture -- Illinois, supra note 8, at 486-540 (provides total acres for particular field crops in all Illinois counties for the year 2007); 2007 Census of Agriculture - Missouri, supra note 8, at 251-73, 573-75 (provides total acres for particular field crops in all Missouri counties for the year 2007).
[24] See id.
[25] See id.
[26] See Quick Stats, supra note 382 (select "Census" under Program, select "Crops" under Sector, select "Vegetables" under Group, select "Vegetable Totals" under Commodity, select "Area Harvested" under Category, select "Vegetable Totals, in the Open – Operations with Area Harvested" under Data Item, select "County" under Geographic Level, select "Missouri" under State, select all Missouri counties in the St. Louis Regional Foodshed under "County" and select "2007" under year; then select "Get Data"; repeat steps replacing "Illinois" for "Missouri" under State and selecting all Illinois counties in the St. Louis Regional Foodshed under "County").
[27] Ctr. Applied Research & Envtl. Sys., National Interactive Maps: CARES Map Room (2011), **http://ims2.missouri.edu/tool/maps/default.aspx.** (select "Food Environment" menu and select "Agriculture" hyperlink; then select "Organic Crop Production, Number of Acres" and select "Make Map" button). (last visited Aug. 2, 2012). For all Center for Applied Research and Environmental Systems (CARES) maps created for this study, the first step to create all CARES maps in this report is given here and omitted from subsequent footnotes: Select "Administrative Areas" menu and follow "Census Boundaries" hyperlink; then select "County Boundaries." The parenthetical that follows the CARES Map Room URL in each footnote describes the second step, which is locating each layer on the CARES website that is used for the particular map. When data from

CARES maps are referenced in the study, that data can be located on the CARES Map Room webpage with the following final steps: select "select features" tool from toolbar and drag mouse across Foodshed counties on map; select [specific data layer name] from Active Map Layer drop down menu and select "Download All Data" button. If a map shows more than one data layer, repeat the last step for each data layer's exact numbers.

[28] Ctr. Applied Research & Envtl. Sys., supra note 27 (select "Food Environment" menu and select "Agriculture" hyperlink; then select "Orchards, Number of Acres" and select "Make Map" button).

[29] Bill Ganzel, Farm Boom of the 1970s, Wessels Living History Farm (2009) **http://www.livinghistoryfarm.org/farminginthe70s/money_02.html.**

[30] U.S. Census Bureau, Section 3. Health and Nutrition, in Statistical Abstract of the U.S.: 2012, 99, 141, 142 (131st ed. 2011) **http://www.census.gov/prod/2011pubs/12statab/health.pdf** [hereinafter Section 3. Health and Nutrition] (providing 2009-estimated per capita consumption of grain and meat products). Red meat consists of beef, veal, lamb and mutton, and pork. Id. Protein sources consist of meat, poultry, eggs, beans and peas, processed soy products, nuts and seeds, and seafood. U.S. Dep't of Agric., What Foods are in the Protein Foods Group?, ChooseMyPlate.gov, **http://www.choosemyplate.gov/food-groups/protein-foods.html** (last visited July 10, 2013) [hereinafter What Foods are in the Protein Foods Group?].

[31] JoAnn Burkholder et al., Impacts of Waste from Concentrated Animal Feeding Operations, Envtl. Health Persp., Feb. 2007, 308, 308, **http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1817674/pdf/ehp0115-000308.pdf.**

[32] See Quick Stats, USDA Nat'l Agriculture Stat. Serv., **http://quickstats.nass.usda.gov** (select "Census" under Program, select "Animals & Products" under Sector, select "Livestock" and "Poultry" under Group, select "Cattle," "Chickens," "Eggs," "Hogs," and "Turkeys" under Commodity; select "Production" under Category; select each option with "Operations with Production" under Data Item; select "Total" under Domain; select "County" under Geographic Level, select "Missouri" under State, select all Missouri counties in the Saint Louis Regional Foodshed under "County" and select "2007" under year; then select "Get Data"; repeat steps replacing "Illinois" for "Missouri" under State and selecting all Illinois counties in the Saint Louis Regional Foodshed under "County").

[33] See 2007 Census of Agriculture - Missouri, supra note 2, at 454-68, 419-33, 469-83 (providing inventory numbers for hogs and pigs, cattle and calves, beef cows, milk cows, broilers and other meat-type chickens, layers and turkeys for each county in Missouri); See 2007 Census of Agriculture - Illinois, supra note 2, at 429-441, 398-428, 442-54 (providing inventory numbers for hogs and pigs, cattle and calves, beef cows, milk cows, broilers and other meat-type chickenrs, layers and turkeys for each county in Illinois).

[34] Our Standards, Am. Grassfed Ass'n, **http://www.americangrassfed.org/about-us/our-standards/** (last visited July 11, 2013).

[35] See Pastured Products Directory – Missouri, Eat Wild, **http://www.eatwild.com/products/missouri.html.**

[36] See Section 3. Health and Nutrition, supra note 1, at 141.

[37] See National Family Farm Coalition Food, Inc. and FRESH: Facts and Solutions Needed to Fix the Food System! www.nffc.net.

[38] See Quick Stats, supra note 5 (Select "Census" under Program, select "Animals & Products" under Sector, select "Dairy" under Group, select "Milk" under Commodity, select "Milk, Incl Other Dairy Products - Operations with Sales" under Data Item, select "Total" under Domain, select "County" under Geographic Level, select "Missouri" under State, and select all Missouri counties in the Saint Louis Regional Foodshed under "County"; select "1997," "2002," and "2007," under

Year; then select "Get Data"; repeat steps replacing "Illinois" for "Missouri" under State and selecting all Illinois counties in the Saint Louis Regional Foodshed under "County").
39 See Quick Stats, supra note 5 (select “Survey” under Program, select “Animals & Product” under Sector, select “Livestock” under Group, select “Cattle” under Commodity, select “Inventory” under Category, select “Cattle, Cows, Milk – Inventory” under Data Item, select “County” under Geographic Area, select “Missouri” under State, and select all Missouri counties in the Saint Louis Regional Foodshed under "County"; select “1925,” “1934,” “1949,” “1964,” “1974,” “1987,” “2002,” “2007,” and “2013” under Year; then select "Get Data"; repeat steps replacing "Illinois" for "Missouri" under State and selecting all Illinois counties in the Saint Louis Regional Foodshed under "County").
[40] See 2007 Census of Agriculture - Missouri, supra note 2, at 454-68; 2007 Census of Agriculture - Illinois, supra note 2, at 429-44.
[41] Missouri Swine Audit, U. Mo. Extension Commercial Agric. Program, **http://agebb.missouri.edu/commag/swine/audit/** (last visited June 25, 2013).
[42] Id.
[43] See 2007 Census of Agriculture - Missouri, supra note 2, at 469-83 (providing inventory for broilers and other meat-type chickens for each county in Missouri); 2007 Census of Agriculture - Illinois, supra note 2, at 442-54 (providing inventory for broilers and other meat-type chickens for each county in Illinois).
[44] See 2007 State and County Profiles - Missouri, supra note 6 (follow the hyperlink for Bollinger county to display a summary of the county’s agriculture data, including the top five livestock commodities; then follow the hyperlink for Osage county to display a summary of the county’s agriculture data, including the top five livestock commodities); 2007 State and County Profiles - Illinois, supra note 6 (follow the hyperlink for Fayette county to display a summary of the county’s agriculture data, including the top five livestock commodities).
[45] See MO 2012 NPDES AFOs, supra note 14.
[46] Mo. Dep’t of Natural Res., Guide to Animal Feeding Operations 1 (2011) **http://www.dnr.mo.gov/pubs/pub915.pdf** [hereinafter Guide to Animal Feeding Operations].
[47] See id., at 449.
[48] Food & Water Watch, Food Safety Consequences of Factory Farms 3 (2007) **http://documents.foodandwaterwatch.org/doc/FoodSafetyFactoryFarms.pdf** (citing Doohoo I. et al, Report of the Canadian Veterinary Medical Association Expert Panel on rBST, Health Canada (1998)).
[49] Michael Bomford, FOOD:Getting Fossil Fuels Off The Plate 4 (2011) **http://www.postcarbon.org/Reader/PCReader-Bomford-Food.pdf.**
[50] Id. (citing Letitia L. Star, The Best Foods to Reduce Cholesterol, The Herb Companion (Feb./Mar. 2012) **http://www.herbcompanion.com/heal/health/best-foods-to-reduce-cholesterol-zmrz12fmzdeb.aspx?page=4**).
[51] Id.
[52] What’s the Problem?, EPA (June 2, 2011), **http://www.epa.gov/region9/animalwaste/problem.html.**
[53] FY-2005 Annual Report Manure and Byproduct Utilization National Program 206, USDA Agricultural Research Service (Oct. 28, 2008), **http://www.ars.usda.gov/research/programs/programs.htm?np_code=206&docid=13337.**
[54] Harvey Blatt, America’s Food, What You Don’t Know About What You Eat 136 (2008).
[55] Id.
[56] See id. (providing a special supplement, World Rivers/Water Footprint, which illustrates the gallons of water needed to produce common food products).
[57] Id.

[58] Id.
[59] Horrigan et al., supra note 14, at 452. While this study does not address the ability to shift entirely to organic farming in the Foodshed, organic production does without pesticides or chemical fertilizers and significantly decreases the risk of super weeds. Philpott points out that organic farming, which uses compost, manure, and cover crops to provide nutrients, increases productivity in stressed conditions. Tom Philpott, Food and Extreme Weather: It's the Soil, Stupid, Mother Jones (July 9, 2012 3:00 AM), **http://www.motherjones.com/tom-philpott/2012/07/what-organic-ag-teaches-us-about-feeding-ourselves-while-planet-heats.**
60 Horrigan et al., supra note 14, at 450.
[61] Horrigan et al., supra note 14, at 451.
[62] Id.
[63] Id.
[64] Id. at 446.
[65] Id.
[66] Id.
[67] Id.
[68] Id.
[69] Id. at 447.
[70] See John A. Lory, Univ. of Mo. Extension, Div. of Plant Sciences, Managing Manure Phosphorus to Protect Water Quality, **http://extension.missouri.edu/p/G9182.**
[71] JoAnn Burkholder et al., Impacts of Waste from Concentrated Animal Feeding Operations, Envtl. Health Persp., Feb. 2007, at 308, 308, **http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1817674/pdf/ehp0115-000308.pdf** ("Overapplication of animal wastes or application of animal wastes to saturated soils can also cause contaminants to move into receiving waters through runoff and to leach through permeable soils to vulnerable aquifers. Importantly, this may happen even at recommended application rates.").
[72] Lory, supra note 24 at 1.
[73] Horrigan et al., supra note 8, at 446 (citations omitted).
[74] Fertilizer Use and Price, USDA ERS, **http://www.ers.usda.gov/data-products/fertilizer-use-and-price.aspx#26744** (follow hyperlink for "Table 10—Nitrogen used on corn, rate per fertilized acre receiving nitrogen, selected States, 1964-2010," hyperlink for "Table 14—Potash used on corn, rate per fertilized acre receiving potash, selected States, 1964-2010," hyperlink for "Table 22—Nitrogen used on soybeans, rate per fertilized acre receiving nitrogen, selected States, 1964-2006," and hyperlink for "Table 24—Phosphate used on soybeans, rate per fertilized acre receiving phosphate, selected States, 1964-2006;" then view data for Illinois and Missouri in each data sheet).
[75] Fertilizer Use and Price, USDA ERS, **http://www.ers.usda.gov/data-products/fertilizer-use-and-price.aspx#26744** (follow hyperlink for "Table 10—Nitrogen used on corn, rate per fertilized acre receiving nitrogen, selected States, 1964-2010," hyperlink for "Table 14—Potash used on corn, rate per fertilized acre receiving potash, selected States, 1964-2010," hyperlink for "Table 22—Nitrogen used on soybeans, rate per fertilized acre receiving nitrogen, selected States, 1964-2006," and hyperlink for "Table 24—Phosphate used on soybeans, rate per fertilized acre receiving phosphate, selected States, 1964-2006;" then view data for Illinois and Missouri in each data sheet).
[76] 2011 Estimates of Foodborne Illness, Centers for Disease Control & Prevention (Feb. 7, 2012) **http://www.cdc.gov/foodborneburden/2011-foodborne-estimates.html.**
[77] Id.; see Campylobacter: General Information, Centers for Disease Control & Prevention (July 20, 2010),

http://www.cdc.gov/nczved/divisions/dfbmd/diseases/campylobacter/#food_water; Toxoplasmosis: Epidemiology & Risk Factors, Centers for Disease Control and Prevention (Nov. 2, 2010), http://www.cdc.gov/parasites/toxoplasmosis/epi.html#animal; Escherichia coli: General Information, Centers for Disease Control & Prevention (June 17, 2012) http://www.cdc.gov/ecoli/general/index.html [hereinafter E. coli: General Information]; Diamond Pet Foods Expands Voluntary Recall of Dry Pet Food Due to Potential Salmonella Contamination, FDA (May 7, 2012), http://www.fda.gov/Safety/Recalls/ucm303034.htm [hereinafter Diamond Pet Foods].

[78] Id. at 204.

[79] Gardiner Harris, Steps Set for Livestock Antibiotic Ban, N.Y. Times (Mar. 23, 2012), http://www.nytimes.com/2012/03/24/health/fda-is-ordered-to-restrict-use-of-antibiotics-in-livestock.html.

[80] Id.

[81] Horrigan et al., supra note 14, at 449.

[82] Nonmedical use refers to use for animal growth instead of use for treating illness. Renée Johnson, Congressional Research Service, Potential Trade Implications of Restrictions on Antimicrobial Use in Animal Production 2 (2011) http://www.fas.org/sgp/crs/misc/R41047.pdf.

[83] Horrigan et al., supra note 14, at 451.

[84] Recombinant Bovine Growth Hormone, Am. Cancer Soc'y (Feb. 18, 2011), http://www.cancer.org/Cancer/CancerCauses/OtherCarcinogens/AtHome/recombinant-bovine-growth-hormone.

[85] Id.

[86] Id.

[87] Information on rBGH or rBST - aka Posilac - Eli Lilly's Genetically Engineered Bovine Growth Hormone, Organic Consumers Ass'n, http://www.organicconsumers.org/rbghlink.cfm (last visited July 25, 2013).These countries include Australia, New Zealand, Canada, Japan, and the entire European Union (EU). Id.

[88] Company History, Monsanto, http://www.monsanto.com/whoweare/pages/monsanto-history.aspx (last visited Aug. 13, 2012).

[89] Charles M. Benbrook, Genetically Engineered Crops and Pesticide Use in the United States: The First Nine Years 1, 2 (2004) http://organic.insightd.net/reportfiles/Full_first_nine.pdf.

[90] Genetically Engineered Crops, Grounds Maintenance (Katie Eagan eds.) http://grounds-mag.com/mag/grounds_maintenance_genetically_engineered_crops/ (last visited Aug. 9, 2012).

[91] Roundup Ready System, Monsanto, http://www.monsanto.com/weedmanagement/pages/roundup-ready-system.aspx (last visited Aug. 13, 2012).

[92] Thom Hartmann, Unequal Protection: the Rise of Corporate Dominance and the Theft of Human Rights 162-63 (2002).

[93] Id.

[94] Horrigan et al., supra note 14, at 452.

[95] Id. at 451.

[96] Genetically Engineered Crops, supra note 602.

[97] Jane Rissler & Margaret Mellon, Environmental Effects of Genetically Modified Food Crops - Recent Experiences, Union of Concerned Scientists (June 12, 2003) http://www.ucsusa.org/food_and_agriculture/science_and_impacts/impacts_genetic_engineering/environmental-effects-of.html.

[98] David Kruft, Dickinson Sch. of Law, Impacts of Genetically Modified Crops and Seeds on Farmers 3 (2001) http://law.psu.edu/_file/aglaw/Impacts_of_Genetically_Modified.pdf.

[99] David Vogel, The Politics of Precaution: Regulating Health, Safety, and Environmental Risks in Europe and the United States 73, 89-90 (2012). "As of 2002, seventeen countries had adopted mandatory GM food labeling requirements, including Japan, China, Brazil, Chile, Indonesia, New Zealand, Australia, Turkey, Korea, Mexico, China, Taipei, and Saudi Arabia, though none are as strict or as comprehensive as those of the EU." Id. at 89-90.
[100] Horrigan et al., supra note 14, at 448.
[101] Gateway Greening, **http://www.gatewaygreening.org** (last visited Mar. 7, 2013); see GatewayGreening: Building a Community Garden, YouTube (Sept. 9, 2012) **http://www.youtube.com/watch?feature=player_embedded&v=Gwpx_FTql80#!.**
[102] Incorporating organic practices into local food systems further reduces fossil fuel dependency by eliminating the hidden fossil fuel costs of transporting and packaging of pesticides and chemical fertilizers. Further, chemical fertilizers contain nitrate, a by-product of natural gas and an important compound for increasing production.