Curriculum Units by Fellows of the Yale-New Haven Teachers Institute
2011 Volume IV: Energy, Environment, and Health

Thinking about Food: Making Sustainable Food Choices

Curriculum Unit 11.04.06
by Kimberly J. Workinger

Rationale and Objectives

When armed with information, people can make decisions that are rational. When it comes to food, students may not even realize that information is available to make decisions and that the choices they make have far ranging consequences. It can be argued that many adults don't know where their food comes from so it is not farfetched to think that urban students, with nary a field or production animal in sight, know where that burger and fries came from. The Emmy Award winning television program staring Jamie Oliver called "Food Revolution" illustrated this when he held up a potato and asked what could be made from this. They didn't even recognize it as a potato! The kids being asked were elementary school kids but my experience with high school students indicates that there are still many misconceptions and lack of knowledge about what is involved in bringing the immense variety of food that is available to them from seed to plate and how this process uses enormous amounts of non-renewable energy and natural resources.

Sound School is a regional vocational aquaculture school. Included in the population are a group of students who have expressed an interest in agriculture. They come to Sound School for a variety of reasons that range from wanting to attend a smaller school in an urban district to genuinely having an interest in animals or plants. Being from an urban environment, they come to the class with limited information or misconceptions about where their food comes from. This unit is designed for these students so that they may make real world connections between the material they learned in the greenhouse and lifestyle decisions. Future developments in the unit will further explore animal production for the students whose interest is in animals.

The process by which food comes to our table is often referred to as the food cycle and in modern agriculture it is quite complex. Consequently, this unit will address only two components of the cycle; transportation and production. Transportation refers to the movement of the product from its point of origin to the consumer. Production refers to the method used to grow the food to market weight, size or volume. As consumers, we make our first choice about food when we decide what and where to purchase. Food selection and understanding where it was produced geographically allows the consumer, in this case the student, to have some impact on how far it travels to the plate for a given time of year. When we decide where we purchase our food we are making choices not only about how far it traveled but how it was produced; hence, the second part of the unit which is production. There have been immense changes in the way our food is being produced to feed an ever increasing population. How the food is grown can have an impact on the environment, energy

use and health. This unit can be further expanded to include more components of the food cycle.

Agriculture and how it has changed

Agriculture supplies the food and fiber we need from the land. When humans stopped hunting and gathering, we started culturing or growing our food. At first, we did this in a sustainable way. We had many different plants and animals growing and being harvested on farms and for the most part the produce harvested supported the farmer. In this polyculture system crops were rotated and manure from the animals living on the farm was spread to replenish the nutrients removed by the crops. Farmers and their environment were in balance. As people moved away from farms into the cities with the advent of industrial societies, fewer and fewer farms were feeding more and more people. According to the USDA in 1920 there were 6.4 million farms utilizing 9.6 billion acres of our country to make food. The average farm was 148.2 acres. In 1992 there were 1.9 million farms on 9.5 million acres meaning that the average size had jumped to 491 acres. (1) This trend continues today. As farms grew in size, they increased their yields per acre to meet the demands of the people. With the emergence of monocultures, vast areas of land were used to produce a single crop. With no animals living on the farm, their manure that was spread as fertilizer had to be replaced. Factories that had once made weapons for WWII used these same ingredients to make synthetic fertilizers. Also in the 1940's the pesticide industry began to flourish due to advances in chlorine chemistry, producing chlorinated hydrocarbons, such as DDT. Seed companies developed specialized seeds that were resistant to drought and insects as well as the mechanization that came along with harvesting the increased yields. From planting to harvesting to the manufacturing of fertilizer, agriculture became an oil dependent industry. As long as oil was available and easy to get, food remained inexpensive. In recent years, oil prices have been variable and rising resulting in increased food prices. Climate change is affecting weather and the consistent, reliable availability of those crops. Heat waves, droughts, and severe storms are increasing in severity, and all threaten successful harvests. While producing the food is more expensive both in terms of energy and resources, moving it from where it was produced to consumers all over the world is also energy intensive. Some believe that modern energy-intensive agriculture is not sustainable. Others contend that only by developing more resistant seeds, better fertilizers, more effective pesticides and increasing mechanization on the farm will we feed the world expected to include nine billion people by the end of the century.

The Food Production Cycle- Seed to Plate

images/2011/4/11.04.06.01.jpg

While the food production cycle has become increasingly complex over time, it starts at the farm where the animal is raised and the fruit, grain or vegetable is planted. This phase of the cycle ends when the product is mature or has met a target weight or volume and is ready for market. From this point on, the path that any particular product takes can be very complex or very simple and direct to the consumer. For most of human history, the farm owner was the consumer. Current farming operations are in the business of producing far more than they need to make a profit. The product is transported to food processors for milling, slaughter,

cleaning, sorting and grading, chopping, packaging, and blending with other ingredients among other processes. It is then shipped to a distribution point where it is stored until being transported to the retail location or restaurant that has arranged for its purchase. A retail location includes supermarkets, convenience stores, or bulk distribution outlets like BJ's or Sam's Club. Food purchased here usually, although not always, requires preparation at the home. The final step of the process includes the disposal of foodstuff and the packaging.

Transportation

The term "food miles" is often used now to define the average distance food travels from its source to the table. Current estimates range between 1500 and 1700 miles. (2) Our society tends not to change dietary patterns seasonally. Food crops will not grow in many temperate parts of the world during the winter months, and this forces food to be stored and shipped long distances. Increasingly, our food comes from all over the globe as we demand tomatoes in January and fresh fruit any time of year. "In 1970, 21% of the fruit consumed in the United States was imported. By 2001, 39% of fresh fruits were imported". (3) Nearly 90% of the vegetables consumed in the US are grown in the San Joaquin Valley of California.(4) As farm size increased, and the number of farms declined, most growers concentrated on fewer and fewer crops. Most foods are grown by farmers who practice monoculture, or growth of a single crop. At the same time our dietary preferences diversified. The effect is that food is shipped longer distances than at any previous time in history. In order for these products to reach markets, they rely on many different modes of transportation. The term food mile incorporates the amount of energy used to move the food. It provides the basis to estimate the amount of greenhouse gas emissions as well as the air, water and land pollution associated with fuel use in vehicles. Foods that are frozen or require refrigeration cost more to move: red meat produces 150% more greenhouse gases than chicken or fish (5). The study referenced suggests that there would be a greater effect on greenhouse gas emissions by changing dietary patterns to fish, chicken and vegetables than if everyone bought food grown locally (6).

Transportation accounts for only 11%, of the total carbon footprint in greenhouse gas emissions of the food production industry while food production accounts for 83% (7). The consumer can have an impact on that energy expense each and every time they go to the grocery store. They can choose to walk, ride a bike or even take public transportation to pick up the food and further reduce the food miles. Eating at home instead of choosing restaurants allows the consumer to decide where the food originates and reduces emissions from numerous trips to restaurants.

Eating Locally- Another Solution to Food Miles

The explosion of farmers markets and Community Supported Agriculture (CSA) in recent years is the most obvious result of a renewed interest in reducing the food miles and subsequently our impact on the environment. A farmer offers "shares" in a CSA to interested consumers who as a result of their participation receive a bag, box or crate of fresh farm products on a weekly basis during the growing season. Occasionally, the farmer will establish a cooperative relationship with other producers which will result in a variety of other products for the shareholders. The farmer gets his cash flow before the season begins allowing him to focus on the production of quality food and less on the marketing of the food. The consumer gets fresh locally

produced food that is higher in nutritional value and establishes a relationship with the grower through weekly personal exchanges. In 1990 there were an estimated 60 CSAs in the US. Today there are approximately 1500-1700. (8) Farmers markets are another direct marketing opportunity for producers. In a USDA study, Farmers Market Trend Analysis indicated that in the last decade, the number of farmers markets has increased from 1,755 markets in 1994 to 2,863 in 2000, a 63% increase. In 2000 2.8 million customers were being served. The USDA study includes only those operations where a group of farmers come to a common location to direct market their products to the consumer. This type of successful direct marketing to the consumer is likely the reason some of the small to medium sized farms are still in existence.

Reasons to buy locally can range from enhanced nutrition to the esoteric, hard-to-measure benefits such as the relationship with the farmer that is developed, an enhanced connection to the community, a shared risk that comes from variable weather and other conditions and the sense that you are connected to your food. Buying locally also generates revenue for the local economy. The 1500 mile trip to the table may take up to two weeks to complete diminishing the nutrients available not including the methods used to bring the product to the color that is most marketable including gassing and dyeing. Food that is produced locally has been picked more recently and has therefore not lost many of these nutrients. Without farmers, integral members of society, there would be no food.

"Through the conventional food distribution system, farmers, on average, receive less than twenty cents for every dollar of food they produce. Farmers who sell directly to consumers at farmers markets receive on average 90 cent per dollar of food they produce. Farmers selling to consumers at their own farm stands and CSA's are earning the full dollar for each dollar of food produced!" (9)

Activities: How much food am I eating & How far did that meal travel?

Keeping a journal and logging what students eat and how many calories are consumed daily will teach many of the concepts addressed above. In this activity, students will record what they consume for five days. They will also research the number of calories available in each meal and break the meal into its components or ingredients. The USDA website allows the student to choose the unit of measure. Students will work together in groups to analyze the information and discuss trends. This same information will be used later as we examine the possible sources of the food and its geographic diversity. This activity has potential for extension and cross-curricular activities including the teaching of units of measure and ratios in math as well as cultural influences for social sciences or health classes.

Production

Conventional agriculture is doing a phenomenal job as the amount of food consumed by Americans is staggering. The availability of a wide range of food 24-7 is arguably the single biggest contributor to our ever expanding waistline and healthcare costs. "The average American consumes 2,200 lbs of food per year containing an estimated 3,747 kcal per day". (10) Whatever happened to the government's healthy diet recommendation of 2,000 kcal per day?! A glance into most students' daily eating habits will hopefully explain this disparity.

In an urban high school, there are a variety of foods served, prepared for or consumed by our students.

Fortunately, cultures mingle here and those cultures influence the food choices. Generally, it is high in fats and therefore high in calories. In January 2011, Agriculture Secretary Tom Vilsack released another set of dietary guidelines aimed at reducing obesity and diet related illness including heart disease, diabetes, high blood pressure, stroke, colon cancer and arthritis. Once again, as this is not a new message, he encouraged that we should increase the amounts of vegetables, whole grains, fruits, low-fat and fat free dairy and seafood while decreasing the amount of sodium, trans and saturated fats as well as refined grains and sugars we consume. The USDA published a document summarizing research on the quality of a child's diet in 2003-2004. It showed that across all ages, dietary quality was poor for most children. Low consumption of dark green and orange vegetables, legumes category and whole grains pose the biggest challenge. (11) The health implications are dire: the Center for Disease Control and Prevention recently declared that the current generation is the first whose life expectancy is less than their parents. (12)

Feeding a family of four is not inexpensive. The USDA keeps track of this as well. The data is arranged in several categories but essentially all categories assume that the family of four is preparing all of its meals at home. In June of 2000, the cost of feeding two adults and two children between the ages of 6-8 and 9-11 for one month was $559.50. Ten years later it was up 36% to $758.90 per family (13). What if consuming fewer calories of more nutritious food was less expensive and healthier?

Food Production in the US

Agriculture has long depended on energy to function. The energy that it historically depended on was recycled from year to year. Plants utilize the nitrogen it finds in the soil through the decay of a crop left over from last year or the nitrogen that special plants called legumes have fixed for them. In the polyculture farming system of old, what nitrogen was not placed in the soil by plants was deposited there by the animals in the form of manure. As mechanization evolved, energy in the form of oil was burned to move manure from the barn to the field, but the overall expense of energy remained small by today's standards. Today 20% of the total system energy is used for on-farm production and 40% of that is used to make chemical fertilizers and pesticides. (14).

The Center for Sustainable Systems, a non-profit affiliated with the University of Michigan estimates that of the 921,590 million pounds that are raised as crops, nearly a third of that is fed to animals. Between 1920 and 1999 corn yields have increased 350% (15). This increase is largely due to fertilizers and pesticides, mechanization and genetic modifications of the seed. Synthetic fertilizers were developed by a German chemist, Fritz Haber over a hundred years ago. He made nitrogen, the most abundant element in the atmosphere available in a digestible form called ammonia. He did so by applying heat and pressure to a mixture of atmospheric nitrogen, oxygen and osmium. Since the advent of synthetic fertilizers, the thinking had been to add more and the yields will continue to increase. In 1998, the US applied about 20 million tons of fertilizer on US fields or about 15% of the world total. (16) Fortunately, this was the peak of fertilizer applications. Since then, the science points to less of fertilizer coupled with cropping systems management including timing and better understanding of soil nutrient uptake.

Selective breeding and hybridization of plants is not a new concept but the advances in these strategies have led to plants that are resistant to drought, infestation and the rigors of being harvested mechanically. Corn can be grown very closely packed so that every bit of the field is utilized by this highly efficient super grass. 44% of the primary productivity of the plants on our planet come from just three cultivated plants; rice, corn and wheat. (17) These super plants have been crossed with a wild variety to capitalize on the resistance to threats. The technology that has not been around for as long, only since 1996, is the genetically engineered or

transgenic crop. These crops are defined as crops containing traits from unrelated organisms including from both the animal and plant kingdoms. In 2001, 130 million acres were planted worldwide. (18)

Mechanization of crop and animal production continues to evolve. Enormous machines are replacing humans and creating efficiencies in crop production. GPS technology guides the machines utilizing every last square inch of that field. As with many other industries, the number of people required to run such a business is dwindling. A dairy farm in northern New Hampshire installed a robotic milking machine, the only one of its kind in New Hampshire, about three years ago. It uses transponder technology to determine the milking needs of the cow based on when it approached and was serviced last by the milking machine. While she is in the machine, the computer determines, based on where she is in the milking cycle, how much and what combination of grains will support her and dispenses that to her as she is milked. Laser and camera guided technology locates her teats, cleans each one of them and places milking cups over them to pump the milk. Her transponder also indicates for the computer if she is "fresh cow" whose milk is to be shunted to another tank where it is collected for feeding to her calf in the first few days after calving. It would also shunt her milk away from the bulk tank if she is on antibiotics. The farm operator is free to take care of the many other things on the farm, the cow is free to be milked when she needs it and the whole operation can be managed and viewed from the smart phone on his hip that will take a call from the computer if there is a problem.

Mechanization of animal production has also led to Concentrated Animal Feeding Operations (CAFO), another form of monoculture only an animal is the product. In CAFOs animals are housed in high concentrations requiring smaller space for housing. For example, the number of hog farms has declined from over a million in 1967 to just 157,000 in 1997 that result in 3% of farms producing 60% of the US hogs. (19). A similar trend exists for beef and chicken production. When many animals are housed in a very small space where animal waste is hard to remove, antibiotics are administered in the feed to combat disease.

Impacts of Production Agriculture

Fertilizers

With all of these advances, there are challenges. Fertilizer use, while continually evolving and necessary to some extent in order to keep up with worldwide demand for food, is not very efficient. Some estimates put the actual uptake of this fertilizer at one third to one half of what is applied. (20) The rest is running off the land and into waterways like the Mississippi River. The runoff is making its way to the Gulf Mexico where some estimate the hypoxic "dead zone" due to the nitrogen loading to be the size of the state of New Jersey (21) Nitrous oxide, which comes from agricultural use of fertilizer, is a gas that is 310 times more potent as a greenhouse gas than carbon dioxide (22).

Pesticides

"The standard approach has been to pump up the dosage of chemicals. In 1965, US farmers used 335 million pounds of pesticides. In 1989 they used 806 million pounds. Less than ten years after that, it was 985 million pounds. That's three and half pounds for every person in the country, at a cost of $8 billion. Twenty percent of these approved-for-use pesticides are listed by the EPA as carcinogenic to humans." (23)

Monocropping activities are responsible for this trend as they are more vulnerable to pests. A farmer vested in one crop will tend to do all that is necessary to support the success of that crop. The effectiveness of this strategy is questionable when after applying nearly a billion pounds of pesticides we are still experiencing crop loss percentages are not changed by appreciable amounts (24) and millions of people living in the Midwestern states are drinking water that is contaminated with the pesticide residues. (25) Pesticides are not applied effectively either. Estimates of 0.1% of the pesticides are reaching target pests while the rest affects the environment including bird and bee populations and the reproductive structures and legs of frogs (26).

Production agriculture or factory farming has used economies of scale to provide food in abundant supply. It is an energy intensive industry consuming about 19% of the energy used in the US with 14% being used in production, processing and packaging (27). Unfortunately, the amount of energy we put in is not efficiently converted as for every three calories of energy we put into production there is only one calorie produced on average with some studies showing energy intensive products like grain fed beef requiring thirty-five calories. (28)

"Satisfy human food and fiber needs. Enhance environmental quality and the natural resource base upon which the agriculture economy depends. Make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls. Sustain the economic viability of farm operations. Enhance the quality of life for farmers and society as a whole." -The USDA definition of Sustainable Agriculture.

Sustainable agriculture is a concept that has gained more and more momentum as Americans make daily dietary decisions. It is impractical both from a geographic and an economic point of view to expect that even after being armed with the information, the students in the class will be able to make a complete switch to foods obtained in a sustainable way. It is possible, however, that right now in their homes and certainly as they finish high school and move on to whatever future awaits them they can make decisions and choices about the way they purchase food that could make a large difference to their health and the environment.

Lesson Plans/Activities

The Big Picture- Food Production Cycle

As a class or in smaller groups, choose a food that was eaten at lunch or breakfast that day. Brainstorm the process that you think the food went through from the point of its origin as a plant or an animal through to the point of you eating. Consider all the steps including how it got to the school cafeteria or you home. Because this unit does not cover aspects of the entire cycle at this point, it is important to bring light to it and indicate that because of the complexity of the cycle; only a few components will be highlighted.

Journaling Your Eating Habits

Introduction: As discussed in class, many Americans eat entirely too many calories in a given day. For five days, you are going to record what you eat. It is important that you record as much as you can about the things you eat in a chart. Develop a spreadsheet on Excel using the bold face column headings below. You will use a new sheet for each day starting with what you eat in the morning, lunch and dinner as well as all snacks.

Some of us might even use more than one per day.

Meal: indicate what meal this is or if it is a snack etc

Name of Food: this is the broad category. For example, Breakfast sandwich or spaghetti sauce or ham and cheese sandwich.

Manuf/Where: this is where you record the manufacturer or processor of the food. For example, Lay's Potato Chips. Frito-Lay is owned by Pepsico, Inc. American owned company. Frito-Lay is located in Plano,TX. This might take some research but information on most companies can be found.

# of Calories per serving and **# of servings:** usually the calories information is on a container or wrapper. If this is not the case if you bought a meal at a chain, you will need to research this. This information is usually found on the restaurants website or at the following website:

www.newcaloriecounter.com – on this website you get calorie information per 100 grams or http://www.nal.usda.gov/fnic/foodcomp/search/ - on this website, the unit of measure can be selected.

Foods where this is not available ie a sandwich you made at home, can also be researched at these websites.

Ingredients: whether you buy a prepared food or make something from scratch, there are ingredients. Here we are not taking spices and additives or colorings into account. Only the major foods that are present in the meal will be listed. For example, a breakfast sandwich at a coffee shop…bacon, egg, cheese and whatever form you chose for the roll…a croissant. So, the ingredients would be…bacon, egg, milk (for the cheese), milk (in the making of the croissant and for the butter), sugar, salt and flour. Again, if you don't have an ingredient list from a packaged food, then it is time you get on a computer and look it up!

This is a tedious process…to be sure. However, it will bring to light what you are eating each day and will eventually lead to discovering just where are food comes from.

Where Did That Meal Come From Matrix Instructions

1) Choose one of the meals that you recorded on the Food Journal. While a more complex meal will take a little longer, the idea here is that you learn something about where a typical day's meal comes from so choose a meal that would be typical for you. Create an Excel Spreadsheet with the words in bold below as the column headings. Allow enough space to accommodate your information. I suggest a landscape format to allow for all of the columns.

2) **Meal:** refers to when you ate it ie lunch

3) **Components:** This is what you ate…ie hamburger, roll, dill pickle and chips

4) **Ingredients:** For each component, list the main ingredients..ie ground beef, potato, cucumber, wheat, sesame seeds

5) **Where could it have been grown?** This will require some research to find out where in the world the ingredients could have come from to make the food that you ultimately ate. If the ingredients could only have come from another country, list the countries

6) Using the attached map of the country, develop a key for each of the ingredients and map where each of them may have come from.

Estimate the number of miles total that your meal traveled to be in your plate in New Haven, CT

Interview an Community Supported Agriculture Farmer or Farmer's Market Participant

Goal: Get a glimpse into the reasons why this movement has gained so much momentum as well as reconnecting with where your food could come from!

Research:

1) The names and addresses of local CSAs or Farmers Market Members

2) Make contact with one and set up an appointment to interview them either in person or over the phone

3) Below are a few of the suggested questions you might ask

a. How long have you participated in this type of agriculture?

b. How many acres do you cultivate/animals do you raise?

c. How much if any of your operation is computerized or mechanized?

d. How many different products/crops do you grow?

e. If you are a producing a plant crop, what method do you employ to enrich the soil?

f. What type of schooling or education do you have?

g. What parts of your business are the most pleasurable and which are the least?

h. Why did you decide to go into business?

i. Has your business being growing and do you attribute this to the increase awareness of sustainable food choices?

4) Gain permission to take pictures if you can visit the farm.

** Keeping in mind the product below, this may not be all that you talk about. Your goal is to get to know the person and collect information for the next step.

Product: You will be presenting your information to the class. You are introducing the class to this person and their business.

Project and Scientific Inquiry

Pallet Garden

Make the Bag or Pallet Garden- the general idea is to obtain a clean, non-chemically treated pallet, cover one large side and a short side with landscaping cloth that is stapled to the wood. Fill the inside of the pallet with garden soil.

Scientific Inquiry

Introduction: Modern agriculture methods are being called into question with a renewed focus on conserving energy, protecting the environment and sustainability. Urban agriculture is a growing phenomenon as people who are disconnected from their food in a fast paced world are discovering not only the enhanced nutrition of food grown locally but the fun of having a garden. Urban gardens have a number of challenges, the amount of space and fertile, uncontaminated soil among them. Roof gardens, raised beds and container gardens have been popping up all over urban areas. Manure is one option but many times the gardens are enriched with commercial fertilizers as they are more convenient and readily prepared.

Scenario: You are a new soil scientist in an urban area Ag Experiment Station. You have seen Pallet Gardens on the internet and would like to introduce them to a neighborhood experiencing renewal. The scientist in you is curious about the effectiveness of the pallet garden as it relates to plant growth or uptake of nutrients. You have the following materials at your disposal to design an experiment.

Materials:

images/2011/4/11.04.06.02.jpg

Design a controlled experiment that tests something about the effectiveness of the pallet garden in growing. Note: use pallets that have not been treated.

The students can work as a class, depending on how many students there are or how much space is available. This is a CAPT-esque/Vo-Ag application based exercise that allows the students to design and implement the scientific method.

Extension Activities

Make a recipe book using foods that can be grown anywhere, including an urban environment or in the pallet garden.

Dry storage for root vegetables Activity: Storing foods in winter/non-growing season. This could be cross curricular with a shop class or other vocational agriculture course. Vegetables that can be grown in New England like potatoes, winter squash, carrots, turnips, garlic, parsnip, acorn squash, spaghetti squash, pumpkin, radishes, onions, shallots and leeks can be stored. You will need one to two weeks in warm temperatures to promote healing of any wounds in the surface and thickens skin for retention of moisture before storing. You can also use buckets of sand for storing carrots, turnips, parsnips, onions, radishes.

Work with or for a farmer from the farmers market- as an extension to the interview, work to harvest, work on a Saturday at a market.

Collect data and observations about the amount of packaging material that is collected at a school in a single day.

District Content Standards

Scientific Inquiry

Scientific inquiry is a thoughtful and coordinated attempt to search out, describe, explain and predict natural phenomena.

Scientific inquiry progresses through a continuous process of questioning, data collection, analysis and interpretation.

Scientific inquiry requires the sharing of findings and ideas for critical review by colleagues and other scientists.

9.3 Various sources of energy are used by humans and all have advantages and disadvantages.

9.8 The use of resources by human populations may affect the quality of the environment.

Emission of combustion by-products, such as SO_2, CO_2 and NOx by industries and vehicles is a major source of air pollution.

10.6 - Living organisms have the capability of producing populations of unlimited size, but the environment can support only a limited number of individuals from each species.

Reference Citations

Horrigan, Leo, Robert S. Lawrence, and Polly Walker. "How Sustainable Agriculture can Address the Environmental and Human Health Harms of Industrial Agriculture." Environmental Health Perspectives 110, no.5 (May 5, 2002).

"Factsheets: US Food Systems", University of Michigan, Center for Sustainable Systems, accessed on April 27, 2011, http://css.snre.umich.edu/facts.

"Food Miles: A Simple Metaphor to Contrast Local and Global Food Systems", accessed July 1, 2011, www.leopold.iastate.edu/pubs/staff/files/local_foods_hen0604.pdf

Kingsolver, Barbara, Hopp, Steven L and Kingsolver, Camille. " *Animal, Vegetable, Miracle*" New York: HarperCollins, 2007

http://longevity.about.com/b.2011/01/26/cdc-reports-decline-in-life-expectancy.htm

Carroll, John E., "Pastures of Plenty: The Future of Food, Agriculture and Environmental Conservation in New England". New Hampshire Agricultural Experiment Station Publication # 2340, 2010

Pearson, T., Grimland, S., &Brown,S. (2010). A Spatial Analysis of Greenhouse Gas Emissions from Agricultural Fertilizer Usage in the US.

Pimentel, David et al, "Reducing Energy Inputs in the US Food System", Human Ecology, 36, (2008):459-471.

"The Issues: Fossil Fuel and Energy Use", accessed June 17, 2009, http://www. Sustainabletable.org/issues/energy/index_pf.html

United States Department of Agriculture, National Agricultural Statistics Service, Research and Development Division, Geospatial Information Branch, Spatial Analysis Research Se, 2009, 2007 Census of Agriculture State-Level Boundaries, (StUS_GCS07.shp -.shx, -.dbf, -.sbn, -.sbx, -.prj, StAK_GCS07.shp -.shx, -.dbf, -.sbn, -.sbx, -.prj, StHI_GCS07.shp -.shx, -.dbf, -.sbn, -.sbx, -.prj, StPR_GCS07.shp -.shx, -.dbf, -.sbn, -.sbx, -.prj): U.S. Department of Agriculture, National Agricultural Statistics Service, Fairfax, Virginia

www.agcensus.usda.gov

www.cdc.gov/outbreaknet/images/investigations/food_production_chain_900px.jpg

www.cnpp.usda.gov/Publications/FoodPlans/2000/CostofFoodJun00.pdf accessed June 19, 2011

www.cnpp.usda.gov/Publications/NutritionInsights/Insight43.pdf accessed on June 19, 2011

www.csrees.usda.gov/nea/ag_systems/in_focus/sustain_ag_if_legal.html)

Weber, Christopher L., Matthews, H. Scott, Food Miles and the relative climate impacts of food choices in the United States. Environmental Science Technology, 2008 Vol 42 3508-3514.

Endnotes

1. USDA agcensus 1920 and 1992
2. Carroll, 10
3. American Dietetic Association 2004
4. Sustainabletable.org
5. Matthews and Weber, 3508
6. Ibid
7. Ibid
8. Leopald, 2
9. www.buyctgrown.com/FAQ
10. Pimental, 470
11. USDA, insights 43
12. CDC- report on life expectancy
13. USDA
14. Center for Sustainable Systems, U of Michigan
15. Horrigan and Lawrence, 446
16. Ibid
17. Manning, 1
18. Horrigan, 449

19. Ibid
20. Horrigan, 446
21. ibid
22. USDA, A Spatial Analysis of Green House Emissions, 1
23. Kingsolver, 165
24. Ibid
25. Wargo, 251
26. Horrigan, 446
27. Pimental, 459
28. Sustainabletable.org