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The Fuel Chain: An Analysis of the Relative Sustainability of the Standard American Diet versus Vegan, Organic, and Local Diets

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Abstract

This thesis serves to fill a gap in current environmental literature that will compare the relative impact of the Standard American Diet to three mainstream proposed alternatives: Vegan, Organic, and Local diets. Food consumption has the biggest impact of any activity Americans do on a daily basis, and the way Americans eat now requires large inputs of fossil fuels, land, and water, while impacting the health and rights of people, animals, and the environment. This thesis will provide a clear, direct comparison of quantitative and qualitative factors that are impacted by the diets Americans choose, and will contain recommendations for further research and will isolate the most important ways consumers can change their behavior to support an adequately sustainable food system.

Preface

My interest in the topic of food sustainability began when I was 13 years old and decided to try vegetarianism with a friend. Since then, I have read countless books, articles, and papers on the topic, trying to understand how to be a true "conscientious consumer." Questioning the mainstream ideal of consumption, and weighing the true benefits of alternatives, is not only my interest but also my moral imperative. I feel that by writing this document, I am contributing to an area of research that will only increase in importance over time, as the population of the Earth increases, and resources are continually depleted.

I would not have been successful in my research without help, of course, and I must give credit to my primary advisor, Nancy Billica, for working closely with me from start to finish. I would also like to thank Leslie Irvine and Dale Miller for sitting on my committee, and every professor, co-worker, and friend who has cultivated my interest in this topic. Thanks also to the Melbourne Lab for screening my defense.

Chapter One: Introduction

What makes a diet sustainable?

By definition, a sustainable diet must provide for everyone's current needs while not taking away from the needs of future generations. Therefore, the ideally sustainable diet would provide everyone on Earth with a sufficient amount of nutritious food every day without irreversibly damaging the planet in the process.

The current system of food production is market-based, with high-income consumers determining what and how food is produced. Therefore, it is up to countries such as the United States to determine how our food is grown, processed, and transported. Ideally, we would do this in the most sustainable manner.

Clearly, not every consumer is created equal. Age, gender, and body composition are the most obvious factors that influence amount and choice of food consumption, but socioeconomic status also plays a large and often-overlooked role. Obesity is becoming more and more prevalent among the poor. In wealthy countries such as the United States, poverty is no longer associated with malnutrition and hunger, but rather a reliance on cheap, high-calorie foods. In the wake of globalization, other countries have begun the same trend.

Many people have already proposed alternatives to the Standard American Diet (SAD), all claiming that these diets are less destructive ways of eating. The three biggest alternative diets that have entered the mainstream are veganism, organic, and locavorism.

A vegan diet (also known as a plant-based or strict vegetarian diet) is one that excludes all meat, dairy, eggs, and other animal products. Some choose to follow the diet for moral reasons such as respect for animal lives. Others choose this diet for its health benefits, as heart disease and obesity are very rare among vegans. Still others choose to be vegan because there are many social issues involved in animal agriculture. The meatpacking industry is the most dangerous and injury-prone job in America, and undocumented immigrants are regularly recruited by the industry to minimize potential lawsuits from workers. Last but not least, many have posited that a vegan diet could drastically reduce inefficiency along the food production chain. Feeding crops to animals instead of directly to people uses far less land, water, and fossil fuels (Goodland 1997). More people choosing to follow a vegan diet would reduce demand for animal agriculture, and would be using fewer resources altogether.

Those who follow organic diets do so for many reasons as well. In our current system large tracts of land are dedicated to massive monocultures of corn, soybeans, and wheat, often genetically modified, and 50 percent of those crops go toward feeding animals harvested for meat. Huge amounts of pesticides and herbicides are used to minimize crop damage, and these chemicals wash into water systems, causing algal blooms and disrupting aquatic life. Farmers that work in pesticide-heavy fields have higher rates of cancer and other diseases than the general population. Following an organic diet helps reduce demand of so-called "conventional" agriculture.

Another recent dietary trend is "locavorism," a concept that involves only eating foods native to the place in which the consumer lives. There are different definitions of what constitutes as eating local—generally, anything grown within 100 miles of consumption, or within state lines. Locavores are not just conscious of food miles, but also community-based agriculture. Maintaining personal connections with those who grow your food is important in locavorism, as is supporting the local economy.

If industries are only responding to markets, and indeed large markets for all these diets have increased over the past decade, we as consumers could have a massive beneficial environmental impact by supporting the most eco-friendly diet. But which diet *is* the most sustainable? Current literature fails to provide an adequate side-by-side analysis of each of these diets. This is what I am attempting to provide.

In each of these diets, there are many factors to consider for sustainability. In my analysis, I will quantitatively compare three of the largest and most important environmental factors to the best of current available data: Land, water, and fossil fuel use. I will use these factors because they currently have the greatest threat to human populations. There is currently high competition for arable land to be used as agriculture, grazing land, human sprawl, and resource extraction. Considering only 1 percent of the water on Earth is fresh and drinkable, and even much of that has become polluted, water is becoming an increasingly valuable resource. Finally, fossil fuels and emissions are important to study because climate change is becoming more of a problem as time goes on. Increasing global average

temperatures will also mean increasing natural disasters, droughts, floods, loss of biodiversity, immersion of islands and island nations, displacement of people, and countless other factors that will affect everyone and everything on the planet.

Other potential environmental and social implications will be discussed qualitatively. To do this, I will be analyzing the most recent literature on the subject, using scientific papers and data from unbiased, reliable sources.

In a system where food is making our bodies and the planet sick, something has clearly gone wrong. But, not all is lost. I hypothesize that because our current food system is not sustainable, if Americans were all to adopt an alternative diet, we could drastically reduce the environmental and social impacts of what we eat.

Chapter Two: Methods

As stated above, the purpose of this document is to fill a hole in the current literature regarding food sustainability: A direct, side-by-side comparison of the three alternative diets most commonly viewed as "environmentally-friendly." While there is seemingly endless research on the topic, little of the information is organized in a user-friendly manner, allowing the average consumer to weigh their options when it comes to their daily diets and make choices accordingly. This thesis serves to fill that gap.

Many of the main ideas in this document come from years of curious browsing on the topic, and as such are gleaned from mainstream media. Writers such as Michael Pollan, and big-name documentaries like *Food, Inc.* have helped bring the issue of food sustainability into everyday discussion. However, I found it worth delving into the science behind the scenes, following sources back to their original forms in order to make sure the authors and filmmakers were using solid science to back their claims. As a result, my figures come from the most credible sources available.

However, even from the most credible sources (namely scientific journals and government publications), numbers tend to vary widely. Part of this issue is the variability of food consumption. Even after limiting my analysis to one country, the United States, food consumption varies widely by the individual. Therefore, the numbers and statistics used in this document are to be taken only as estimates.

The three main factors used in my analysis (land, water, and fossil fuels) were chosen because numbers for these resources do exist, though again, these are somewhat based on conjecture. Other issues prove much more difficult to quantify, and yet an analysis of sustainability cannot work without taking them into account. These will be discussed qualitatively.

With increasing scrutiny on this issue, more refined research in this area is inevitable. Over time, comparisons of these diets will become more solidified. For the time being, we must make do with what we have.

Chapter Three: The Standard American Diet (SAD)

Introduction

The Standard American Diet refers to the composition and quantity of what the average American currently eats. Based on the most recent estimates, Americans eat an average of 2700 calories a day. As seen in Figure 1.1, very little of that sustenance comes from fruits and vegetables. In fact, the SAD consists mainly of processed grains, meat and dairy products, and sugar (USDA 2001). The average American eats 270.7 pounds of meat every year, compared with the global average of 102.5 pounds (Barclay 2012, and as shown in Appendices Two and Three). Feeding everyone on the planet equitably on a meat-based diet would require far more environmental resources and would be ultimately unsustainable.

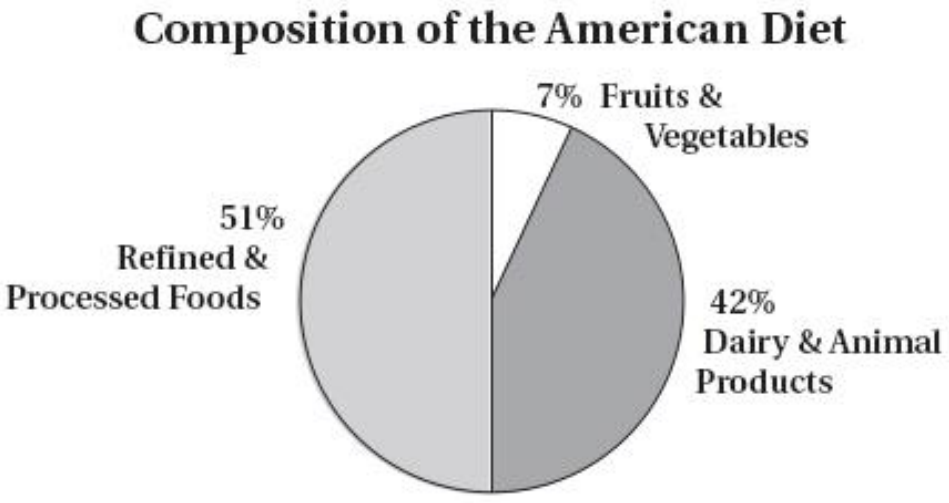


Figure 1.1
Source: Pugliese 2008

The production and distribution process that makes this type of diet possible must be built on efficiency. After the Green Revolution of the 1970's, chemical use in agriculture exploded. Monocultures became the standard, creating the vast fields of corn, wheat, and soybeans lining highways across America today. Each acre of land was carefully irrigated and fertilized specifically to produce the maximum possible number of calories per acre. In order to increase supply and decrease cost of meat, cows, chickens, and pigs were relegated to Commercial Animal Feeding Operations (CAFOs). More than at any time in the past, animals were being selected, bred, and raised to produce the most meat possible per animal. Genetic manipulation of crops and animals became feasible in the 1980's, and has become standard practice over the years.

Such efficiencies, however, have not come without consequence.

Fossil Fuels

Our current food system is extremely dependent on fossil fuels. The biggest anthropogenic greenhouse gases of concern are methane, carbon dioxide, and nitrous oxide, and indeed industrial agriculture is a major contributor to all three. Just some of the emissions produced are from running farm equipment, transporting, processing, and packaging goods, land use changes, storage and refrigeration, cooking, application of fertilizers, and decomposition of food waste. Altogether, these processes contribute to 33 percent of the average American's carbon footprint (Fleischer 2009).

Ruminant animals are another big contributor—fifty percent of the United States' methane emissions alone come from cattle (Berners-Lee 2012).

With the development of better cradle-to-grave analyses of different food products, it is becoming increasingly easier to weigh relative environmental impacts (see Appendix One). Every food produced has some environmental impact, but some have far more than others. Even without analyzing every single product footprint, it is easy to detect certain trends: Meats of all kinds have, by far, the largest cumulative carbon footprint out of any product, and eggs and dairy products have far more than most plant-based products. This will be discussed further in the "vegan" section.

Land Use

Largely thanks to chemical fertilizers, herbicides, pesticides, and genetically-modified organisms (GMOs), industrial agriculture now produces significantly more food mass per unit area than it did before the Green Revolution of the 1940s-1970s. Certainly to feed an ever-increasing population, these efficiency increases have been necessary. However, the productivity of the land can only go so far, and studies indicate that we may have already reached maximum agricultural productivity—that is, we have reached the maximum amount of food that can be grown per unit area (Desrochers and Shimizu 2012).

America has the unique luxury of wide area with fairly dispersed population. The Midwest teems with fields of corn and wheat and soybeans simply because we have the area to use such wide spaces of land for agriculture. Many countries do not

have such an extravagance. China, with about the same land area as America but nearly four times the population, faces increasing strain on its land resources as cities expand along with population growth.

Certainly, then, land conservation is necessary, but making such productive agriculture on such small area has taken its environmental toll, and will only continue to do so in the future unless better agricultural practices are taken into account.

Water Use

Although most cropland in the United States is fed by rainwater, agriculture still counts for 80 percent of withdrawals from the water system. Per capita, estimated water usage is 289,445 gallons per year per person. Again, much of the problem lies in the use of animal agriculture. It takes about 100 times the amount of water to produce animal protein than plant protein, as plants must first be grown to feed to animals, and animals themselves must drink lots of water during their lifetime (Project Blue 2012).

The pollution of water due to conventional agriculture is another problem. Agriculture is the largest non-point pollution source in America. Farming and ranching produce pollutants such as sediment, nutrients, pathogens, pesticides, metals, and salts. Rain washes these pollutants from fields into the water system, and once there, they hard to get rid of.

Some of the worst pollutants also come from CAFOs. Thousands of animals are kept in close quarters on the many CAFOs in America, altogether generating 500

million pounds of manure each year. This manure runs off into surface water systems, introducing pathogens, nutrients, and organic solids that damage the aquatic ecosystems and reduce water quality for potential human consumption (EPA 2005).

Finding an Alterative?

The Standard American Diet is a product of a long history of scientific development and a response to the economics of supply and demand. Certainly it has proved itself to be land-efficient, but such efficiencies will only last as long as the Earth has an abundance of fossil fuels, fresh water, and chemicals. Pollution and global warming are inevitable consequences of these uses, and as discussed in the "Other Factors to Consider" section, many other aspects of sustainability are overlooked to keep providing an industrial, processed diet such as the SAD.

Vegan, organic, and local diets are the three biggest current "mainstream alternatives." Each provides a unique perspective on the question of how to make food production more sustainable. Using the SAD as a baseline, how does each add up in comparison? What would have the greatest effect—eliminating animal agriculture, cutting out synthetic fertilizers and pesticides, or simply growing our food closer to home?

As with many big environmental questions, the answer may lie somewhere in the middle of all these solutions. There are many issues that need to be addressed with how our food is produced, and we can only begin to contemplate the answer here.

Chapter Four: Veganism

Introduction

A vegan diet is one that excludes all products that come from animals, including meat, dairy, and eggs. Many people choose to practice this diet for ethical reasons, including the welfare and rights of animals. Some believe animals have the same right to live as people. Others simply protest the practice of raising animals on a mass scale for consumption, since producing so many animals for meat inevitably leads to sloppy, inhumane farming practices. Some follow veganism for health reasons, such as losing weight or lowering cholesterol. Furthermore, some choose this diet simply because, according to most popular literature on the subject, reducing our consumption of animal products is the number one most important way to reduce our environmental impact on the planet.

The biggest reason for the high environmental impact of raising animals is that animal agriculture is very resource-intensive. Growing feed for animals instead of food for humans takes away valuable land and water resources, and the grazing, industrial processing, and waste products from animals have major environmental consequences as well.

Simply put, eating lower on the food chain is more energy efficient because of energy losses through the food chain. Plants only absorb about one percent of the sunlight that hits them, and most energy consumed by heterotrophs is used for metabolic processes, meaning that only a small portion of energy consumed is

actually converted into meat. The practice of feeding grain and soybeans to animals instead of people means wasting a large amount of potential food (Pensel 1998).

Fossil Fuels

Cows are ruminant animals, which is to say, they have evolved multiple stomachs in order to process the tough fiber found in grasses. However, allowing cattle to roam about eating grass has caused environmental destruction on a massive scale through land degradation and erosion. As a result, American farmers have been forced to meet demand for large amounts of cheap animal products by keeping their animals in Concentrated Animal Feeding Operations (CAFOs), where cattle are fed grains, soybeans, and filler products instead of their natural grasses. Thus, the fossil fuels used in the production of these plants are being used at a much faster rate.

Ruminants such as cows also naturally produce methane, a greenhouse gas 23 times more potent than carbon dioxide. Altogether, producing one pound of beef causes 14.8 pounds of carbon dioxide emissions and between 2.7-4.5 ounces of methane. Even more supposedly efficient meats such as fish, pork, and chicken produce emissions at a much higher rate than any plant-based product (Fiala 2009).

Land Use

Figure 2.1
Source: Intent Blog 2013

As seen in figure 2.1, 30% of all land on the planet is used for growing crops. Of all those crops grown, 50% are fed to animals used as livestock (Goodland 1997). A common statistic among vegan literature is that it takes 16 pounds of grain to produce one pound of meat (Intent Blog 2013). Animals need to use most of what they eat for their own metabolic processes, leaving only roughly 10 percent of the calories they consume to be turned into tissue.

Since the SAD relies heavily on animal products, average land use for the American consumer is about 23.7 hectares (or 58.6 acres) per year (Berners-Lee 2012). Thirty percent of the land surface on Earth is used for livestock, both as pasture and to grow feed. The destruction of the world's forests is also a major issue. In Latin America, 70 percent of former forests in the Amazon have been deforested and turned over to grazing (FAO 2006).

Eating an entirely plant-based diet would require one-fifth of the land currently used, as there would be no need for pasture, grazing, or room to grow animal feed (FAO 2005).

Water Use

Again, largely because of the inefficiency of feeding crops to animals instead of directly to humans, a vegan diet saves a large amount of water per year compared to the SAD. Livestock themselves also need water. In a world without animal agriculture, the United States could save 70% of all freshwater used every year (Care2 2013).

Chapter Five: Organic

Introduction

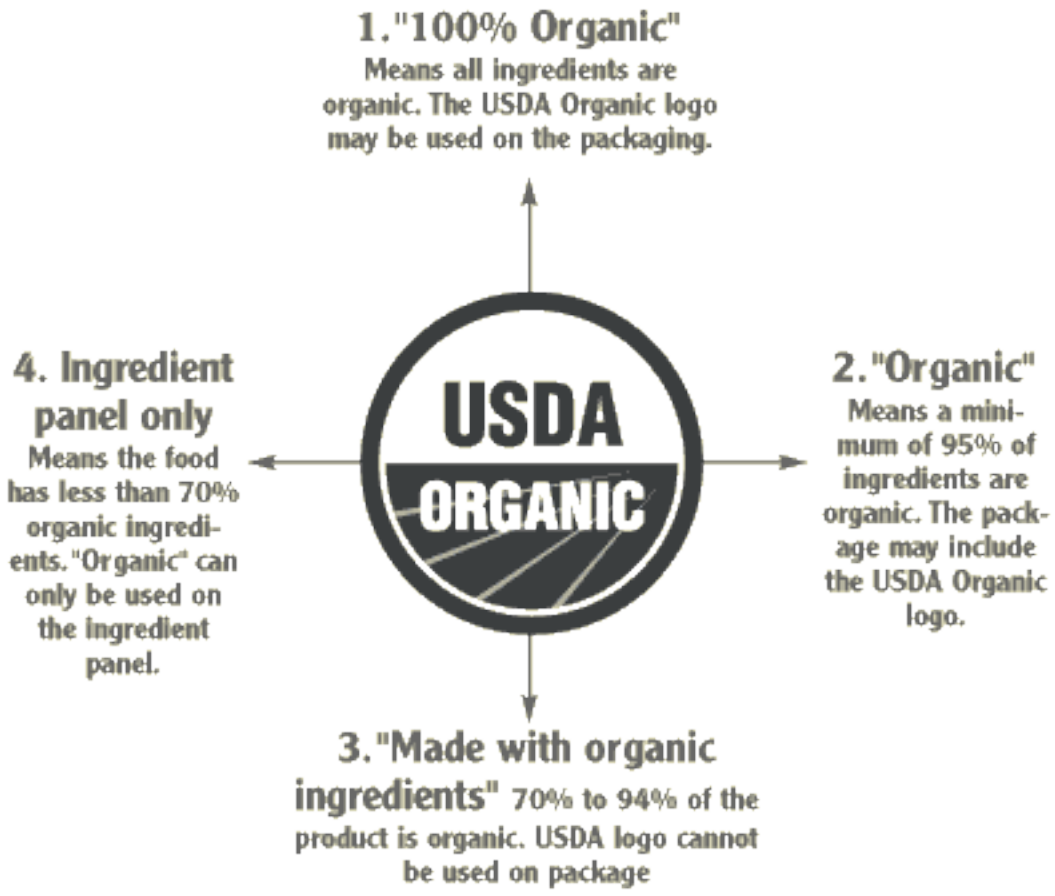


Figure 3.1
Source: The Markets 2013

"Organic" is not a clearly defined term when it comes to food production. Figure 3.1 details how placement and use of the word "organic" can mean very different things. The common definition and the legal definition are sometimes at odds. Even from country to country, the certification process for organic foods differs, making trade and labeling imports difficult.

The most important aspect of organic agriculture, and the definition used in this document, is that "organic" food does not employ the use of synthetic chemical fertilizers, herbicides, or pesticides.

Fossil Fuels

One of the largest fossil fuel costs in food production comes from the use of inorganic chemical fertilizers. The nitrogen in these chemicals is produced using a steam process that requires natural gas (MadeHow 2013). One of the major benefits of an organic diet would be that these synthetic fertilizers would no longer be needed, which would cut down on fossil fuel use.

However, some fertilizer is necessary, especially in areas with unfertile soil. One potential solution to this problem would be to have animals share the same land as plant fields, and the animals would act as natural fertilizing agents. However, as detailed in the "vegan" section, raising animals requires a much higher energy input and results in high methane emissions, which would ultimately be even more destructive. However, the extent of human ingenuity cannot be discounted in this context. Better solutions to this problem could involve reprocessing food waste into compost, or even using dried algae as natural fertilizer (Mulbry 2010).

Land Use

While organic foods are certainly less destructive to the soil, water, and creatures that eat them, their biggest pitfall is inefficiency in agricultural yields. Conventional agriculture, with its chemicals and genetically modified organisms,

definitely outperforms organic agriculture in this regard. Organic crops are estimated to produce only about 50-70 percent of conventional yields (McWilliams 2009).

Although this may seem like a failure of organic agriculture, the truth may be that the Earth simply cannot sustain an artificially high level of productivity. Chemicals used in fertilizers, pesticides, and herbicides have the tendency to degrade soil quality over time, causing salinification, acidification, erosion, and eventually loss of production potential (Oldeman 1994).

Using chemicals over long periods will only worsen the problem, but not all is lost. There are many potential benefits from polyculture, crop rotation, allowing fields to lie fallow, and using insect predators to cut down on pests. Such agricultural practices make sense for preserving soil quality while maintaining high crop yields indefinitely (McWilliams 2009).

Water Use

One of the biggest issues with industrial agriculture today is the pollution of water. Chemicals applied to agricultural fields runs off into the water supply, and the massive amounts of nutrients cause large algal blooms. The algae eventually die and decompose, decreasing the amount of available dissolved oxygen in the water and essentially suffocating fish, in a process called eutrophication that is detailed in Figure 3.2.

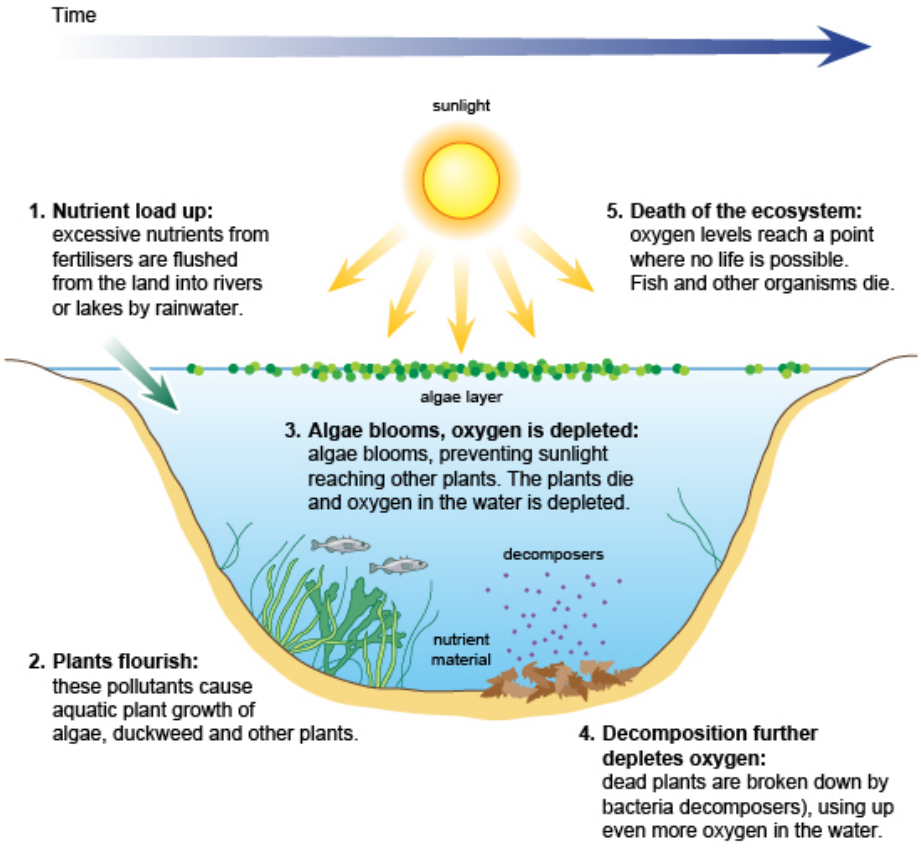


Figure 3.2
Source: BBC

Soils treated with organic fertilizers instead of chemical have also been shown to use water more efficiently, because of the erosion issues associated with chemicals. Organic agriculture retains soil quality and therefore more water, requiring less input of precious freshwater resources into the system (Gonzalez 2013).

Chapter Six: Local

Introduction

Of all four diets outlined in this document, local diets are the hardest to define. Along the same line, the relative sustainability of local diets is by far the hardest to judge simply because not every locavore is the same. There are not any clear "rules" in place for a local diet, simply guidelines that vary based on region and on the individual consumer. Some define "local" food as any food grown within 100 miles. Others say within state boundaries, or even within the same eco-region.

Another big issue is that the sustainability of local diets ultimately depends on what the locavore decides to eat. Unless the locavore in question lives in a region with a tropical climate and lots of arable land, they will not have year-round access to fresh produce. Certainly, with modern technology it is possible to grow bananas on the tops of the highest mountains, and to raise fish in the middle of the desert—but at what environmental cost? More fertilizers, irrigation, fossil fuels to run the operation and transport the final goods? That would hardly qualify as a more suitable alternative to the SAD.

That said, a local diet could still benefit the environment. However, this would only be possible if the food grown was suited to the local climate. This would leave consumers who live in cold, dry regions such as the American Midwest or the Alaskan tundra with little to eat for most of the year. Growing pineapples in the arctic may be technically feasible, but would certainly not be sustainable.

Fossil Fuels

Interestingly, the biggest problems regarding fossil fuel use and emissions do not come from food transportation, even over extremely long distances. Highly efficient machinery is one of the major technological advances of our time. Thus, only 11% of the energy used in food production actually goes to transportation (Weber 2008). Figure 4.1 shows how little of the fossil fuels used in food goes toward transportation. Thus, the big question is not whether food has traveled a long distance to the consumer's destination, but rather, what were the practices of the farm? Was it organic or conventional, big or small? Is the product in question animal-based or vegan? Without that information, it is difficult to judge the potential fossil fuel savings of local diets.

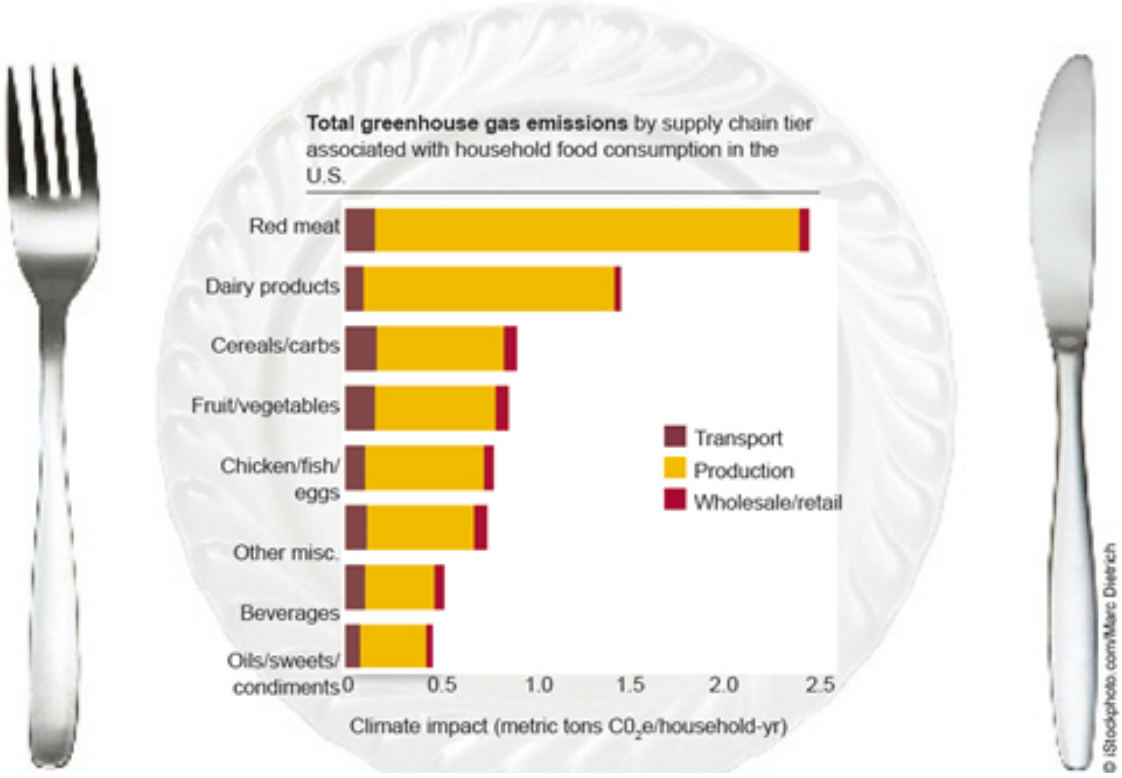


Figure 4.1
Source: Carengie Mellon

Land and Water Use

Again, quantifying the amount of land and water used in a local diet is controversial, and largely depends on how animal product-heavy the diet is and whether the diet is organic or not. Small local farms that work in tandem with the environment are mostly still a niche market, and in fact are decreasing in number every year as large companies like Monsanto out-compete them in the market (McWilliams 2009).

Still Better for the Planet?

Although there may be no obvious environmental benefit to growing food close to where you live, local foods may contribute to other aspects of sustainability. These are outlined in "Other Factors to Consider."

Chapter Seven: Comparison and Analysis

Based on the best, most recent available numbers and estimates, I have created the following table and graphs to clearly outline the difference in fossil fuel, land, and water use between all of the described diets. As mentioned before, these numbers are estimated, but they are based on the best current available data. Each number is measured by the amount (in given units) per individual consumer per year.

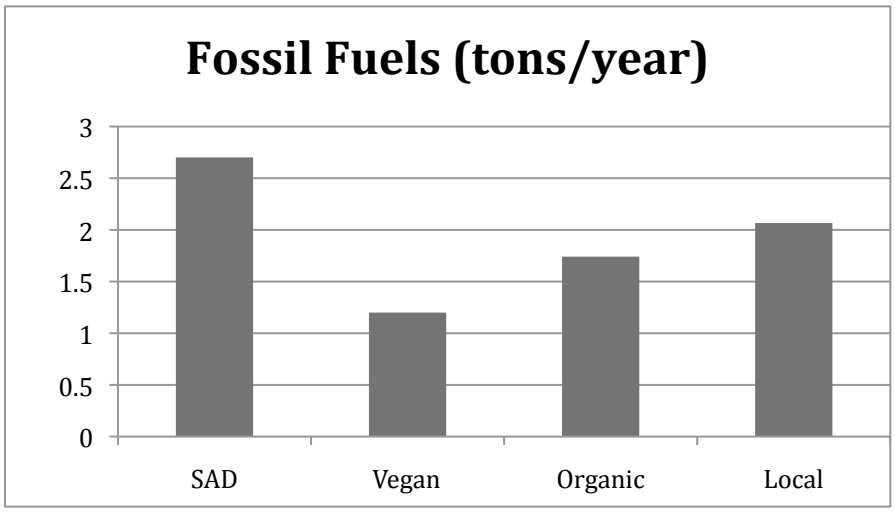
Diet	SAD	Vegan	Organic	Local
Land Use (hectares/year)	23.7	4.7	40.0	30.1
Fossil Fuels (tons/year)	2.701	1.200	1.741	2.066
Water (gallons/year)	289,445	57,889	202,612	202,612

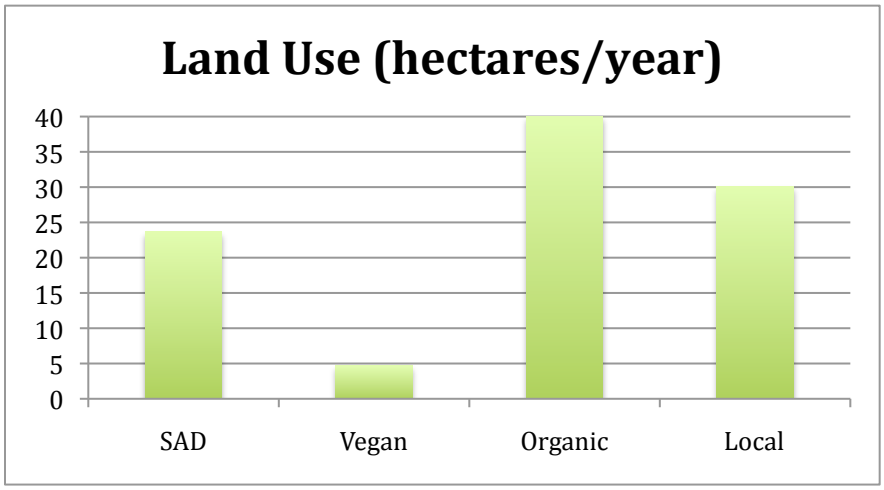
Table 1

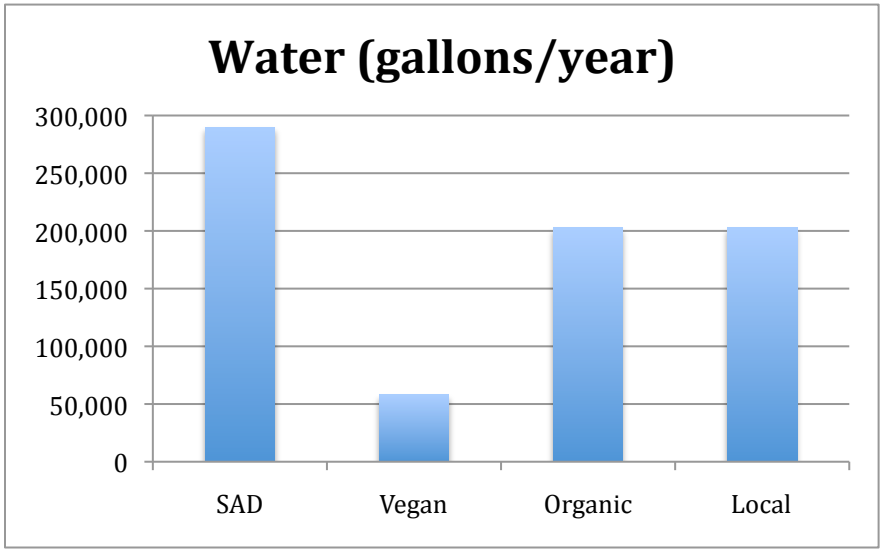
Sources:

Diet	SAD	Vegan	Organic	Local
Land Use	**Berners-Lee 2012**	**FAO 2005**	**Brighter Planet 2010**	**Sexton 2011**
Fossil Fuels	**Marlow 2009**	**Eshel and Martin 2006**	**Chait 2013**	**Chameides 2013**
Water	**Project Blue 2012**	**Reisner 1986**	**Gonzalez 2013**	**Gonzalez 2013**

These numbers are more easily compared visually in graphic form.


Fossil Fuels (tons/year)
3
2.5
2
1.5
1
0.5
0
SAD
Vegan
Organic
Local


Land Use (hectares/year)
40
35
30
25
20
15
10
5
0
SAD
Vegan
Organic
Local


Water (gallons/year)
300,000
250,000
200,000
150,000
100,000
50,000
0
SAD
Vegan
Organic
Local

A vegan diet is the only one that uses fewer fossil fuels and less land and water than the SAD. Organic and local diets use less water and fossil fuels, but significantly more land. Organic and local diets use similar amounts of these three inputs.

The SAD uses by far the most fossil fuels because chemical fertilizers are very energy expensive. For example, producing synthetic nitrogen uses large amounts of natural gas. These chemicals make it possible to grow a lot of food on very little land, but they degrade soil over time, causing erosion and desertification of once-fertile lands.

By far, the hardest numbers to get a handle on are for the local diet, because a "local" diet can mean so many things. Many locavores strive to eat only organic food, which would reduce their water and fossil fuel use, but increase their land use. In summary, the only guaranteed method of reducing environmental impact in all three key areas is to reduce or eliminate meat consumption. Eating local and organic may do some good, but the effects are not as dramatic as in a vegan diet, and both require more land space to grow crops.

Chapter Eight: Other Factors to Consider

Human Rights

A look at current problems with the meatpacking industry show little evidence that conditions for slaughterhouse workers have improved since the days of Upton Sinclair's *The Jungle*. Industrial meatpacking consistently ranks as the most dangerous job in America due to high injury and illness rates. Workers are underpaid and receive no health insurance (PBS 2013).

A need for cheap, complacent labor necessitates a constant flux of undocumented immigrants, who are actively recruited for the job, mainly from Mexico. They are often too afraid to protest their working conditions for fear of deportation by the slaughterhouse owners. A combination of these factors means that the turnover rate for meatpacking workers can be as high as 200 percent in some plants (Farooq 2013). Smaller farms are more likely to treat their workers better, but the animals raised on those farms are often still sent to larger meat processing plants. Again, the only diet choice that does not support this type of human rights abuse is veganism.

Even in the realm of plant agriculture, however, human rights violations are plenty. While current studies on pesticide use and disease in consumers are largely inconclusive, farmers are definitely affected by the use of pesticides, herbicides, and fertilizers, particularly fertilizers that include organophosphates. Rates of non-Hodgkin's lymphoma, cancers, and immune deficiencies are more prevalent in

farmers with long-term exposure to these chemicals than in the greater population, as seen in Figure 5.1.

Table 1. Associations between various classes of pesticide and various forms of cancer.

Class of pesticide	Cancer
Phenoxyacetic acid herbicides	Non-Hodgkin's lymphoma, soft-tissue sarcoma, prostate
Organochlorine insecticides	Leukemia, non-Hodgkin's lymphoma, soft-tissue sarcoma, pancreas, lung, breast
Organophosphate insecticides	Non-Hodgkin's lymphoma, leukemia
Arsenical insecticides	Lung, skin
Triazine herbicides	Ovary

Figure 5.1
Source: Blair and Zahm 1995

Health, Nutrition, and World Hunger

It is clear that from a larger perspective, the American food production and distribution system is unbalanced. Worldwide, around one billion people (one out of every seven people on the planet) are hungry or malnourished (World Hunger Education Service 2012, Appendix Four). Meanwhile, the obesity rate in the United States currently stands at 35.7 percent (Center for Disease Control 2012). The social justice issues behind the current distribution of food are widespread and deep-set, but this contrast alone is the most telling of all. Allowing one-seventh of the world's population to starve while the populations of developed countries overeat to the point of destroying their health is not sustainable.

Processed food is so ubiquitous in America and in most of the developed world that it is almost impossible to avoid, especially for low-income consumers who depend on low prices and high caloric content per volume. High in sugar, sodium, and fat, these foods have lead to the diseases that currently plague many

Americans including heart disease, hypertension, diabetes, and osteoporosis. This high disease rate tells us that while most Americans are getting more than sufficient amounts of calories, nutrition is still a problem.

Animal Rights

In his book *Just Food*, author James McWilliams states that we could in fact feed everyone in the world meat in a sustainable manner—if everyone only ate twelve pounds of meat per year. The average American, however, eats 270 pounds of meat every year (see Appendix 3). The large-scale animal operations currently in use, all of which produce massive amounts of meat to feed demand at a cheap price, are fundamentally unsustainable. However, the debate goes deeper than that.

What rights do animals have in our society? Is it ethically permissible to raise animals for meat and byproducts? At the very least, do animals raised for food deserve protection? Interestingly, a majority of Americans across all political parties, genders, and ages agree that farm animals do in fact deserve more protection (Moore 2003). It is difficult to conceive of another current social or political issue that more Americans would agree on.

A vegan diet is the most compatible with animal rights, while an organic or local diet is more likely to take animal welfare and consideration into account. Smaller farms do not have to slaughter animals at the rapid pace that larger meatpacking plants do. However, a small local farm is no guarantee of animal welfare, as such standards are lacking and largely unregulated.

Building Community and Food Security

Even without an obvious environmental benefit, a more localized diet could be considered more sustainable than the SAD simply because such a diet would reorganize food production and make people more connected to where their food comes from. Farmers markets benefit the local economy, and give consumers a chance to interact with those who produce their food, an impossibility at most mainstream American supermarkets.

Community gardens are another attempt to localize food production that benefit local communities, often by giving resources to communities that otherwise may not have access to fresh fruits and vegetables on a regular basis. A study of communities with gardens in upstate New York showed an increase by 46 percent in addressing other local issues (Armstrong 2000). Such empowerment of communities is essential in a sustainable world.

Growing food closer to home may also prove to be essential in a world facing international conflicts such as wars and global warming, which could at some point shut down essential links of the food chain. A disconnection between the consumer and their local area may lead to problems in the future when tropical climates, from which the United States imports much of its food, suffer increasing damages from climate change-induced flooding and disasters (Brown and Funk 2008).

Chapter Nine: Discussion

The ideal sustainable diet would feed everyone on the planet equitably now and for all future generations. Even more than that, it would feed everybody without unduly costing people, animals, and the environment their rights. Every factor included in this document must be weighed accordingly.

The Standard American Diet has developed as a way to use land efficiently, and it has succeeded in this one area, but at great cost to the environment, people, and animals.

Individual consumption is a currently underused tactic for influencing the production process that could be employed to change these dangerous, unhealthy, and unsustainable agricultural practices. Boycotting the most destructive of foods, reducing meat consumption, and increasing use of local resources in food production will go a long way toward making agriculture a sustainable enterprise.

The three mainstream alternative diets outlined in this paper all show promise in different aspects of sustainability. Certainly, the number one finding from this research is that the most important way consumers can reduce their environmental impact is to reduce their meat consumption drastically, as veganism proved the most successful of all the diets at significantly lowering environmental impact in all areas. However, the benefits of organic and local diets cannot be discounted—the world cannot subsist on chemically subsidized agriculture forever, nor can it always rely on long-distance transport of food between typically

underdeveloped and tropical countries that grow produce, and developed countries where little produce is grown at all.

More research is necessary to clearly define cradle-to-grave environmental assessments of every food product sold on the market, and this information must be made easily available to consumers. But even absent this information, a few guidelines can ensure generally responsible consumerism when it comes to food. Less meat consumption, more organic and local produce, and less industrially processed food is a good way to start.

From there, it is up to industries and governments to structure food production in a way that is sustainable not just for all the people that currently exist on the planet, but also for future generations. Governments can do so by re-distributing subsidies to a wider variety of crops and away from cash crops such as corn and soybeans, which artificially cheapen processed food and animal products. Private industries can also help by investing in new technologies such as vertical farms, green roofs, and community gardens.

Creating a sustainable food system and finding the ideal diet to feed all current and future consumers is a large task, and must come from a collaborative effort of all involved parties. However, this task is entirely feasible. Technology and communication have never progressed at a faster rate than they are now, and there is no obstacle humanity cannot surmount, and no limit to what people can accomplish when we work together.

Appendix One: Greenhouse Gas Emissions Caused by Different Foods

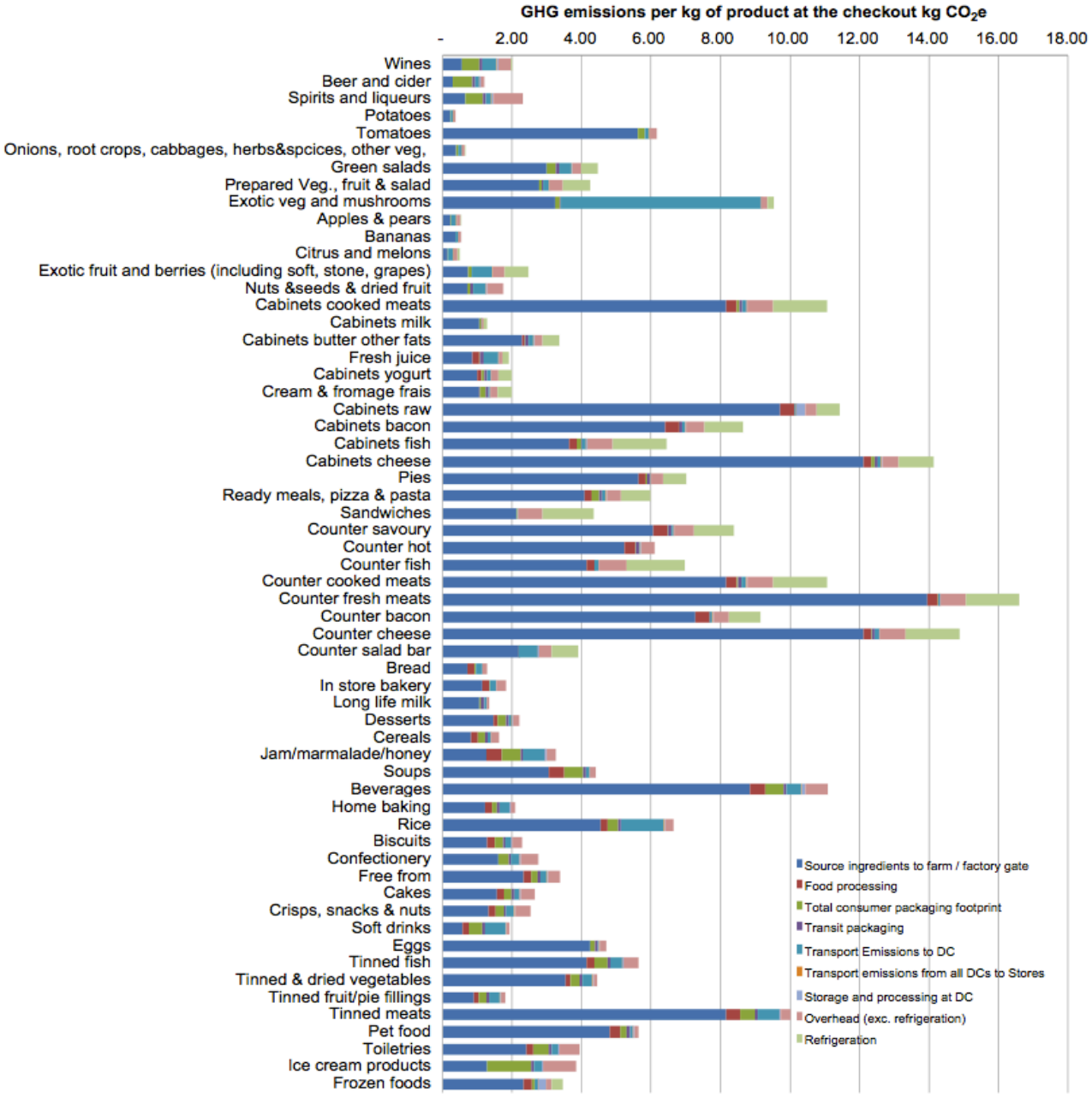
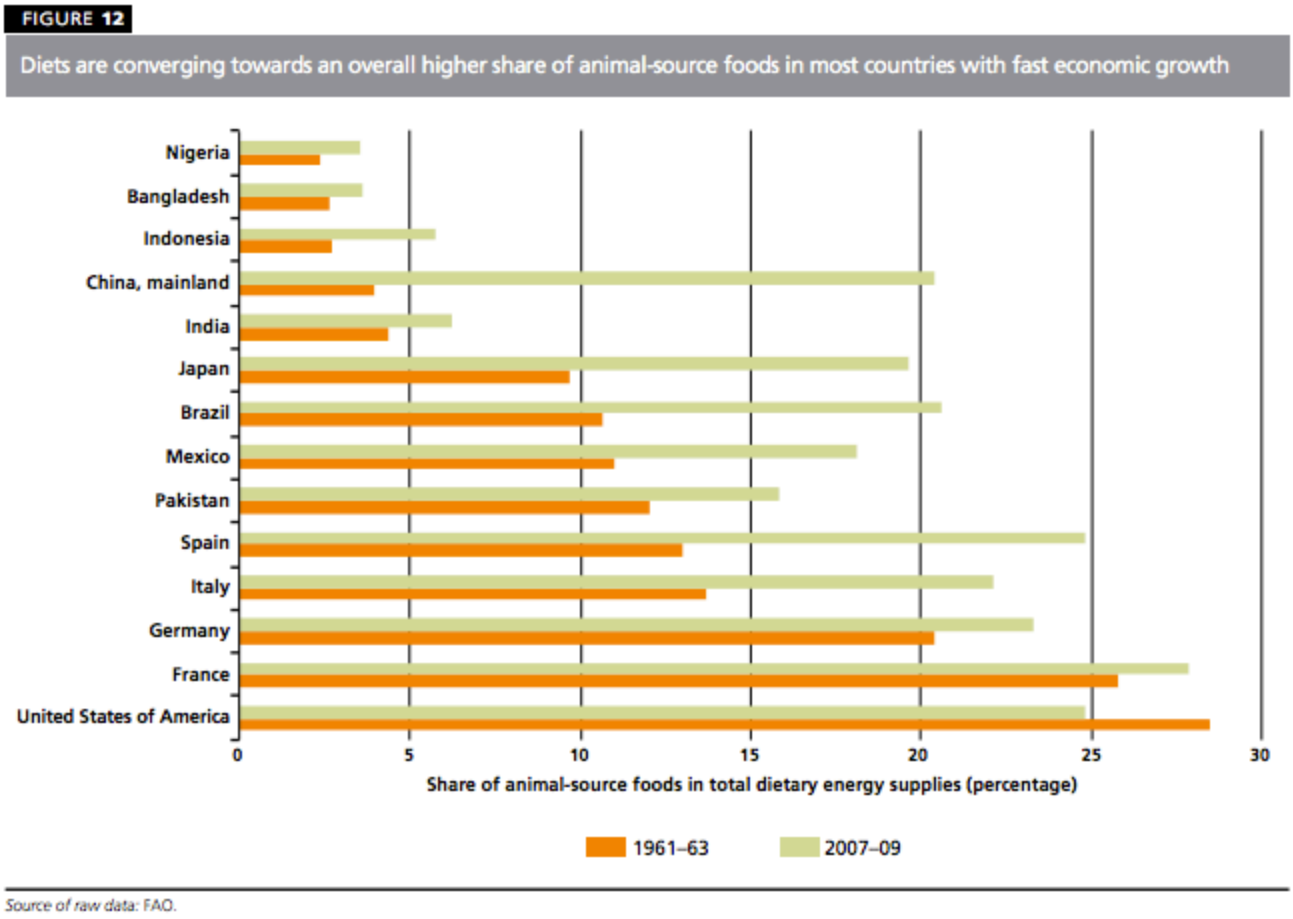


Fig. 1. Greenhouse gas emissions (kg CO_2e kg^{-1}) embodied in 61 food categories, at the point of purchase.

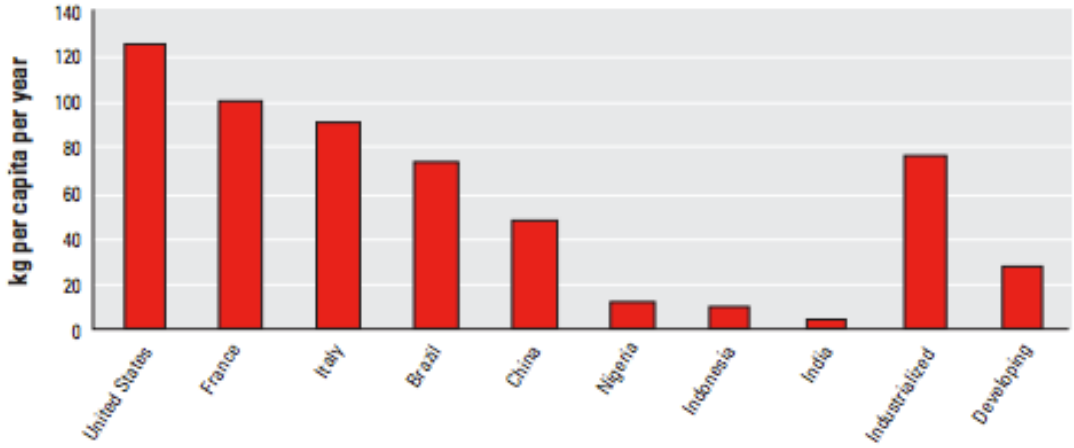
Source: Berners-Lee 2012

Appendix Two: Percentage of Food Coming from Animal Sources by Country



Source: FAO 2012

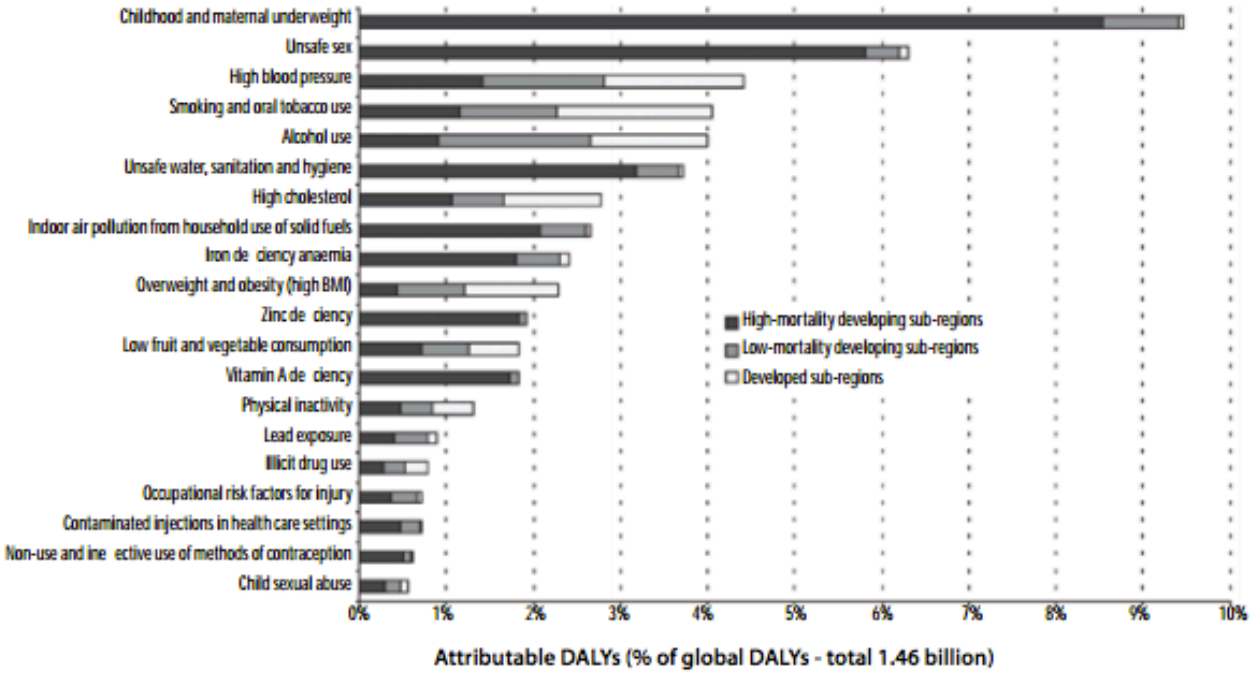
Appendix Three: Average Meat Consumption in kg Per Capita Per Year by Country



Also note the last two columns compare Industrialized versus Developing countries.

Source: U.N. Food and Agriculture Organization

Appendix Four: Global Burden Of Disease by Risk Factor



Source: United Nations Environmental Program

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