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Sustainability and Our Current Food Production System

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Abstract

Food is necessary to human survival and having a sustainable food supply is one way to help guarantee this necessity. Sustainability comes in two forms. Weak sustainability, or substitutability, defines sustainability as the ability to substitute a diminishing resource with another more plentiful resource without irrevocably damaging the environment. Strong sustainability shifts its focus away from substitution and focuses only on renewable resources while maintaining the environmental caveat found in weak sustainability. Our current industrial food production system fails to meet the definition for strong sustainability because of its heavy reliance on fossil fuels, chemical fertilizers and pesticides as well as its inability to maintain healthy soils. The current system also fails to meet the definition for weak sustainability due to its heavy reliance on antibiotics in meat and dairy production, lack of biodiversity and heavy pollution. In order to have a sustainable food supply, the current industrial system needs to be replaced. Small organic operations with the use of farmers markets and CSA's meet the definition for weak sustainability and can be implemented relatively quickly. Vertical farming and other future innovations will allow us to work towards a food supply that meets the requirements for strong sustainability over a longer timeframe. This move away from industrial food production towards small scale sustainable food production will be brought about through the implementation of a new food culture.

Introduction

Food plays a vital part in our everyday lives and yet is so common to our experiences that many of us seldom take the time to think about where it comes from, in what way it was produced, how it was transported and what all of that might mean for the sustainability of the food production system on which we are dependant for life. The current industrial food production system found here in the United States is unsustainable and needs a dramatic overhaul. It places unnecessary burdens on us, our environment and future generations which cannot be ignored.[1] The current food production system meets neither the definition for weak sustainability nor for strong sustainability. The current system is heavily reliant on fossil fuels for transportation and food storage, heavily dependent on chemical fertilizers and pesticides and fails to maintain healthy soil. For these reasons the current system fails to meet the definition for strong sustainability. The current system also fails to meet the definition for weak sustainability since it is heavily dependent on antibiotics for meat and dairy production, lacks biodiversity, could fail in its ability to find a substitute for some of the resources on which it is dependent and fails to meet the environmental requirement due to heavy pollution. For all of these reasons a new, sustainable food production system needs to be implemented. All of these failures of the current industrial food production system as well as possibilities for new food production systems will be discussed in more detail in the following sections.

[1] The issues involving animal rights and animal welfare in our food production system have largely been discussed by environmental philosophers such as Peter Singer and Tom Regan. Issues such as third world hunger and the global food market are also extremely important and should be examined more thoroughly both from within the realm of philosophy and from without. Those important issues however will be set aside in order to more adequately address other issues within the scope of this paper.

Two definitions of sustainability:

Weak sustainability:

Weak sustainability is also referred to as *substitutability*. Robert Solow introduces and argues in favor of this type of sustainability in his article 'Sustainability: An Economist's Perspective'.[2] This definition of sustainability states that an action can be considered sustainable even if nonrenewable resources are being used. This is the case only if the resource being utilized can be substituted with another resource that is as good as the initial resource once that initial resource runs out. Thus an action can be carried out perpetually into the future and is sustainable so long as new resources can be found to replace lost ones.[3] Another important aspect of weak sustainability that is often overlooked is that this form of sustainability must not cause irrevocable damage to our environment. Substitutable resources are allowed so long as the environment is left in a state that meets the Lockean requirement for leaving enough and as good for future generations.[4]

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[2] Solow, Robert. "Sustainability: An Economist's Perspective." *The Environmental Ethics & Policy Book.* Eds. Donald VanDeVeer and Christine Pierce. Toronto: Wadsworth, 2003. 438-443. Print.

[3] Donald Scherer argues against this definition of sustainability. Scherer, Donald. "The Ethics of Sustainable Resources." *Environmental Ethics: An Anthology.* 334-358.

[4] John Locke discusses the requirement of leaving as good and as much in his definition of property rights which come about by mixing one's labor with what can be found in the state of nature. "For this labor being the unquestionable property of the laborer, no man but he can have a right to what that is once joined to, at least where there is enough, and as good left in common for others." Locke, John. "The Creation of Property." *The Environmental Ethics & Policy Book.* Eds. Donald VanDeVeer and Christine Pierce. Toronto: Wadsworth, 2003. 374-377. Print.

Strong sustainability:

Strong sustainability refers to the definition of sustainability often alluded to in the debate on nonrenewable resources such as fossil fuels. This definition of sustainability excludes the use of nonrenewable resources even if substitutes can be found for a resource once it runs out. Strong sustainability describes actions which utilize only renewable resources and can be carried on indefinitely without a reliance on nonrenewable resources. Donald Scherer argues for sustainability through reusability which has the same strong focus against the use of nonrenewable resources and substitution.[5] Strong sustainability, like weak sustainability, also has an environmental requirement of leaving enough and as good for future generations.

If we could implement either of these definitions, strong sustainability would be more desirable than weak sustainability. Relying solely on renewable resources allows us independence from the necessary complications that arise from substitutability. There may come a time when reliable substitutes simply cannot be found. In this case we would fail to meet the Lockean requirement of leaving enough and as good for future generations. Working towards a strong sustainable system is better than having a weak sustainable system. That being said, strong sustainability is more difficult to bring about. Our technical knowledge and innovations involving reliable renewable resources are only in the beginning stages of production. We therefore would not be able to bring about strong sustainability today. Weak sustainability is more attainable in the short term.[6] We

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[5] Scherer, Donald. "The Ethics of Sustainable Resources." *Environmental Ethics: An Anthology*. 334-358.
[6] Robert Solow believes that weak sustainability is the best system. He argues that by using up mineral resources, we will be able to develop technology that would otherwise be unattainable. This he argues will benefit future generations more than leaving those mineral resources unused. Solow, Robert. "Sustainability: An Economist's Perspective." *The Environmental Ethics & Policy Book.* Eds. Donald

should work towards strong sustainability and think of weak sustainability as a stepping stone in the right direction. We will refer back to these two definitions of sustainability as we explore possible replacements for the current industrial food production system.

Having a sustainable food supply

Some might ask why there should be an emphasis on sustainability in replacing our current food production system. An aim towards sustainability would mean a more stable food supply for the human population. If we rely on unsustainable practices and we fail to strive towards practices that will last overtime and work *with*, rather than *against*, nature, we are setting our food supply up for failure. Since we depend on our food supply for life, we also will be setting the human race up for failure. For example, we know now that our ability to use fossil fuels at the rate which we currently do will run out eventually. Our current system is entirely dependent on those fossil fuels. If we were to run out of fossil fuels next year without having another system not only conceived of, but put in place, we would starve. The system we have is not stable since it will fail in the absence of a finite resource for which there is no obvious substitute. If we know now that the system is not stable, we should work towards a stable food supply now and not later. A reliance on fossil fuels is only one of many ways in which the current system in unsustainable. More unsustainable practices will be explored in later sections.

VanDeVeer and Christine Pierce. Toronto: Wadsworth, 2003. 438-443. Print. Robert Goodin on the other hand argues against Solow's views of substitution and discounting. Goodin, Robert. "Sustainability." *The Environmental Ethics & Policy Book.* Eds. Donald VanDeVeer and Christine Pierce. Toronto: Wadsworth, 2003. 443-450. Print. Donald Scherer also argues against substitutability and in favor of reusability. Scherer, Donald. "The Ethics of Sustainable Resources." *Environmental Ethics: An Anthology*. 334-358.

Effects of Current Food Production on the Environment

An Unsustainable System Dependent on Fossil Fuels

The first unsustainable practice utilized by the industrial food production system is a dependence on fossil fuels. This dependence causes the current system to fail to meet the definition for strong sustainability. The desire to have the foods we want when we want them and the dependence of the industrial food system on fossil fuels goes hand in hand. In order to have tomatoes in December in much of the United States, fossil fuels are necessary either to bring us tomatoes from a great distance or to heat greenhouses in order to grow tomatoes near to where we are in spite of the cold weather. Many of us have a desire to eat tomatoes in December despite the fact that they are not even close to in season. We have become accustomed to getting whatever it is we want to eat from the grocery store and so industrial agriculture has found a way to meet these unusual expectations through the use of fossil fuels. Such a system is unsustainable and causes unnecessary pollution. Rising gas prices as well as the realization that long term use of gasoline is unsustainable has long been on many Americans' radars. We now realize that it is not a question of *if* we run out of fossil fuels but *when.* This is a problem for industrial food production because the current system is heavily reliant on transportation to get products such as the tomato from as far away as California or even Chile to dinner tables in places like Vermont during the frosty month of December. We have sacrificed precious fossil fuels to eat a fresh salad during a time (the dead of winter) which would have made our great grandparents question our knowledge of something as basic as seasonality. Seventeen percent of the United States' energy is utilized for agriculture but only one fifth of the total oil used for our food is utilized on the farm. The large majority

is consumed through transportation, processing, packaging, warehousing and refrigeration of the food we eat. If every U.S. citizen ate one meal a week that was locally and organically grown, we could reduce oil consumption in the United States by over 1.1 million *barrels* a week.[7]

The Dependence of the Industrial Food Production System on Chemicals

Another unsustainable practice currently used to grow our food is a dependence on chemicals. This dependence also causes the current food production system to fail to meet the definition for strong sustainability. Pesticide and herbicide use has become the norm in industrial agriculture largely for financially motivated market-based reasons. Large commercial fields are cared for by few workers and thus pesticides and herbicides take the place of direct observation and natural methods. Chemical production also uses large quantities of fossil fuels and chemicals cause severe damage to natural systems. For example experts believe that at least part of the problem of honey bee losses comes from pesticides and herbicides being sprayed on commercial crops which the bees then frequent to gather pollen. Many of these chemicals also end up in the water supply when rain washes them out of fields and into the river system. These chemicals end up in the oceans where they leave large dead zones in their wake.[8] Farmers often spray more

[7] Kingsolver, page 5

[8] Dead zones are areas where oxygen has been depleted in a region of the ocean making marine life in those regions impossible. There dead zones are caused by algae blooms which after they die and sink to the bottom are decomposed by bacteria which use up the oxygen normally available to marine populations. The cause of the initial algae blooms are an increase in nitrogen levels which occurs when nitrogen based fertilizers are washed out of farm fields and into river streams. These river systems eventually make it to the ocean where the dead zone occurs. These dead zones have major effects on the livelihoods of fishing operations as well as tourism and recreation. Walsh, Bryan. "This Year's Gulf of Mexico Dead Zone Could Be the Biggest on Record." *Time Science and Space.* 19 June 2013. Web. <http://science.time.com/2013/06/19/this-years-gulf-of-mexico-dead-zone-could-be-the-biggest-on-record/>

chemicals then they actually need because it is better to 'be on the safe side' than lose a whole crop. The warning labels found on packages of such chemicals let farmers know of the hazardous effects they can have on those who come in contact with them. These chemicals are routinely sprayed on the produce, plants and soil that become our food. The long term effects of eating such foods are largely unknown.

Seed and chemical companies like Monsanto have found new ways to use pesticides, herbicides and chemical fertilizers. One way that Monsanto has genetically modified the seed is by making it 'round-up ready'. This means round-up (an herbicide also controlled by Monsanto) won't kill the seed like it would other seeds. Due to another genetic modification, some corn is actually registered as an insecticide. This registration is due to the fact that when a corn borer (or other insect) begins eating the corn the bug will actually die. The US pesticide industry and the seed industry is now largely one and the same. This merging means that a small number of companies now own the legal rights to much of our food source. In addition chemicals are automatically sprayed on crops now rather than being used only as needed largely in part thanks to round-up ready seeds.[9]

Effects of Current Food Production on Us

Antibiotics in Meat Production and Our Health

Heavy antibiotic use in meat and dairy production is another unsustainable practice utilized by the current system for food production. This overuse of antiobiotics means that the antiobiotics will become less effective overtime. Since both definitions

[9] *The Future of Food.* Dir. Deborah Garcia. Lily Films, 2009. Film.

for sustainability require leaving enough and as good for future generations, this practice fails to meet either definition for sustainability. Antibiotics are used in nearly every beef cow that is commercially produced. This has a direct impact on our own health in a number of ways. Overuse of antibiotics means that antibiotic-resistant microbes become more common. These microbes could potentially threaten the lives of beef cows and thus a large portion of our food supply. The same could happen to other agriculturally produced animals resulting in large losses of our meat and dairy markets. By consuming industrially produced meat, eggs and dairy products we are ingesting some of these antibiotics ourselves. Thus the antibiotics will not only become less effective in curing diseases in animals, but will also become less effective in us when we are sick. This could lead to a superbug and a devastating loss of human life. We have a limited supply of antibiotics and, by using them to such a large extent in our food supply we are losing ground against diseases. By losing ground in antibiotic use, we risk the sustainability of our medical dependence on antibiotics.

The reason beef cows are given antibiotics often has to do with the way they are raised (in high-density concentrated animal feeding operations) and the diet they are fed. Feeding cattle a diet made up of primarily cheap corn means that meat can be produced for the consumer much more quickly and at a lower financial price. Unfortunately for the cows they are ruminants and have thus evolved to live on grass; not corn. Not only must they endure a life in crowded feed lots living in their own manure, but must also eat a diet

that makes them sick. In fact if the cattle weren't slaughtered as quickly as they are, there is a very probable chance their diets would kill them.[10]

The Problem with Monocultures

The commercial crops on which we largely depend for our food supply are grown in industrial monocultures year after year largely to the benefit of large food production industries. This dependence on monocultures means the industrial food production system fails to meet either the strong or weak definition of sustainability since monocultures lead to a lack of biodiversity leaving fewer varieties of crops for future generations. Thus the Lockean requirement of leaving enough and as good for future generations fails to be met. Another concern for the way food is currently produced is the sustainability of soil health which is also being lost with our dependence on monocultures.

Instead of following a crop rotation that utilizes a large variety of plants like those that used to be grown on the average farm, most commercial farms now plant only two crops in rotation; corn and soybeans. This means that traditional cover crops and other plants that add key nutrients to the soil are no longer being utilized. To make up for this loss of healthy soil, chemical fertilizers are used. Nitrogen, phosphorous and potassium are added back to the soil and all other trace elements are largely ignored on the current industrial farms. Since plants absorb the nutrients from the soil which we in turn consume ourselves, it makes sense that the health of the soil in which our food is produced is directly related to the nutrition levels of our food and thus directly related to

[10] Pollan, Michael. *The Omnivore's Dilemma.* New York: The Penguin Press, 2006. Print.

our health. This important connection to the soil is largely overlooked in our current food production system at the expense of our health. Soil health is often taken for granted and when small farms planted a variety of crops, the health of the soil could be taken for granted. We can no longer do so however with our fairly recent turn to monocultures. Monocultures are threatening the long term sustainability of our soil. Continued depletion of key nutrients without an effort to replace those nutrients will lead to lifeless soil which will take time to recover.

In our past there were more farmers and agriculture was vital to the growth of civilization. There also used to be more diversity among our crops. At one point there were around 5,000 types of potatoes grown in the United States. A uniformity of crops began to occur. Less and less diversity became the norm. Today instead of having 5,000 types of potatoes, only four varieties are widely grown. 97 percent of vegetable varieties that could be found at the beginning of the twentieth century are now extinct.[11] This uniformity causes major problems with plant disease and insect devastation. Since all of the crops tend to be of the same variety, they are all susceptible to any diseases or insects that attack that particular variety. Thus large amounts of crops can be wiped out in a single growing season. The long term sustainability of various crops that could replace those lost to insect or disease devastation is threatened. If we lose diversity among our crops, our ability to overcome crop devastation will be significantly reduced.

Consolidation of our food supply is also of concern. Such consolidation is not only happening but it is happening rapidly. For example 80 percent of beef products are being processed by only four companies. This is also occurring in the retail sector. It has

[11] *The Future of Food.* Dir. Deborah Garcia. Lily Films, 2009. Film.

been projected that in the next ten years only six companies will control all retailed food in the world. Only one of these companies will be American-based and that is Wal-mart.[12] This means less choice to consumers since all decisions about retail food will become profit based decisions.

Monocultures simplify the food system and thus lead to less diversity in our diets. Much of the processed foods found in supermarkets (although large in number) are largely made from the same few primary ingredients (namely corn, soy, wheat and rice). In fact, two thirds of the calories we as Americans consume in an average day are made up of these four grains. We also tend to eat the same varieties of whole foods. For example, 99 percent of the turkeys we consume in America are Broad-Breasted Whites and half the broccoli grown commercially is a single type (Marathon).[13] Basing a diet on such simplification leads to an odd result. Americans are both overfed and undernourished. Our simplified food sources have led to a number of health problems. Such problems include being overweight or obese (two thirds of Americans are), diabetes and heart disease. These health problems are top killers. They can also be largely prevented through a change in our diets.[14]

Effects of Current Food Production on Future Generations

Problems from Dependence on Nonrenewable Resources for the Future

We are already seeing the effects of a reliance on nonrenewable resources on ourselves and our environment. Over time these effects will only get worse unless

[12] *The Future of Food.* Dir. Deborah Garcia. Lily Films, 2009. Film.
[13] Pollan, In Defense of Food, Page 116.
[14] Pollan, Michael. *In Defense of Food.* New York: The Penguin Press, 2008. Print.

something changes which means future generations will have to face the challenges we leave behind. Predictions for greenhouse gas effects show an increase in natural disasters and a rise in ocean levels. Extreme weather and a loss of coastal areas will both have major impacts on food production. Floods and droughts will both be more common which leads to adverse effects on crop production. Soil erosion and simplification will get worse over time as well. A loss of coastal areas will cause an inward movement of people leading to less land available for agricultural use. All of these factors combined could put so much stress on the food production system that it could collapse leaving behind a starving population.

Falling Behind on the Development of Sustainable Practices

Failing to overcome our dependence on nonrenewable resources for food production will also harm future generations in another significant way. If we fail to focus on sustainable food production now then we will be spending less time developing the necessary technology and infrastructure needed to put a sustainable system into place. If we spent our time now focusing on a shift away from nonrenewable resources in the food supply, we would be that much closer to a sustainable system. This could help us prevent a food supply collapse because we will have time to conceive of and then implement new ideas. Failing to work towards a sustainable food supply system now means failing future generations.

Why the Current Food Production System Fails to Meet Either Definition of Sustainability

The current food production system fails to meet either the weak or strong definition for sustainability. The reason the current food production system fails to meet the definition for strong sustainability is fairly straight forward. The heavy reliance on nonrenewable resources disqualifies the current system from strong sustainability. Fossil fuels are used in the transportation and storage of food and in chemical fertilizer and pesticide production. The industrial food production system is also in the process of depleting the soil of its nutrient content therefore threatening the sustainability of healthy soil. Since the current industrial food production system relies so heavily on nonrenewable resources, it fails to meet the definition for strong sustainability. Perhaps not so straightforwardly, the current food production system fails to meet the definition for weak sustainability as well. The decreasing effectiveness of antibiotics due to their overuse in meat and dairy production fails to meet the requirement of both definitions for sustainability since we will not meet the requirement of leaving enough and as good for future generations. Our failure to maintain biodiversity among the crops on which we are dependent for food also fails to meet this Lockean requirement. The speed at which we are depleting fossil fuels challenges our ability to come up with a reliable substitute to maintain our current level of reliance on the transportation of much of our food supply. Even if we could come up with a substitute in time, the likelihood of building the necessary infrastructure in time is less then certain. These obstacles could perhaps be overcome but the level of pollution put out by the use of fossil fuels is high enough to cause the heavy use of fossil fuels to fail to meet the requirements for weak sustainability.

Even if a substitute for fossil fuels was found and even if the necessary infrastructure was put into place in time, the negative impact that the use of fossil fuels has on the environment will lead to our inability to offer future generations an environment which is as good as what we have had and enough to maintain a similar level of health and food production capabilities. For these reasons our current industrial food production system is unsustainable from both the weak and strong perspectives. These unsustainable practices are bad not only for us and the environment on which we depend for life, but also for future generations. We need to work towards a sustainable food supply and to do so we need to implement a new food production system which overcomes the flaws of the current industrial food production system.

Possible Solutions-Replacing the Industrial Food Production System

Big Organic and Why it is not an Overall Solution

'Big organic' refers to food that has been produced both organically and on an industrial scale. Chemical pesticides, herbicides, antibiotics (in the case of animal production) and fertilizers are not used in the production of such food and thus it does prove to have advantages over the chemically-dependent industrial food system. Big organic however does have the same problems environmentally when it comes to transportation and food storage as other commercially produced foods. Such food is still transported over long distances to reach the dinner table and thus is a drain on fossil fuels. Furthermore organic meats, dairy products and eggs produced in this way face their own set of problems. Animals used in production of such organic products are usually housed in overcrowded conditions very similar to those animals found in factory

farms that do allow the use of antibiotics and animal feed dependent on chemicals. Such overcrowding without the use of antibiotics leads to a much higher risk of disease and death.

Government enforced organic standards are relatively lax compared to what most consumers consider truly organic food. Although better than their commercially produced counterparts, foods produced by big organic are not always what the consumer thinks they are. It is important for consumers to educate themselves about organic standards and realize what conditions animals live in on such farms and what standards large scale crop producers are using. Just because there is a picture of the traditional small family farm on the package does not mean the food inside was produced on such a farm or with the methods traditionally used on such farms. Consumers should be fully aware of what they are purchasing.

Small Organic

Small organic operations grow organic food and raise organically produced animals on a much smaller scale than big organic. They also tend to have local customers with whom they have a much more personal business relationship. They generally embrace a much more holistic approach to producing food that takes into consideration concerns about the health of their soil, plants and animals as well as the health of the environment and their consumers. Because of their close proximity, consumers are able to ascertain for themselves whether or not a small organic farm meets their needs and concerns when it comes to growing their food. Such operations built on

the outskirts of cities could be used to help feed large populations through the use of CSA's and farmers markets.

CSA's and Farmers Markets

CSA's (community supported agriculture) and farmers markets have become much more common recently as consumers have started looking for an alternative to the industrial food production system. There are websites dedicated to these organizations and finding the ones closest to where the consumer lives. Community supported agriculture is a program used to help local, usually organic farming operations get started. Interested consumers pay an upfront fee at the beginning of the growing season to help cover initial costs. As a result of their investment, they are given a share of the produce grown each week throughout the season. This brings local food to a family's dinner table while also supporting the family or group that grows that food. Farmers markets also help support local agriculture by bringing producers and consumers face to face. A community farmers market often meets once a week during the growing season and includes a number of producers selling produce directly to consumers. With a simple lesson in canning and freezing, the average consumer can take advantage of in season prices to supplement their food supply year round. This is especially useful in places where the growing season is short. Farmers markets allow consumers to ask questions about the source of their food while allowing producers to literally stand behind the food they grow. This gives the consumers more direct control over the foods they eat without the need for extensive research on where and how their food was grown. Farmers markets can be found in cities as large as New York and as small as Hicksville, Ohio. Low income families using government assistance can even use their SNAP benefits at

many farmers markets across the United States.[15] Thus such markets are accessible to a number of incomes in a large number of locations. As the demand for such options grows, the availability of CSA's and farmers markets will also become more commonplace.

Gardening/Personal Farming

Although certainly not available to all consumers, gardening or personal farming can be a way to supplement one's food supply. This can be as simple as growing a tomato plant and herbs in a container garden on a sunny balcony or as involved as producing most if not all of one's food for the year in a large garden just as Kingsolver and her family did and described in Animal, Vegetable, Miracle.[16] This is a great way to gain firsthand experience about what it takes to grow food. It can give the consumer an appreciation both for the flavors that can be produced locally and organically as well as the work it takes to produce such food without chemical input. Growing food can also be an excellent lesson for children and can bring about awareness of food and where it comes from in future generations.

Vertical Farming

Vertical farming is an idea introduced by Dr. Dickson Despommier in his book The Vertical Farm. In his book, he describes an urban, vertical farm that would grow the food we need to feed the ever-expanding human population with a much smaller ecological footprint than current farms. Using this new technology, we would also be

[15] The United States Government. 9 September 2013. Web. <http://www.fns.usda.gov/snap/ebt/fm.htm>

[16] Kingsolver, Barbara. *Animal, Vegetable, Miracle.* New York: HarperCollins Publishers, 2007. Print.

able to repair (or rather let nature repair) much of the damage that we have caused in the natural environment. Much of Dr. Despommier's work is theoretical. He is willing to admit that many obstacles would need to be overcome in order to make the vertical farm a reality. He is optimistic however that the human race can make this concept into a reality and offers a glimpse into what this new innovation would look like and how it would change the way in which we live within our environment. Humanity in general is much too concerned with financial gain and not concerned enough with sustainable living. We live in the moment and don't often consider what effects our current practices will have on us and later generations. Despommier argues we can live sustainably by bringing farming *into* cities. This will occur not as green roof gardens or community gardens (although these are important too) but in the form of the vertical farm. This farm will basically be built by stacking several high-tech greenhouses on top of one another. These farms will use hydroponic and aeroponic technologies to grow crops without using soil. Vertical farms fix two major problems. First, they produce food to feed an increasing urban population. Secondly, they allow current farmland to be reclaimed by nature thus allowing the damage farming has caused such land to be reversed.

There are several advantages to having vertical farms in the urban landscape. Such farms allow for year-round crop production without weather-related crop failures. These farms virtually end agricultural runoff. They also allow for ecosystem restoration which will be done free of charge by nature itself. Despommier claims that they will not need to use pesticides, herbicides or fertilizers. Pests will be kept out with the design of the building and fertilizers will be replaced with 'pure water with dissolved, balanced nutrients'. The hydroponic and aeroponic systems will also use 70 to 95 percent less

water than traditional farming thus freeing up large quantities for drinking. The need to use fossil fuels to transport and grow food will be greatly decreased since food will be produced within blocks of a majority of the population rather than hundreds of miles away. There will be more control of food safety and security as well as new employment opportunities.

The vertical farm is just one example of a new system that could be developed and utilized in the future. Innovation has been one of humanity's strong points and other innovative ideas could be conceived of and implemented to help overhaul our current food production system and lead to a more sustainable way to grow food.

An American Food Culture

Here in the United States we lack what is referred to as a food culture. Other groups of people in different areas of the world have such a food culture and that helps them decide what is appropriate to eat, how that food should be prepared and how it should be eaten. A food culture is something that is a collection of a given population's knowledge about the plants and animals around them and how they can be used to feed us. This knowledge gives us vital information about survival, good health and controlling overindulgence. Without this food culture in place, a group of people runs into trouble just as we have here in the U.S. Instead of a food culture, we have a string of fad diets which lack 'national and biological integrity'. Barbara Kingsolver describes a food culture as arising out of three steps. "Step one, probably, is to *live* on the land that feeds them, or at least on the same continent, ideally the same region. Step two is to be

able to countenance the ideas of "food" and "dirt" in the same sentence, and three is to start poking into one's supply chain to learn where things are coming from."[17]

Throughout her book Animal, Vegetable, Miracle Kingsolver mentions a lack of food culture here in the United States many times. She and her husband take a vacation to Italy and she holds this country up as an example of what an excellent food culture looks like. In the United States we have many eating establishments where good food isn't the point. In Italy on the other hand anyplace that serves food, from a museum café to a restaurant at a small hotel, strives to serve good food. Food is the point if food is being served. Kingsolver also notes that people in Italy take the time to enjoy their food. Their meals are often extended, contain multiple courses and people can be seen closing their eyes and focusing solely on the bite they are taking. The dishes being served are simple in the number of ingredients used but value is placed on the quality of those ingredients. Furthermore there is a lot more green space close to urban centers. People make it a point to squeeze in small gardens near to where they live. Food and how it is grown is a priority because it is so central to everyday life.

Here in the United States we are more concerned with the number of calories we are eating, convenience and everything else going on in our lives and less concerned with the quality of the food we consume. Although paying attention to things like calorie intake could be a stepping stone towards more understanding of the food we eat, there are other important aspects of food that we need to take into account in order to build our own food culture. If we spent more time thinking about food, learning about food and cooking food we would begin to develop a food culture that reflected the one Kingsolver

[17] Kingsolver, Page 20

so lovingly describes from Italy. Food traditions in the form of holiday meals and family recipes would bring us closer to our roots, cooking as a family would strengthen our family bonds and buying local, organic foods or even growing it ourselves would bring us closer to our communities. All of these things would give us our own food culture and would dramatically change the way food is produced in this country. With our new food culture we would be healthier, the plants and animals we raise for food would be healthier and our planet would be healthier. A lack of food culture seems to be the problem. Finding such a food culture seems to be the solution.

The Best Solution

If we need to have a food culture in order to overcome many of the problems facing our current food production system today, how do we get there? We have seen that big organic is not the best possible solution but it is a step in the right direction. Every dollar that a consumer spends on organic food over other foods is a vote in favor of food produced in a different way; in a way that uses no chemicals in production. When consumers make this choice they are helping to bring about change in the industrial food system. Since big organic uses much of the same industrial techniques as the current non-organic system, it is a way to support change until another system can build the necessary infrastructure to feed all of us. Consumers should remember however that even though big organic is a step in the right direction, it does not go far enough in overcoming other problems, particularly those problems involving the use of fossil fuels. Therefore consumers should seek out local sources of food (preferably organic) and support those systems. If consumers actively seek out small organic operations, farmers markets, CSA's and even grow some of their own food then this support will strengthen

this system and help it to grow. Thus as demand increases, so will the number of local operations. Such a system where consumers seek out and value local organic food will lead us to the food culture that Kingsolver and others discuss. We will gain a relationship with our food and an understanding of where that food comes from. A new food production system might look different depending on where you live. CSA's make the most sense in rural areas whereas farmers markets make more sense in urban areas. A focus on sustainable food production might mean the way we get our food will be different depending on where we choose to live. Even when a sustainable system is fully realized, we need not remain in that system if a better one can be conceived. We should always look for ways to make the system a more sustainable one. Looking for ways to continue to improve may mean making Despommier's vertical farms a reality or perhaps putting into place another as of yet unconceived idea. Vertical farms would be an excellent way to minimize the transportation of food and unhealthy soil in big cities while rural dwellers might be better served with traditional small organic operations. The key is finding the right mix of food production possibilities that will lead to the most sustainable system. If the goal is a sustainable food culture, consumers and producers should always strive to support the best system they can and this sometimes means major change. If consumers educate themselves about these issues and stay open to such change, a new food production system will replace the current industrial one and will continue to become more sustainable and stable overtime.

We need to examine whether or not these solutions to our current food production problems meet the definitions for weak and strong sustainability. First we will take a look at small organic operations. Small organic does not use chemicals in their food

production practices. They do however often rely on *some* transportation to get their food to the customer whether that transportation is directly to the home or first to a farmer's market. Although fossil fuel use is dramatically less then that used in industrial scale production, fossil fuels none the less are used to some extent. This means that small organic as it is currently used does not meet the definition for strong sustainability since it does have some reliance on nonrenewable resources. But what about meeting the weak definition of sustainability? If fossil fuel use is confined to local transportation of food then the ecological footprint is on a dramatically smaller scale than the industrial system. If an alternative is sought out for overcoming this dependence on a nonrenewable resource and if minimal fossil fuels are used, then small organic operations could meet the definition for weak sustainability since the minimal use of a nonrenewable resource will give us adequate time to come up with a solution so long as that solution is being actively sought. We will have time to come up with a sustainable transportation option or a reliable substitute if we minimize the use of fossil fuels. Can we do better though? Is there a way for a new system to meet both the weak and strong definitions for sustainability? Despommier's vertical farms have a chance of doing just that. Their close proximity to dense population areas cut transportation to an absolute minimum and their ability for continuous production without fertilizers means no chemical inputs and local fresh food year round. The vertical farm relies on renewable resources. It also focuses not only on leaving the environment in the same shape but helping to improve the environment over time. For these reasons vertical farming has the potential to meet not only the weak definition of sustainability but the strong definition as well. That being said, we aren't there yet. We don't have a system developed that meets the definition of

strong sustainability but we do have some ideas. If we place our focus on sustainability then we will come ever closer to reaching the goal of a truly sustainable food supply which will be good for us, for our environment and for the future of the human race.

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