

Future Trends: How to Live Sustainably

By EES 115-04 Sustainability Class, Vanderbilt University, Spring 2009

Edited by John C. Ayers

The Three Spheres of Sustainability

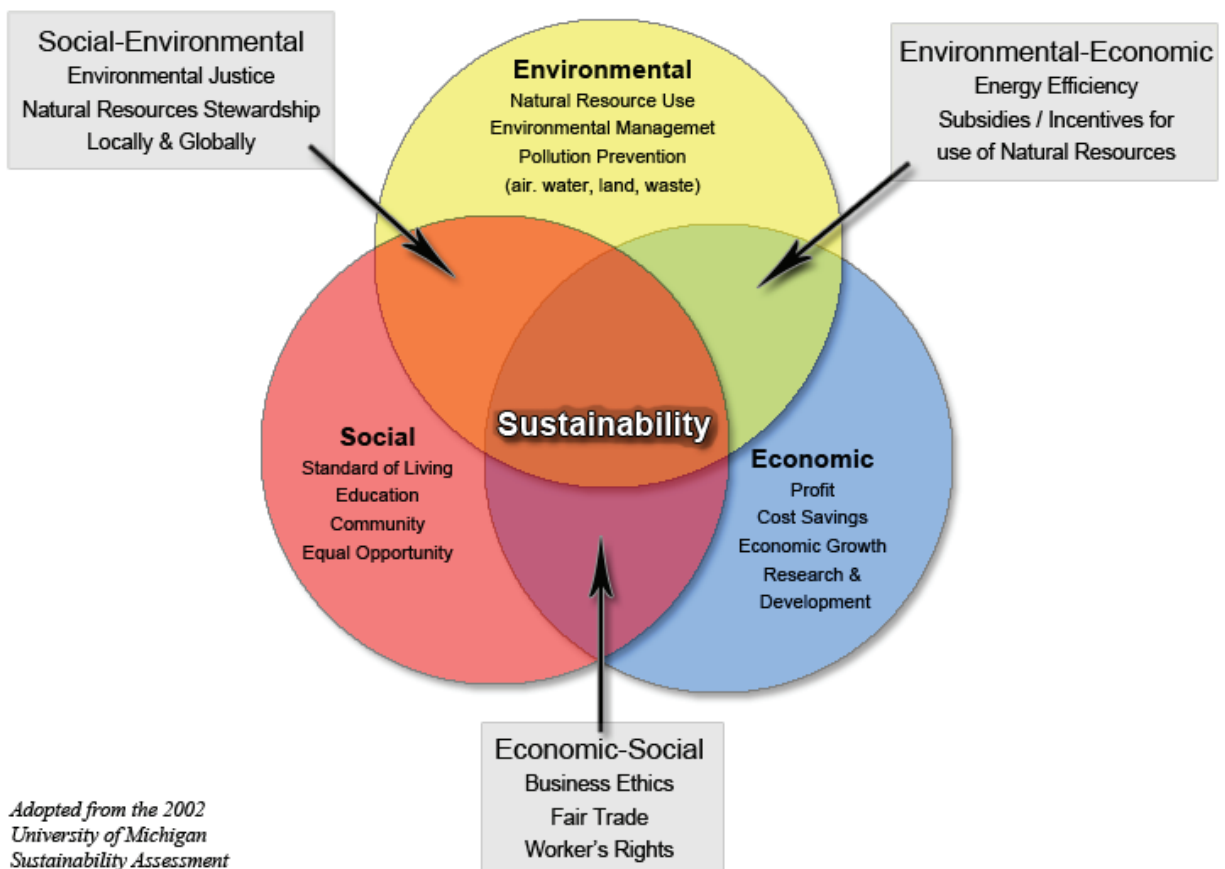


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Introduction

Professor John C. Ayers

In the spring of 2009 I taught a freshman writing seminar at Vanderbilt University titled “Sustainability: An Environmental Science Perspective”. For the first term paper, I created an outline for a book titled “Future Trends: How to Live Sustainably” and asked each of the 16 students to choose a topic for their paper. Each of the student’s papers became a chapter in the book. We hope that people will find this book to be a useful resource, and that it will help to promote sustainable living.

Chapter 1: Sustainability: Why We Should Care

by Jack McCallum

Sustainability is a topic that becomes more important with each coming year. It is a subject that has been stressed neither in education nor in practice up until recently. It is no longer possible to ignore the environment and environmental impact of the practices which we partake in each day. Sustainability is by definition the ability of an ecosystem to maintain ecological processes and functions, biological diversity, and productivity. In plain speak, it is the ability of a system to function without destroying itself, and this is exactly what we as a global community are doing right now. Although most people are not doing what they can in order to save this world, many people recently have rallied under the banner of Sustainability with a fiery intensity that has not been seen since the civil rights movement. Countless lobby groups, NGO's and personal protestors have pushed for a change in the way we as a global community interact with the earth. The intensity stems from the knowledge that change is a choice, and, that we have no option but to act if we have any hope of surviving another few centuries. Sustainability is the attempt to allow our children to inherit the same earth that we inherited.

The first use of the word sustainability came in a British 1972 book about humanities' (Sustainability Science). Its' official meaning came into being in 1978 when it was used in a United Nations document to describe the term "ecodevelopment." In the years after that document was published, the definition of sustainability expanded to encapsulate the three spheres of sustainability which are environmental, social, and economical. Encapsulating these spheres are three very serious issues which much be curtailed in the near future. These problems are population growth, resource use, and pressure on the environment. Population growth is perhaps the least controllable of the 3 issues, for it is hard to slow the influx of babies in the third world]. The only chance in slowing population growth lies in making contraceptives more available and expediting the development of the third world countries into civilized societies.

The resource use issue states that if the current cycle continues, the world's resources will dry up to the point that the high costs will make production unprofitable, and economic growth will cease, thus humans population will have reached the limit of their growth. (Evolution of Sustainability, Charles V. Kidd, in journal Sustainable Science). The pressure on the environment is more a summation of all the other problems. Pressure on the environment can be calculated with the equation: $\text{burden} = (\# \text{ of people}) \times (\text{demand per person}) \text{ divided by } (\text{technology})$, meaning that advances in technology can decrease the burden put on the environment. Theoretically the only way to decrease the burden is to either decrease demand per person or increase the advances in technology. This is why 1st world countries have recently been spending billions of dollars trying to figure out easy ways to decrease their carbon output.

America, essentially a global hegemony and theoretically acting as an example for all nations, alone contributes about 1/3 of the worlds carbon output each year. The sad thing is that America is not the world's biggest problem right now. With the economies of China and India growing exponentially, combined with the minimal environmental restrictions placed on their biggest industries, one cringes to think of the state of the world in 25-50 when their economies will peak. Various attempts have been made by the UN and other global organizations to reduce carbon dioxide emissions, the most famous being the Kyoto protocol. These attempts have had very little impact on anything and are too muddied by politics and greed to effect any real change on the world. An example of a successful treaty from which we can draw hope is the Montreal Protocol on Substances that Deplete the Ozone Layer. This was an agreement signed in 1987 by more than 150 countries to limit the production of substances that were deemed harmful to the ozone layer. This agreement led

to a complete ban of these chemicals, and eventually led to the reduction of the ozone hole over which the agreement was signed.

One cannot rely on governments and international organizations alone to fix the pollution and global warming problems that our world faces. This is a problem that can be worked on daily by every person in the world. That perhaps is why the problem is so frustrating, for it would only take small changes by everyone to fix these problems effectively. The changes that sustainability calls for are really not that hard to implement, and in most cases, seem to be fairly practical anyway. Whether it be recycling garbage or reusing products, each person can do their part. While sustainability is incorporated in businesses and governments, it starts with the individual and in his/her desire to maintain the earth. A government can issue as many mandates and bills as it pleases, but without a public push for change, and a real desire for green practices in the upper echelons of industry, nothing substantial will ever be achieved, and the current trends in will continue to run their course. This desire for green practices can only be preached through education, which is essential in the development of sustainability. Education must be spread to all ages and classes of society, it can be spread through media, school and by all those who expertise in sustainability (10 commandments of sustainability).

Despite all the negatives of the world's current situation, the fight for green now can be looked at in a very positive light as of late. Attention to sustainability has increased markedly in the last ten years. Major corporations are spending millions of dollars to create environment departments. They are doing this because a large population of consumers is asking for something more than the mass production at low cost tactics that have been employed since the industrial revolution. They are asking for sustainable products made through sustainable means. Carbon output by America has actually started to level off due to green practices by businesses, and increasing knowledge of the subject of the sustainability by the general public. Our country must become even better at this as we attempt to set an example for growing economies and third world countries. As countries go through their own industrial revolutions, they cannot make the same mistakes that America made, and must not let their carbon peak reach the same heights that the first countries to industrialize let theirs reach.

One of the main problems faced by the leaders of the green movement is convincing average, every day people that it is worth their time to worry about sustainability. Why should one care about being sustainable? While it does not take much to help the cause, most people are either too lazy or too set in their ways to do the little things required to be green. The reasons to care about sustainability can be divided into two groups, fear of the consequences to oneself, and the moral obligation to protect the planet and its' inhabitants.

The fear of consequences is a very powerful incentive, for the amount of evidence pointing towards what will happen with just a minor temperature increase to the planet is enough to scare most people. This was the strategy for such activists as Al Gore, who attempted to scare people into going green by demonstrating the water level rises and ecosystem destruction that would result from global warming. Environmental problems leading to the demise of a civilization is not a new concept, for it has been documented that the demise of many ancient civilizations resulted not from economic problems or war, but rather from environmental problems such as heat waves, collapsing fisheries, and powerful storms (The Post-Petroleum Survival Guide and Cookbook). These are all problems that exist today, and along with them come many others. The oil production of the world has leveled off for the first time in history, and with shrinking supplies, the production will soon start to decline, leading to a global crisis. Virtually all first and second world countries are dependent on the millions of gallons of oil imported each day. It is what supplies the vast majority of the energy needed to fuel an economy, and as prices sky rocket, no doubt economies will take further hits. Glaciers all around the world are melting, and as the world's greatest fresh water source diminishes, the ocean levels will rise and destroy coastal communities in all corners of the planet.

The state of the earth is not a stagnant problem either, for each year new problems arise, and the old problems morph. That is why it is important that the issue of sustainability be pushed now, for it is now that the changes must be made. Sustainability becomes more and more important every year as the population of the world grows while the global resources diminish. Renewable energy is obviously the ultimate goal, but in these years where that transition is being made, it is vital to use only the bare minimum of the non-renewable resources.

The other incentives to become green lie in the moral obligations that every person should feel towards his neighbors and the earth. A study by the Clean Air Task force found that coal pollution indirectly kills about 30,000 people a year through cardiac problems, and the asthma attacks associated with the tiny particles from coal power plants. This is not just a burden the coal industry should feel, for it is us that demands that millions of tons of coal be burned each day to power our TV's and dish washers. Over 50% of Americas power comes from coal power plants, and while the industry is taking serious steps to move towards clean coal, there are still many dirty power plants causing irreparable pollution. It is depressing to think of the thousands that must die each year from pollution in the heavily polluted countries of China and India, and to know that there is no short-term solution is even worse.

People must realize that the actions they take now will determine just how many animal species will be alive a few generations from now, and what kind of earth their children will inherit. It is selfish to produce needless waste by throwing products out after one use, and upgrading to newer models when the original product is just fine. The earth will not die from the damage we are doing. It is us, and our fellow citizens of the world, whether animals or plants, who will die. This planet is strong, and can fix itself if given time, but with the onslaught of carbon being injected into the atmosphere by humans, it is only after their death that the earth will have time to rejuvenate. The earth is a flawless piece of art, and sustainability is literally the only way there is any chance to preserve it and hold back the deterioration. So, if you find yourself wondering why you should care about sustainability, just look outside your window, look at your family, and realize that it is the only way any of that will stay the same.

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Chpt. 2: What Are the Near-Term Challenges to Sustainability?

Sam Marinelli

Living sustainably is certainly a worthy goal, and with an unlimited amount of time and manpower, it is one humankind would likely be able to achieve eventually. However, the unsustainable aspects of humanity's existence thus far have already begun to have effects on the Earth, and there are more to come, some that may already be inevitable even without further damage to the environment. Pollution threatens to taint the world's natural resources, and even now, many societies consume their resources at rates that cannot last. Meanwhile, world population continues to grow, so the next generation will be larger and will have to live off increasingly scarce resources. Presently and in the near future, the world's chief difficulties in attaining sustainability will be preventing further pollution, using only renewable resources, and reaching zero population growth.

By definition, sustainability cannot occur if the quality of the environment is being constantly degraded, and so in order for sustainability to be achieved, pollution must end. Atmospheric pollution in particular threatens to change the Earth's climate and weather, thereby having a direct influence on human quality of life all over the world. The primary mechanism for this is global warming.

One of the key difficulties in dealing with global warming is that the greenhouse gases that are at its root have already begun accumulating in the air as a direct result of mankind's actions. Since the Industrial Revolution began in the late 1800s, concentrations of greenhouse gases have been rising significantly. Carbon dioxide concentrations have risen by a third, methane concentrations have risen by half, and nitrogen monoxide concentrations have also risen significantly (Speth 21). Until recent times, there was relatively little concern over any effects these gases might have, and now that the danger has been realized, global warming is already under way. Because of greenhouse gases, Earth's average surface temperature is expected to rise another 1.01 to 1.65 °F within the twenty-first century (IPCC 5). It is also believed that temperatures and sea levels will continue to rise for a millennium because of carbon dioxide's presence in the atmosphere, as it lingers there for quite some time (IPCC 17).

Another consequence of atmospheric pollution is acid rain. This occurs as the result of releasing certain sulfur- and nitrogen-containing compounds into the atmosphere. These include sulfur dioxide and nitrogen dioxide (Seinfeld). In the atmosphere, sulfur dioxide is converted to sulfur trioxide, which reacts with water to form sulfuric acid. Nitrogen dioxide is converted to nitric acid. These acids dissolve in atmospheric water and fall to the ground in rain. This can have disastrous effects on forests. In addition, acid rain can leach minerals such as magnesium and calcium, micronutrients required by trees, out of the soil (Effects).

Water pollution is also a serious dilemma posed by man's need to dispose of waste. Due to relatively recent technological advances, modern products are manufactured with ever increasing amounts of toxic chemicals such as the heavy metals used in many electronics. These products, when disposed of improperly (which they often are), end up in landfills. Thus, the toxins in some cases are able to leach into groundwater. Additionally, numerous types of manufacturing produce toxins not within consumer products but simply as byproducts of production, and these must also be disposed of properly, carrying with them the same risk of contaminating groundwater.

Much of the problem with pollution is that it damages natural resources, and so the issue is compounded by the problem of overconsumption. In order for sustainability to be achieved, humankind must consume only renewable resources and use them only at the rates at which they can be regenerated. Of all the resources humanity consumes, perhaps the one it most overuses, the one that is most detrimental to the environment, is energy.

Presently, the world depends largely on fossil fuels such as coal, natural gas, and oil for its energy. However, this is clearly not sustainable, as fossil fuels require millions of years to form and are being consumed much faster. In particular, oil, which is responsible primarily for the energy used for transportation, is expected to peak in production around 2012 (Koppelaar 3). The cars, trains, ships, and airplanes on which civilization depends are in turn dependent on a resource whose use can clearly not be sustained for much longer. Therefore, it will be necessary to find alternative energy sources to supplement and eventually replace oil and fossil fuels in general.

Among the most promising alternatives to fossil fuels are solar, wind, and nuclear power. Each, however, has its limitations. Solar and wind energy, for instance, are not dependable for twenty-four-hour power, as solar power only functions during the day, and wind power depends on sufficient winds to turn windmills. Nuclear energy also has its flaws, “including the restricted availability of uranium, security considerations, safety issues, and limited public support” (Mann 160). The most significant cause for concern, however, is that there is not yet a satisfactory way of disposing of nuclear waste.

Energy is not the only resource humanity is consuming at an unhealthy rate. Deforestation is occurring in many parts of the world, leaving soil arid and decreasing forests' capacity to reduce atmospheric carbon dioxide. Most deforestation is carried out deliberately for logging and to provide land for farms, residences, and businesses. This has numerous negative effects on the land. Forests have the capacity to act as carbon-dioxide sinks (Mann 174), and so cutting them down is essentially equivalent to emitting carbon dioxide in that it increases atmospheric concentrations. In addition, deforested land quickly becomes less arable. Once the trees' roots are no longer present, the soil can erode with little difficulty, and so while deforestation is often performed in order to make land more appropriate for farming, in the long term it usually will not be suitable for this purpose, and once the land becomes arid, farmers often look to clear-cut more land to replace it. The lack of trees can also cause the climate to become drier. This is because in the water cycle, trees normally allow a certain amount of water to evaporate from their leaves, and so in their absence, the atmosphere contains less water.

Because forests are home to various species in different parts of the world, deforestation is a grave threat to biodiversity (Nilsson). As much as eighty percent of the world's biodiversity may be located in forests (Mogato), and so the deforestation carried out so far has already likely caused a significant loss in species. Most people appreciate the intrinsic value of biodiversity for its own sake, but having a variety of species extant also facilitates research in biology that can be of direct help to humankind.

Pollution and overconsumption clearly must both end in order for sustainability to be accomplished. However, even if the world's resources are not destroyed by toxic chemicals or overused by individual people, if the population continues to grow, the demand for resources will continue to increase with it, and so society will still eventually overstep its bounds. The equation $I = PAT$ models the effects of population, affluence (consumption per person), and technology on mankind's ecological impact. The equation states that impact is the product of population, affluence, and technology, meaning that ecological impact and population are directly proportional. Thus it is imperative that population growth end in order for the other prerequisites to sustainability to have their desired effect.

It is often said that technology has the potential to negate the limits to world population, for in the past, when there have been apparent limits to human population growth, new technological advances have often been what allowed growth to continue. Nevertheless, there still must be a limit to how large a human population the Earth can support. This is a problem because even if pollution ends completely and each person only consumes what presently is a sustainable amount of resources, a continually growing population will still require more and more resources, and so there would be no limit to consumption, and sustainability could not occur.

Presently, much of the world's population growth occurs in developing countries, where the quality of life is far below that of the developed world. However, it would seem that supplies of certain rare metals are not sufficient for the present quality of life in developed nations to be extended to all of the world's people sustainably (Cohen 1). Thus with present populations, the quality of life of developed nations is already unsustainable, and the problem will only be exacerbated by further world population growth. It is of course possible for a population to temporarily exceed its carrying capacity. Thus there could conceivably be a short period in which a significantly larger population could experience the quality of life of developed countries. Nevertheless, any such period of exceeded carrying capacity would be unsustainable by definition, and so the natural resources that power said quality of life would be exhausted.

The reason for this disparity in quality of life stems partly from the fact that developed nations tend to have lower rates of population growth. In developing countries, birth rates are much higher, partially because such societies are more agrarian in nature. This means that parents are likely to have more children, as children, once old enough, are able to aid in the various tasks of farming. Additionally, birth control is not widely available in some of the poorest parts of the world like sub-Saharan Africa, and so sometimes the means to limit births cannot be obtained. Thus most of the world's population growth occurs in less developed nations (Lindsay). However, because these nations' industries and technology are also less developed, the argument is often made that they ought not bear the burden of slowing population growth until they catch up to the developed countries in these respects.

It is therefore clear that developed and developing nations must cooperate in their efforts to reduce and eventually halt global population growth. Overpopulation is an issue whose primary source now lies in poorer nations, but only the richer nations have the wealth and technology to make zero population growth attainable. Only when the industrialized and developing countries of the world learn to work together will progress be made toward establishing a sustainable, constant world population.

The three primary hurdles to sustainability are pollution, overconsumption, and overpopulation. However, these should not be seen as three unrelated, isolated problems to be dealt with. For instance, overconsumption of consumer goods and overuse and misuse of technology are partly responsible for high levels of pollution. Therefore, it is imperative that these dilemmas be viewed as three aspects of the same fundamental problem of resource management. Sustainability requires that the world's resources remain untarnished and plentiful. Thus, it can only be achieved by ending pollution, limiting consumption, and controlling population. When these three goals are met, the world's population will finally be sustainable.

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Chapter 3: Buy Organic and Local Foods

Emily Kurtz

Ideally, food production does not require any additional inputs besides those that are already provided by the land itself. For thousands of years, crops flourished using the natural microorganisms and nutrients found in the soil and animals prospered by eating the plant life around them. Yet today, we thrust millions of pounds of artificial chemicals onto the living things around us in order to maximize food output, while simultaneously eradicating the planet's future potential for food production. Our current system of agriculture is based on an industrial model that focuses on monoculture production and the use of large amounts of fertilizers, herbicides, pesticides, antibiotics, and genetically modified organisms with little regard to environmental and human consequences. The results of such a system are unnecessary costs, degradation of the environment, food insecurity, and a worldwide food production system in which costs do not reflect true expenditures. Our current agricultural system is not sustainable because there is no way we will be able to meet the needs of both present and future generations. Therefore to promote sustainability, we need to return to a more holistic approach to food, one that focuses on producing and consuming organic and local foods that are less detrimental to our future and the future of the planet.

Organic agriculture, while not yet perfected as a system, has the ability to overcome many of the problems associated with industrial agriculture. Even though specific standards are not fully developed and loopholes still exist, organic food systems are still better for the environment and demand is increasing as consumers are beginning to recognize its potential. "Consumer demand for organic products is increasing worldwide. In 2006, the organic market was estimated at nearly US\$40 billion (2 percent of food retails) and is expected to reach US\$70 billion in 2012" (Food and Agriculture Organization of the United Nations 2). Organic foods require, among other things, freedom of contamination by human or industrial waste, fertilizers, pesticides, herbicides, and antibiotics, which decreases the possibility of desertification, pollution, and loss of diversity. In May 2007, the International Conference on Organic Agriculture Food Security published a report on the benefits and drawbacks of organic foods. Among their findings, they stated that:

Organic agriculture emphasizes preventive measures (rather than control) that result in an overall agro-ecosystem stability, especially of soils that have increased soil organic matter and microbial biomass. Organic soil structure results in better water drainage and percolation, and soil organic matter improves water-retention (20-40 percent more), thus decreasing irrigation requirements and enhancing crop yields in drought periods. Better ecological balance is achieved through mandatory crop rotations, use of adapted seeds/breeds and rehabilitation of functional biodiversity...Organic systems yield a higher animal immunity and increased resistance of plants to disease, with 50 percent fewer mycotoxins in crops and a longer shelf-life. The restriction on synthetic input use contributes to safer drinking water, due to decreased leaching of phosphates and nitrates, and avoids pesticide poisoning (conventional agriculture chemicals cause about 20 000 deaths per year) (5-6).

These findings are a great summary of the numerous benefits that organic agriculture offers to our planet and food system. Many of these benefits are not usually, but should be, considered when examining agricultural food systems.

Organic agriculture also addresses issues of food security, economic independence, and fossil fuel use. In order to be truly organic, agriculture must be operated on a small to medium scale; it cannot be an industrialized system that is controlled by corporations utilizing monoculture techniques on a large scale. There must be diversity in the production process with numerous farms growing numerous crops. This consequently allows for better food security as the possibility of crop

devastation due to pests, diseases, or weather related events is diminished. Nor will we be devastated if corporations go out of business, as farmers will not be reliant upon them for seeds, chemicals, etc... Furthermore, our food security and economic independence would be increased because of the decreased reliance on fossil fuels. Organic farming requires “33 to 56 percent less energy per ha” (Food and Agriculture Organization of the United Nations 2) and “organic farmers in a range of different countries required only 30 to 50 percent of the energy consumed in conventional farming systems” (Singer and Mason 205). Many people complain that organic foods are too expensive, yet the prices of organic foods more accurately reflect the true costs of production. Consumers of organic foods are not paying for unnecessary synthetic chemical inputs that originate as fossil fuels, therefore they do not rely on fuel imports from other countries, nor do they diminish our own fuel stocks. Organic agriculture is a low-footprint energy system that maximizes resource efficiency and helps to establish self-reliant food systems. Unfortunately, organic foods will never be price competitive with conventional foods until issues such as economies of scale, subsidies, and negative externalities are taken into account.

Even though issues of health and taste are still controversial and government agencies maintain that organic foods are no better for you than traditionally processed foods, studies are popping up around the globe that suggest otherwise. Because organics avoid the use of pesticides, herbicides, fertilizers, and antibiotics, the food we ingest contains much smaller amounts of these chemicals than conventionally grown foods. No matter what we do, some chemical residue will enter our bodies, but “where the same pesticide was found in both conventional and organic foods, the levels of pesticide were significantly lower in the organic food” (Singer and Mason 200). Little is known about the long-term effects of industrial agriculture and the ingestion of chemical residues, so why should we risk our health when we know that organics avoid these issues upfront? Moreover, it has been demonstrated that organic agriculture “contributes to micronutrient intake and healthier diets through the reintroduction of under-utilized varieties and diversification of production” (Food and Agriculture Organization of the United Nations 8). When foods are harvested before they are ripe or excessively processed, as they are in industrial agriculture systems, they lose vital nutrients and taste. A diverse food system, as exemplified by organics, is not solely focused on maximum output, as it allows for other questions to be taken into account such as the taste and health potential of the foodstuff. Taste, quality, and nutrient content should be our main focus when producing and consuming foods, which is why organic foods are optimal.

We live in a global marketplace that essentially allows us to eat whatever we want, whenever we want. Our food choices are no longer constrained by seasons, distances, or growing regions. One consequence of this unrestrained consumption is a loss of knowledge. Our current system of agriculture has not only degraded the land, but our minds too. Presumably many people today, including myself, could not tell where their food comes from, how it is grown, or what it takes to grow it. It was not until recently that I learned kiwi fruit grows on trees and brussel sprouts grow on stalks, and while I know their methods of growing, I could not begin to say what regions of the country these foods are grown in. Instances such as these illustrate the importance of a return to local produce. By growing foods locally, we advance the opportunity to educate ourselves and others about the origins of our most basic need. To know about what we eat is to know about the world around us. Visiting a local farm allows us the opportunity to not only see the growing processes in action, but to learn about a whole host of other things such as soil, climate, insects, life cycles, etc... the educational opportunities are endless. What’s more, eating locally also entails eating seasonally. While many of us may feel constrained by this restriction of choices, eating seasonally also allows one the opportunity to explore new foods and recipes. We may be completely unaware of foods that are endemic to our local area, and thus miss a whole host of new possibilities. Eating locally and seasonally helps to preserve a connection to the land that is crucial to survival. Knowing where you came from and where you are can help foster a sense of identity and it can nurture ones spirit. Food has always been very close to our hearts as humans, thus we need to continue in such a way that that connection is never lost.

Eating local foods also helps to reduce the high costs of transportation that come from shipping foods worldwide. Food miles are “the distance food travels from where it is grown to where it is ultimately purchased or consumed” (Food Miles 1). Much of the food we consume comes from far away places without any regard to the consequences this has on our health, the planet’s health, and our pockets. Our food comes to us via ships, trucks, and airplanes, all of which emit harmful pollutants. In fact, “in 2005 the import of fruits, nuts, and vegetables into California by airplane released more than 70,000 tons of CO₂, which is equivalent to more than 12,000 cars on the road” (Food Miles 1). The effects of pollution from transporting foods are well documented and cannot be ignored. It is extremely difficult to go to ones local grocer and purchase local foodstuffs, but it is ludicrous to purchase something that is flown in from halfway across the country when it can be grown locally. Importing foods from faraway distances adds costs, and as fuel prices continue to rise and pollution controls are initiated the cost of importing foods will rise dramatically. People around the world are starting to take notice of the impact of food miles, with countries such as Sweden instituting food miles labeling. By eating locally, we begin to shed light on issues of food transportation and hopefully reduce the average 1,500 to 2,500 miles it takes for our food to reach us, which in turn will diminish our consumption of fossil fuels. Furthermore, food quality diminishes after it harvested, hence the freshness of your food is dependent on the time it spends away from the soil. Locally produced foods are generally richer in nutrients and flavor because of their ability to ripen in the soil longer, and they are selected based upon their flavor rather than transportation feasibility. Wouldn’t you rather pay for taste than transportation?

The media is consistently highlighting the plight of local farmers, disclosing their inability to compete with globalized food production, crop destruction from weather related events, and their simple inability to make ends meet. Yet one of the best ways to sustain small family farms is to buy their products, something many of us do not do. By eating locally, one is able to support their local farmers and communities. FoodRoutes.org (a local foods advocacy group) accurately states that “Buying local food keeps your dollars circulating in your community. Getting to know the farmers who grow your food builds relationships based on understanding and trust, the foundation of strong communities”. All across the country small family farms are going bankrupt and the communities in which they reside are suffering as families move away. Local business owners (which include farmers) are more likely to put their profits back into the community, by supporting local school groups, churches, fundraisers, etc.. We live in a country where the dollar has greater power than we imagine, but our money has a voice attached to it, and we can maximize its potential by spending in such a way that benefits our friends and neighbors. Community supported agriculture programs (CSA’s) are one such example of an individuals ability to support their local farmers and community. CSA’s are a way for people to not only receive fresh, seasonal, local produce, but they allow us to form a connection with local farmers. You essentially become a “shareholder” of the farm through your financial support, thus creating a symbiotic relationship that benefits all.

Another added benefit of eating local foods is its ability to moderate ongoing concerns of accountability and food security. People are more likely to pay attention to environmental concerns when they occur in their own community. The same goes for farmers as well. The chances of environmental degradation and harm are diminished as things become more personal. Thus, it could be reasonably assumed that a farmer is less likely to use toxic chemicals on their fields when they know their children are out playing in and around the fields. Moreover, a farmer would be less inclined to utilize harmful agricultural practices when they know it means lost productivity and vitality of their land and livelihood. Not only will farmers hold themselves more accountable, but the community and consumers will as well. In addition, if environmental or human harm should occur, it is much easier to trace it back to the source when the source stays local. One such recent example is the salmonella outbreak that occurred from contaminated peppers from Mexico. If consumers were to eat locally then problems could not only be confined to smaller areas, but it would be much easier to trace the harm back to its source, thus lessening economic and health crisis’. The FDA originally

thought that the salmonella originated in raw tomatoes, thus causing a countrywide recall which cost producers and consumers hundreds of thousands of dollars and did nothing to eradicate the source of the bacteria.

Localized food production will also enhance our food security in a similar manner. Having many smaller farmers spread across the country creates more barriers to destruction. Decentralized food production makes it more difficult for weather related events, pests, and even radical groups to wipe out entire food sources. This also helps to reduce our reliance on fossil fuels by decreasing food miles and by (hopefully) using less energy intensive farming methods. Our dependence on fossil fuels for agricultural production puts us in a precarious state as a nation where in order to eat we must rely on an unsteady supply of oil from other nations, which consequently compromises the security of our food. Thus, we must find ways to decentralize our food processes, not rely on a few large producers, and utilize local renewable energy sources for food production. We will not be 'putting all of our eggs in one basket' by increasing our consumption and supply of local foods, therefore ensuring the existence of plentiful foods and a vibrant culture.

Therefore, if we want to achieve a more sustainable lifestyle, our efforts must include rethinking our food systems. Industrial agriculture is not sustainable with its excessive use of synthetic chemicals, environmental degradation, utilization of enormous quantities of fossil fuels, expansive food miles, monoculture crops, corporate control, and food security risks. However, if we shift towards a system based upon organic and local foods, we will be able to combat many of these issues and leave a healthy, prosperous planet for future generations.

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Chapter 4: Become a Vegetarian

Alex DiValerio

The cost of various types of energy in order to produce meat greatly outweighs the benefits of this luxury good. While the vast majority of the world's citizens have less water and land than is necessary to sustain them, those of us in developed countries do not grasp the seriousness of the harm we do to the world by importing and producing meat. We could help the world's sustainability by reducing our consumption of livestock. As a race, we consume enormous amounts of water, oil, and other resources. Every little bit conserved counts, and if we can reduce our consumption of livestock, then we can reduce the use of water, oil and other resources.

One of the major problems with raising livestock is the amount of rain forest destruction that takes place mainly in Central and South America. Cattle ranching is the leading cause of destruction of rain forests in these regions. On average, 55 square feet of rain forest is destroyed to produce a quarter pound of ground beef. (Rain Forest Action Network, www.ran.org) This is one of the best, if not the best, example as to why the costs of cattle ranching are greater than the benefits. These regions of rain forest in Central and South America are regions that lack nutrients in the soil. So as soon as the land can no longer grow grass and other plants that feed the cattle, the ranchers begin to cut down more rain forests to do the same thing over again. Not only is this devastating to the land, but all the animals whose natural habitat is the rain forest now have to either live in a smaller region of rain forest, or worse, if they cannot adapt quickly enough, they become endangered species or even extinct. This also leads to the process of desertification, which comes with many other environmental problems.

The monetary cost of beef is not an accurate value of what it costs to produce the beef either. If the cattle ranchers paid the actual costs of what it takes to produce beef, we can be certain that there would be very few, if any, cattle ranchers still working. The land that is continuously cut down is one expense. Other expenses range from the cost of caring for the cattle, in terms of keeping them healthy, the water that is used, (again, a resource for which the cost is not entirely paid for by the consumer), and the amount of oil and fossil fuel that is burned to transport the meat once the cattle has been slaughtered and packed. So it becomes obvious that the five dollars that someone pays for a pound of ground beef in the grocery store is not an accurate measure of the cost of beef production. However, if it is not the producers or consumers paying for the production of beef, it is now easier to see how the earth and the environment becomes the primary financier.

The cost of meat production can be measured by the amount of water consumed. There are the unseen costs of where the water could be better used, including by those who do not have enough water to sustain themselves. On average, about 2,500 gallons of water goes into the production of one pound of beef. Not 2,500 gallons per cow, but per pound! This is an amazing statistic that really makes the thought of how much water would be conserved if everyone didn't eat meat for a year a mind-boggling concept. On average, a person eats 120 pounds of meat per year. This would mean that if one person became a vegetarian for one year, that person would save 300,000 gallons of water. And if more than one person reduced or stopped their intake of beef, then the number of gallons of water saved would begin to become truly significant. As a culture, we could begin to reduce our excessive use of water.

When we compare the energy costs of being a meat eater versus a vegetarian, the difference is as between night and day. In terms of water, the amount used for one pound of beef is enough to produce hundreds of pounds of grain. It only seems reasonable that in order to become a more sustainable world, we need to be more energy efficient, and produce as much food as possible with as little water use as possible. Buying meat in a city requires producers to raise, slaughter, and ship cattle. This requires an enormous amount of energy. On average, it takes 2 gallons of water to produce one pound of vegetables compared to 2,500 gallons for one pound of beef. Also, with today's technology, people can grow fruits and vegetables inside of a building anywhere, which means that the costs of shipping and transporting vegetables is reduced, or even eliminated if the vegetables are bought locally. Considering that there are alternative forms of protein, it is possible to eat plenty of protein without eating meat. This is also considered a major contributor to the problem of world hunger. Massive amounts of energy are being used to produce very little beef for those who can afford it, while others are going to sleep hungry.

There are almost endless advantages to being a vegetarian. While many people try to become a vegetarian and do not succeed, this is because the only thing that is essential to being a vegetarian is making sure there is protein in your diet. Soy is full of protein and a great alternative to beef. Tofu is also a great way to get protein without eating red meat. Being a vegetarian is also clinically proven to reduce the chance of having an array of medical issues such as; coronary artery disease, gallstones, cancer (particularly lung and colon), kidney stones, colon disease, diabetes, high blood pressure, as well as many other conditions that can be life threatening. (www.britishmeat.com) It is also believed that even if these conditions are present in a person, becoming a vegetarian contributes to the curing process and recovering from life threatening conditions. While the U.S. has a relatively high life expectancy rate, the countries that top the charts are countries that have high vegetarian diets along with sea food because of their sea side location; places like Macau, Andorra, Japan, Singapore, and San Marino. While it may be difficult for countries to mimic diets like those with high life expectancy because of central land locations, seafood is only part of their diets; the majority of it consists of vegetarian foods.

While there are many advantages to being a vegetarian, like many things, it has its disadvantages as well. When it comes to flavor, the variety is reduced because the various parts of cattle and livestock that taste different, whether it's a T-bone steak and tenderloin, or pork chops and bacon, meat has a variety of specific tastes. Also, because meat seems to be such a large aspect of our culture, going out to eat at restaurants can mean you have a limited selection to choose from because so many dishes contain meat. Many people believe that your body cannot function properly over long periods of time with protein deficiencies. This could possibly be the largest problem many face with being vegetarians. However, if you look for help and ideas of how to get the correct amount of protein in your diet, then there is no problem. The reason why this is an issue is because many people do not do the proper research to find out the appropriate means of eating protein. Two very accessible types of protein rich vegetarian foods are textured soy protein and tofu. Both are forms of soy protein and both come in a variety of flavors and tastes that make it hard to believe that its not meat. (Bates, 52) While the protein selection is available, is it much smaller and possibly harder to come by. Understanding the concept of helping our earth become more sustainable is easy, the actions we take and adjustments we make are the harder aspect of this change.

There are also many environmental advantages to being a vegetarian as well. The major reasons are more directed toward the slowing of harmful behaviors that can help prolong our environment. Because of this, we are more sustainable and are able to continue to raise children without drastically changing life styles due to the constantly changing resources and energy sources

we use up at an exponential rate. While the world's population grows extremely fast, this does not mean we must destroy the natural forests and land at the same rate. If we keep up this rate of destruction, we will surely destroy all resources and human life will not be viable. While it is a group effort, something as simple as reduction of one's consumption of red meat or becoming a vegetarian can greatly help our environment, not only for us, but for all the animals that will then get to stay in their natural habitat instead of adapting to a new environment or dying off as a species. With water consumption a major issue associated with global warming and the knowledge that only a finite percent of the world water is drinkable, we must be aware of how we are using water and if we are using it in a sustainable way. Right now, we are being very wasteful and it is hard to tell when we will run out of fresh water, but if we stay at this pace of consumption, it will surely happen.

Even if the concept of becoming a vegetarian seems to radical at this time, there are still ways to help the environment. By organically raised beef is one way. Organic techniques of raising and allowing cows to graze as they wish conserves 30% more fossil fuel than chemical dependent techniques. (Steffen, 61) Also, by using what seems like waste produced by cattle can actually be beneficial. Central Vermont Public Service electric company has devised a way to use manure and turn it into electricity. (Steffen, 63) So even without giving up meat, it is still possible to help become a more sustainable planet.

There are countless ways in which we can help out our environment and earth to make it a more inhabitable place for future generations. We need to make sustainable living our primary standard of how we live and treat the earth. Otherwise the problems and issues we face today will be miniscule compared to what we will face in the future if we maintain our consuming lifestyle. Every little bit will help change the way in which we use the earth's natural resources, and while becoming a vegetarian might seem extreme to some people, just reducing one's consumption of meats can still help. All the water, natural gas, and land that are used for very small portions of meat are not sustainable, or even close to being so. The cost of producing this luxury good produces far more cost than overall benefit. The saved water then can be used to grow vegetables and fruit, and the land to support animals indigenous to a specific area. The harm we do is enormous for such little pay-off. Any amount of change can help, but it must be something that can be maintained and adapted into an everyday lifestyle. While it only took the world's developed regions a very short period of time to destroy so much that we will never get back, it must now be our job to try and preserve what is left for as long as possible. There is no better way to start than to become a vegetarian, or even just a reduced meat eater.

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Chapter 5: Changing Your Ride

Amaobi Enyinnia

In the summer of 2008, the cost of oil rose dramatically, peaking at a record high of \$147.27 per barrel. As seen around the world, the price for a gallon of gas just about doubled over the span of the summer, putting tremendous and sudden strain on many people's budgets and leaving many to ponder their automotive future. With all this in mind, getting the maximum fuel economy or even possibly acquiring a fuel-efficient vehicle, has become a priority. Many options that could displace the traditional gasoline powered vehicle are available now or in the near future. Changing your ride from an inefficient personal car to mass transit, vehicles with high fuel efficiency or hybrid vehicles, or the upcoming forthcoming electric and hydrogen fuel cell vehicles will not only help you keep the Earth green, but can put some green back in your wallet as well and help you live more sustainably.

For many, alternative transportation has been utilized for decades, whether it is in the form of mass transit with buses, or a vehicle as simple as a bicycle. Even at current levels, the use of mass transit saves substantial fuel and effectively cuts harmful emissions. For example, at current levels of use, mass transit saves about a month's worth of oil imports from Saudi Arabia per year, or about 45 million barrels every year. (Shapiro, Hasset, and Arnold). Theoretically, if America would use public transport at the rate of Europe, for about 10 percent of travel needs, oil imports would be cut by a staggering 40 percent (Shapiro, Hasset, and Arnold). Additionally, at a usage rate of 10 percent, the United States would cut carbon dioxide emissions by 25 percent of what would be required by the rejected Kyoto Treaty (Shapiro, Hasset, and Arnold). In 1999, for example, the use of public transportation reduced nitrous oxides and other emissions by nearly 100,000 metric tons, saving more than \$130 million in regulatory costs imposed by the Environmental Protection Agency (Shapiro, Hasset, and Arnold). Furthermore, increased use of mass transit has noticeable health benefits. For the Summer Olympics of 1996, the city of Atlanta, Georgia implemented a massive alternative transportation plan to reduce motor vehicle traffic, which included a 24 hour transport system, increased use of telecommunication for meetings, and the addition of 1000 buses (Friedman, Powell, and Hutwagner). As a result, over the Olympic period, there was a 46 percent drop in asthma attack events, along with a significant drop in ozone pollution (Friedman, Powell, and Hutwagner). Not only would increased use of mass transit decongest busy city streets and roadways, it would also provide extraordinary energy savings to its users and the nation, more so than continuing to expand the private vehicle fleet, not to mention boosting public health as well.

Alternatively, a good way to change your ride is to switch to a zero-emission vehicle that has been around for centuries, the bicycle. Of course, as noted in a study completed by Paul Schimek of the Massachusetts Institute of Technology, there are many perceived dangers among potential bikers, including the chances of being hit by a car from behind in a collision. Schimek concludes that 89 percent of car-bike accidents occur during turning or crossing situations, usually as a result of bikers' lack of education on these situations and not by being run down by a motorist with road rage (Schimek). Contrary to popular belief, bicyclists are actually recognized as drivers of vehicles under United States law. Obviously, the main benefit of utilizing a bicycle for transport is an improved level of personal fitness, especially when it comes to battling the obesity crisis within the United States. Added benefits include, zero total emissions from their use, not to mention savings on all the fuel not used to go short distances.

A lesser known but quickly emerging form of alternative transportation is carsharing, where users pay a subscription fee plus a fee per use to borrow a wide range of vehicles from a company. In a simplified view, carsharing is an advanced short-term rental program, providing a personal car without many of the burdens of ownership. According to Susan Shaheen, Daniel Sperling, and Conrad

Wagner, up 90 percent of all work related trips are done by single occupant vehicles and vehicles sit unused for an average of 23 hours a day (Shaheen, Sperling, and Wagner). Carsharing is used primarily for short-distance tasks like errands and going to nearby locations for events such as meetings that do not take place at one's workplace. It can also be used as a way to reach other public transit options. An example of the emerging practicality of carsharing can be seen at Vanderbilt University, which teamed up with Zipcar to provide a carsharing program on campus for students and faculty in 2008. The benefit of carsharing comes mainly in its ability to reduce time spent driving, as the costs of time spent is tied directly to how much one will pay for the service, ensuring that drivers will only use the vehicles when necessary. Furthermore, studies have shown that people who join carsharing organizations tend to use alternative transportation such as bicycles more frequently and in some cases, will forego the ownership of a private vehicle altogether (Shaheen, Sperling, and Wagner). Overall, carsharing is an effective means of alternative transportation in its ability to cut vehicle usage and by extension, harmful emissions. This is especially true when carsharing programs such as Vanderbilt's use environmentally-friendly hybrid vehicles for their programs.

Another great choice for changing your ride is a fuel-efficient vehicle, especially one of the growing number of hybrid vehicles that use both an electric motor and a gasoline engine. Hybrid vehicles tend to have features like regenerative braking, shutting the engine off while stopped, and utilizing smaller engines to maximize fuel economy. They can also recharge the battery without having to plug it in. During the summer of 2008, the value of hybrid vehicles, such as the Toyota Prius, jumped extraordinarily, as the cost to fuel big, fuel inefficient cars like SUVs was becoming prohibitively expensive for many families across the nation. In a study comparing the second-generation Prius to a 2001 Toyota Corolla, the Prius was found to get at least nine more miles to the gallon, or about \$1364 saved in fuel versus the Corolla, along with "social savings" of around \$328 (Lave and MacLean). However, the study does concede that fuel prices have to hit a minimum of \$2.50 for hybrids such as the Prius to become more attractive to the average consumer than the Corolla, due to its higher base price at a dealership (Lave and MacLean). With the purely non-gasoline cars on the horizon, hybrid vehicles may not be the most ecologically friendly solution to changing your ride but nevertheless are an excellent and practical option.

According to the media, biofuels such as ethanol are fairly new on the scene of gasoline alternatives. In reality, this is far from the truth, as pioneers such as Henry Ford intended to use ethanol back in the 1910s, claiming that "Gasoline is going—alcohol is coming. And it's coming to stay, too, for it's in unlimited supply. And we might as well get ready for it now." In fact, the original Model T was a "flex fuel vehicle", able to run on both ethanol and gasoline. During the 1970s energy crisis, ethanol regained importance as a viable fuel alternative (Food and Water Watch). In 2006 alone, the United States consumed over 5 billion gallons of ethanol (Food and Water Watch). Biofuels, ethanol in particular, have silently invaded government fleets and mass transit, not to mention modern day flex-fuel vehicles (DiPardo). Additionally, the viability of ethanol seems to be on the rise, as it is starting to be derived from sources other than corn, such as switchgrass and rice straw, which, along with improved production processes, is lowering the cost per gallon of ethanol (DiPardo). Unfortunately, ethanol and biofuels do have serious drawbacks which limit their appeal. The process to produce ethanol is potentially negative in terms of net energy, meaning more energy would be put into producing it than it would yield. Additionally, the ability of ethanol to replace gasoline seems to be hindered by a lack of land to produce biomass, among other things (Food and Water Watch). Furthermore, the environmental benefits of ethanol are dubious, as the growing of more biomass will lead to increased soil erosion and increase the number of low-oxygen areas where fish cannot flourish, along with possibly releasing carcinogens into the air. Another potential problem with corn-based ethanol resides at the dinner table. The increased demand for corn to produce ethanol will increase corn prices, which in turn causes a domino effect, extending to many parts of the food market, meaning higher prices for products like milk (Food and Water Watch). Thankfully, there are much cleaner energy sources for vehicles that are not far from reality.

In 2007, General Motors unveiled its first all electric car to be mass-produced for the American market, the Chevrolet Volt. In a sense, the Volt has become a symbol for the direction of the auto markets since the energy crisis of 2008, dealing a telling blow to the huge and inefficient vehicles that were so favored for the last decade. Although electric vehicles have been around since the 1970s, they have garnered little attention until recently as result of their emerging practicality and the advances in battery technology. As stated by S.R. Ovshinsky, an efficient battery is the key technological element to the development of practical electric vehicles (Ovshinsky, Fetcenko, and Ross). In recent years, lithium ion batteries have become favored over nickel metal-hydride batteries due to their higher power capacity and a rise in the cost of nickel metal-hydride batteries (Kennedy, Patterson, and Camilleri). Environmentally speaking, electric vehicles have the potential to majorly reduce oil consumption, as very little electricity is made from oil directly. Additionally, electric vehicles produce virtually no carbon dioxide. But the true environmental impact of these cars largely depends on how the electricity that fuels them is produced. Overall, electric vehicles may make tremendous strides towards reducing emissions if the electricity is produced by a clean source of fuel.

In terms of helping the environment and human health, hydrogen fuel cells hold the greatest potential. Fuel cells are only now starting to reach practicality for use in cars, and have been deployed on a very limited basis in the 21st century, mostly only in trials. The major benefit of fuel cells is their ability to eliminate vehicle exhaust, instead producing water, effectively making them as clean as the fuel source used to produce them. Another benefit of hydrogen fuel cell vehicles comes in the field of health, as the air in urban areas would become incredibly cleaner should fuel cells be mass adopted (Jacobson, Colella, and Golden). In terms of fuel costs, hydrogen more than doubles the fuel efficiency of vehicles and is extremely abundant on Earth (Ahluwalia, Wang, Rousseau, and Kumar). Of course, a major hurdle in the introduction of fuel cell vehicles is the infrastructure necessary to deliver hydrogen where it is needed, meaning that projects will eventually be underway to build pipelines across the country, not to mention fueling stations. Many carmakers, including Ford, Toyota, and Honda have plans to produce fuel cell cars and have displayed many working prototypes to demonstrate the viability of hydrogen fuel cell vehicles. Although hydrogen fuel cell vehicles are still a bit off, they hold great potential for helping the environment, not to mention delivering excellent fuel mileage.

In the meantime, there are many things a car owner can do to improve and maximize the fuel economy of their current vehicle. One of the simplest things to do is to avoid letting a car idle excessively, because it burns fuel and the car has an effective mileage of zero miles per gallon while it sits idling (Auto Alliance). Another myth that favors idling has been proven false; modern vehicles do not need to idle for more than 30 seconds to warm the engine, contrary to the belief that it was necessary to idle for a few minutes to heat the engine (Auto Alliance). Another trick is to commit to regular tune ups of your vehicle, which could improve gas mileage by up to 4 percent. Often overlooked, a clogged air filter can drop fuel mileage by as much as 10 percent, and replacing it with a clean air filter can keep the engine in better condition as well. Additionally, using the correct grade of motor oil will improve fuel economy by about 2 percent (Environmental Protection Agency). Interestingly, during the 2008 Presidential Election between Barack Obama and John McCain, Obama was mocked by his opponent for suggesting that keeping tires properly inflated would increase a car's miles to the gallon. However, Obama was correct. Keeping tires properly inflated will increase fuel economy by as much as 3 percent (Environmental Protection Agency). Additionally, there are many ways to improve fuel economy while driving. Avoiding rapid starts and maintaining a constant speed will increase mileage, along with efficient use of the air conditioner only at speeds above 40 miles per hour to avoid increased aerodynamic drag from keeping the windows open, which will decrease fuel efficiency (Auto Alliance). Although the sheer majority of people continue to utilize traditional gasoline powered vehicles, there are still easy and effective ways to reduce their footprint on the globe.

In conclusion, there are a multitude of transportation options that can help the environment far more than using an inefficient gasoline powered vehicle. Alternative transportation options such as mass transit and bicycles not only help cut down harmful emissions, but can improve health, as seen by the dramatic decrease in acute asthma attacks during the 1996 Olympic Games in Atlanta, Georgia. Additionally, carsharing programs are proving effective in cutting vehicle usage, along with spurring interest for forms of transportation outside of a private car. However, for those who must have a personal vehicle, there are many current and future technologies that can help decrease their environmental footprint. Available now are highly efficient small cars, along with the dual powered hybrid vehicles and diesel powered cars. All of these deliver impressive fuel economy and have only seen their value rise in the wake of the 2008 oil panic. On top of that, performing regular maintenance on your vehicle will preserve its optimal fuel economy for it. Looking ahead, on the horizon lie both electric vehicles, such as the plug-in hybrid Chevrolet Volt coming in 2010, and hydrogen fuel cell vehicles which are being continually tested and improved. Both of these types of vehicles, along with all the other ways to change your ride, can seriously reduce your impact on the Earth and help us all live more sustainably.

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Chapter 6: Travel Less

Stephen Bai

Environmental sustainability has become a prevalent issue in our developing world, and in response, there has been growing interest in finding new ways to deal with this issue. Some have called for an interactive learning program that educates and encourages citizens to live sustainably (Lange 121). In fact, there have been admirable efforts, both large scale and individually, to make our way of living more sustainable. Recycling programs are expanding, and new research is being done on greener technologies to attack the sustainability issue on multiple fronts. Regardless of these efforts, however, some of the simplest ways of reducing humanity's environmental footprint are being overlooked. In an era where technology is celebrated and advancements are being made at remarkable rates in all major fields of study, perhaps people are prone to overestimate the power of technology and underestimate the necessity of individual human efforts. One of the easiest changes people can make to live more sustainably is to reduce their use of unsustainable transportation. There are many ways to do this, including taking the bus, carpooling, exploiting modern technology, buying a house strategically, and taking local trips.

Many new technologies are aimed at increasing energy efficiency, such as compact fluorescent light bulbs, hybrid cars, and more efficient HVAC (heating, ventilating, and air conditioning) systems. It should come as no surprise then that being more efficient when traveling will also lead to a reduction in negative environmental impacts. For example, if more people are transported per gallon of fuel used, the amount of pollution created by fuel emissions will also decrease. Amongst the most common and easiest ways to transport more people per gallon of fuel is through the use of city buses and active carpooling.

When traveling to public places, riding the bus is a great way to travel less in personal vehicles, which are comparatively unsustainable. The city bus is exceptional in transportation efficiency. Although the fuel economy in miles per gallon of most buses is relatively low compared to most personal vehicles, an average sized bus can seat dozens of people at once, easily translating to a fuel efficiency of hundreds of miles per gallon per person. Most cities have an extensive bus network that provides cheap transportation to all the major venues in town. Taking the bus does not increase one's ecological footprint, because they travel the same route regardless of who uses them, and the amount of pollutants emitted due to each additional passenger is relatively insignificant. In addition, not only do buses directly reduce the amount of pollution created per person to travel somewhere, they also reduce traffic congestion within cities by reducing the number of vehicles traveling on the roads. This means that there will be less intense traffic jams that reduce the amount of time people spend idling their vehicles, which subsequently equates to less pollution caused by the city as a whole. The International Energy Agency has found that "compared to cities dominated by small private vehicles, those with well designed bus systems have much less traffic congestion, lower pollutant and CO₂ emissions, and offer better mobility for all social and economic classes" (IEA 12). The bottom line is that the less people travel in their personal vehicles, the less pollution they create.

It is proper to reason that buses may not be an appropriate or even possible method of transportation in many scenarios; however, carpooling can also be an easy and enjoyable way to reduce fuel emissions. In smaller cities without a busing network, or when traveling to locations which are not located near a bus stop, carpooling can be a worthy alternative. In contrast to riding the city bus, carpooling allows regular interaction with a group of close friends or acquaintances. It gives an opportunity to build closer relationships with friends while traveling less in personal vehicles. One newspaper editor describes the process through which she realized that carpooling has a fun social aspect attached to it in addition to being economically and environmentally virtuous. (Fisher L6). The

author goes on to explain how carpooling has become “a complete success” in her various social groups, and even goes as far as saying that it has become the core of her social life (Fisher L6). Although the main goal in carpooling is to travel less using the personal vehicle, there is definitely an added social incentive to this alternative.

One of the prevailing arguments of advancements in research and technology is that the positive effects will balance out or overcome the negative ones caused by their creation. Since modern technologies have been heralded as the nucleus of sustainability efforts, they should be exploited. Just being aware that these technologies are available is not enough; they need to be taken full advantage of. Relatively new technologies such as videoconferencing and file-sharing can prove vital to today's demanding and fast-paced job markets. Simply having internet access can also prove to be a priceless resource to save time around the house. Utilized appropriately, these technologies can diminish the need for unnecessary errands at both work and home, concurrently reducing pollution.

As an alternative to the traditional round-table business meetings, videoconferencing allows people to interact with each other in the comforts of their own respective environments. New programs (such as Microsoft Office OneNote) allow ideas in the form of files to be visible to selected users via sharing-folders, such that not only will people be able to see a certain presentation, they can also potentially obtain a digital copy of it to refer to later. In fact, the acting director of WWF Scotland (World Wildlife Fund), Dr. Dan Barlow, reveals that traveling makes a major contribution to most companies' carbon footprints. He concedes that alternatives such as videoconferencing are not only good for the environment, but will also save the businesses time and money (Haworth 14). Opponents of this move to an increasingly technology-based business world may argue that a big part of the reason why businessmen choose their jobs is because they enjoy traveling; however, as the world continues to change, people must change with it. In a wonderfully Darwinian fashion, adaptation to the current problems of the day is vital. Indeed, many businesses seem to be embracing this move to greener interactions. A survey conducted by the WWF concluded that 89 percent of the participating companies intended to fly less, while 85 percent viewed videoconferencing as a potential solution for this initiative (Haworth 14). This kind of progressive thinking can begin making businesses more sustainable, although corresponding progressive action clearly must follow.

Just as technology has the potential to make life at the job more sustainable, it also has the potential to make life at home more sustainable. Online databases such as ProQuest and Google Scholar allow free access to a range of information that previously required a trip to the library to retrieve. Whether one needs sources for an essay for school or is just in search of general knowledge from a credible source, these databases can save time and reduce the amount of pollution created. There are also a range of legitimate websites that can help resolve the daily problems that are encountered. For example, Web MD, an online health information center, can save a trip to the doctor's office if used correctly. Although sites like these are by no means meant to be a replacement for the actual thing, they can be a valuable resource when searching for symptoms and treatments to frequent and widespread ailments such as the common cold. When utilized appropriately, these sites can help decrease the amount of time and money spent on sometimes unnecessary alternatives (such as visiting a doctor only to be told that one should be drinking more water and getting more rest) and reduce unsustainable traveling and the subsequent amount of pollution created.

A very effective, though slightly more incommodious method to travel less is to simply buy a home that is located near most of the regular destinations: school, work, grocery store, etc. Doing so will clearly save time and money, but the daily fuel emissions will also be decreased to only a fraction, depending on the relative location. One study conducted by the *Sunday Times* in London even shows a direct correlation between commuting time and personal health. After analyzing the effects of the daily commute on people's overall feelings of wellbeing, the results clearly indicated a linear relationship between the two: the longer people have to travel to get to work, the more their health declines (Boztas 10). In fact, strictly statistically speaking, the survey noted that the average sense of wellbeing decreased 1.2% for every two hours people spent traveling

each week (Boztas 10). If saving time, money, and the environment is not enough incentive for one to buy a house that is reasonably close to daily destinations, then saving one's personal health should be.

When most people think of a vacation, they most likely imagine some exotic place far away from home. In fact, the word "traveling" has become a synonym for going on vacation. Nonetheless, the purpose of a vacation is not to travel to as many exotic locations as possible, but to be able to relax and take a break from one's daily routines. Many vacations are planned out such that people are rushing from destination to destination with barely enough time to enjoy each place. There certainly are many great attractions abroad; however, many people aren't aware of and consequently don't take advantage of the many great attractions right in their home town (or just around the corner). Many cities and universities offer multi-day camping excursions, guided hiking trips, kayaking lessons, rock climbing trips, and a myriad of other opportunities for people to relax and get away from their daily routines. These local attractions are not only a fun and money-saving alternative to vacations abroad, they are also far more sustainable in regards to how far one needs to travel to arrive at the destination.

Despite considerable advancement towards a more sustainable society, personal action must still be at the root of these efforts. The aforementioned suggestions are simple methods to travel less using unsustainable transportation, and habituating into these practices along with the use of common sense can make societies substantially more sustainable. For example, if people stop driving to the local recreation center to walk around the track when the weather is perfectly nice outside, maybe the community can begin to live more sustainably as a whole. As the ESPN acclaimed Coach of the Century Vince Lombardi put it: "Individual commitment to a group effort - that is what makes a team work, a company work, a society work, a civilization work." It seems that this case is no different in that individual effort towards traveling less, amongst other things, is what is needed to make the sustainability movement work.

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Chapter 7: Choose and Maintain Your House Wisely

Julie Choi

Our current way of life is almost entirely dependent upon limited resources that will eventually be unavailable if this rate of consumption continues. The extent of our intemperate way of life is accurately illustrated by how we maintain our home. An average U.S. home "emits or generate 23,000 lbs of carbon dioxide" (McLane). With the threat of environmental depletion as an incentive, we must adopt practices to ensure the earth retains an ecological balance by maintaining a sustainable home.

Living efficiently begins with choosing your home wisely. A house's location, size, and construction are vital to its environmental impact and should be taken into consideration when choosing a home. Living near your job and a local food market reduces the distance you travel; this leads to less pollution, saved time and money, and other benefits discussed in the previous chapter. Furthermore, the size of your home can greatly affect the amount of energy used to maintain it. Smaller homes are generally more energy efficient since less space requires less cooling, heat, and light. Single-story homes are also more energy efficient than multiple-story homes because heat rises and light cannot be illuminated between floors. Hence, your home should not be significantly larger or higher than necessary.

The building materials of a house also have a major influence on its energy efficiency. A home constructed with green materials not only avoids the depletion of natural resources, but it also costs the same or less than conventional building products. This is because the manufacture of green materials consumes less energy and generates less waste (Anderson & Eremic). You would also be wise in choosing a prefabricated modular home, a home made from standardized parts; a prefabricated home is faster, cheaper, and more flexible in its construction than a conventional home.

Although you may not be able to choose and move into a new house, there are numerous alternative ways to maintain any current house more sustainably. This includes renovations and changes within your home. By simply replacing incandescent light bulbs with compact fluorescent light bulbs, you would be saving about \$13 per year with each replaced light bulb. They use only one-fifth the energy of the incandescent light bulbs and last up to 15 times longer in addition to producing much better light (EES). The environmental benefits include saving about 300 pounds of carbon dioxide annually per average U.S. household (McLane). Solar powered lights are also effective alternatives. They use energy from the sun to recharge their batteries and therefore do not require any electricity. This can be useful where no electricity connection is available, or when the electricity bill gets too high.

Because of the growing environmentally-conscious mindset, many energy efficient appliances are being developed that are available for the home, specifically Energy Star appliances. The Energy Star label indicates that the appliance meets the strict energy efficiency guidelines set by the U.S. Environmental Protection Agency and the U.S. Department of Energy. Energy Star appliances exhaust approximately 25% to 40% less energy compared to many generic appliance brands (Anderson & Eremic). Although these appliances may be more expensive, they are worthwhile investments when comparing the additional cost to the savings in energy bills.

Perhaps one of the greatest contributors to unsustainable living is the tendency to consume excessive amounts of water. Less than 1% of the earth's water is ground or surface water that is qualified for drinking and cooking (Water Encyclopedia). Careless expending of water is the reason that an average of approximately 350 gallons is used per day by a typical American household (American Water Works Association). Yet, there are many practices you can adopt in your home to significantly reduce this number. Choosing to shower can use only 9 gallons of water, whereas indulging in unnecessary baths uses approximately 28 gallons. However, power showers can be even

more prodigal--they can use up to 15 gallons each minute (EES). Installing aerators on shower-heads and faucets is a simple and inexpensive way to restrict and utilize water flow, while still maintaining the same water pressure. This can save up to 75% of water (EES). Other simple energy- saving changes to bathroom activities include smarter flushing; if you have a dual flushing toilet, always try to use the shorter flush option when plausible. When brushing your teeth, turn off the water until you are ready to rinse. Outside the bathroom, save water by using your energy-efficiency dishwasher and washing machine only when full, or use the half load button if available. Additionally, if you have any sort of dripping faucet or leaking pipe, getting it fixed as soon as possible will significantly decrease the amount of water wasted in your home.

Apart from reducing freshwater consumption, you can save water by utilizing water that has already been used. This graywater--which consists of any water used in the home, except that from the toilet and kitchen sink--can be collected and redistributed for other purposes, including flushing toilets and irrigating your garden. A graywater system can reduce indoor water use by about 30%, and it can even fully eliminate outdoor freshwater use (Graywater Central). Similarly, rainharvesting systems use barrels or cisterns to collect and store rainfall that can provide most, sometimes all, of a household's non-potable water needs (RainHarvest).

Energy used for heating and cooling can account for up to 70% of the energy used in the average American home (Department of Energy). Hence, insulation is the most important factor in maintaining the heat efficiency of a house. An inadequate amount of insulation can result in higher utility bills and energy wasted; more specifically, up to 25% of heat can be lost through the roof, 20% through windows, and 33% through walls (EES). A simple and economical way to insulate water cylinders and pipes is to place a fitted jacket around them in order to prevent heat loss in the water. Insulating the water pipes in your home will also significantly reduce the likelihood of pipe-bursts during the winter. Furthermore, if the insulation in your walls are outdated or lacking, installing low-density foam insulation can save up to a third of your heating costs (EES). This foam should also be a zero-ozone depleting spray foam.

Air infiltration is another common way for indoor heat or cool air to escape; 20% of heat can be lost through windows and doors (Department of Energy). Hence, you should routinely check for such leaks around doors, window frames, and other small openings around your house. If you find leaking joints, they should be repaired as soon as possible. Window coverings such as energy saving curtains and energy efficient window film, caulking, or secondary glazing can prevent air infiltration. Fitting draft excluders around a window frame or under a door is another very cheap method to maintain heat efficiency.

Another essential element of conserving your house sustainably is to use green products when at home. This includes buying products made with reclaimed or recycled content, using biodegradable products, and using materials manufactured with minimal or no volatile organic compounds. For example, use shower curtains made of polyester, a green replacement for vinyl curtains, since they are washable and emit less VOC. Also, use VOC-free paint when repainting your home while buying accurate amounts and properly disposing unused portions. Optimizing materials by reusing and recycling should apply to every component of or within your house. Home furniture can also contain toxic chemicals, so therefore use FSC certified wood instead of manufactured wood products that contain formaldehyde.

Maintaining your home largely involves cleaning, which should also be done in an eco-friendly manner. A majority of household cleaning supplies are toxic and come with a label (Anderson & Eremic); stay away from such products by practicing green cleaning. Green cleaning involves cleaning using natural products made with organic ingredients in lieu of hazardous chemicals that are harmful to both your health and the environment.

Moreover, there are even simpler measures that can be taken to significantly reduce your energy usage. Turn off televisions, computers, video or music players, and other electronic devices when they are not in use. In order to avoid further electrical leakage through such devices, connect all

your computer equipment with a single power bar and all your television equipment to another. Therefore, you can unplug all devices at once and only turn the power bars when you are using the equipment. Also, turning off the lights when leaving a room or when you are sleeping, and using the minimal amount necessary, prevents wasting electricity.

In the kitchen, you can conserve energy while cooking by placing lids to retain heat and by using pans that cover the entire area of the ring to prevent heat from escaping up the side of the pan. Also, when using the oven, open its door sparingly and use it to cook multiple foods at once. The same can be said with refrigerators--open its door sparingly and use only one if possible. You can even turn the oven off 10 minutes early since ovens stay hot for a long time. Outside the kitchen, saving heat is possible by lowering the temperature on your thermostat by 3°F or more during the winter, layering clothes to keep warm. Similarly, increase the thermostat by 3°F or more during the summer, using fans to keep cool; you can save approximately 10% on your energy bill through these small changes (EES). Also, turn off radiators in rooms which are not being used and keep their doors closed. Use natural fresh air ventilation as often as possible. Most importantly, inspect and clean your house regularly; this includes HVAC systems, insulations, pipes, gardens, etc.

Although being committed to sustainable activity may take effort, the results are tremendously beneficial. Following these measures to maintain your house sustainably is cost-effective by lowering utility costs and making it easier and cheaper to maintain in the long-run. You will also gain greater energy independence, providing more convenience and allowing you more control over your home. Green living is not only better for your health by improving indoor air quality, but also healthier for the environment. Fewer resources are used, including fossil fuels and wood, and less pollution, such as carbon dioxide and smog, is emitted. Green living produces only positive outcomes--a cleaner, cheaper, and healthier living--and should be motivation enough to begin such a way of life in your home.

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Chapter 8: Building Your House Wisely

Hamilton Carpenter

For humans to thrive, three essential elements have always been necessary. Food, water, and shelter are the most basic of needs. Humans have over time developed the ability and capacity to build the largest, most secure, and safest structures the world has seen. However, with these achievements come costs. Initially our homes were constructed from natural materials, met only our needs, and would last until they were returned to the earth; now, however, we build with what we want in mind rather than focusing on what we need. Our buildings now require constant upkeep, use materials that are harmful to the environment, and waste energy that could be used more valuably in other aspects of our lives. With our wasteful habits catching up to us, we have begun taking notice of the need to return to the necessities. By following a new set of ideas when constructing our homes, we are now able to live as sustainably as we did in past ages while still living in the comfort that we have come to know.

The first aspect to consider when building a sustainable house also seems like it would be the most obvious: choose a good location. The instinctive purpose of seeking shelter is to avoid hazards, yet in this modern age, people tend to believe that through our current technology we can effectively establish residences in locations that 100 years ago would have been suicide to live in. When deciding the location for a house, attempt to find one with as few natural hazards as possible. This can include avoiding living on the coast where hurricanes can be an issue, in the flood plains of rivers, in areas such as the chaparral biome that are prone to wild fires, or on severe fault lines where earth quakes could be an issue. Not only is living in these areas counterproductive because of the risk of the house being destroyed, but also if the house is destroyed, harmful materials from inside your house would then be released into the environment and the water table. For the sake of the health of the residents who will occupy the house, it is also important to avoid manmade hazards. It is important to avoid incidents such as Love Canal, where toxic waste consisting of 82 different chemical compounds, 11 of which were carcinogens, were dumped. A neighborhood was built upon the site several years later. Several residents of this neighborhood began having health problems and eventually the entire neighborhood was abandoned (Beck).

The next thing to consider when looking for a location for a home is the availability and quality of water. A location with a plentiful and renewable supply of water is the most ideal. This would include living near fresh water lakes or a river. Living in an area where water is scarce only causes more energy to be used to transport water. The quality of the water is also important because it allows for the land to be fertile and for less energy and chemicals to be used in filtering it for drinking water. The less human touch and influence on a resource, the more sustainably it is being used. Depending on the soil type at the site, different crops can be farmed at any scale, from a small vegetable or herb garden to a fully tilled plot of land producing corn, tomatoes, or whatever else is wanted. It is also important to keep in mind the distance from your home to work, stores, schools, and other places of interest. The less you have to drive, the less impact you have on the environment. The final thing to keep in mind when choosing a location is the prevalence of sunlight and shade on your house. Large amounts of sunlight can be used to heat your house in a colder climate and a shaded house will naturally be cooler in warm environments.

The construction of the house is the most important aspect to making it sustainable. The first step to building a sustainable house is careful planning of the layout. The floor plan of a sustainable house should be small and practical. Not so small that it is uncomfortable for the people who live in it, but small enough that there is no excess energy or materials wasted in its construction or upkeep. It should also be designed with appropriate window banks for the climate to allow for more natural

heating and cooling in addition to natural lighting. The materials used in building the house are also incredibly important to its impact. You should attempt to use materials that have low toxicity, have minimal emissions involved in the manufacturing and transportation, are created from recycled materials, are resource efficient, contain reusable components, are drawn from sustainable sources, and are affordable (Froeschle). The goal is for all the materials to have minimal environmental impact before and after the house is built. A good example of the proper use of green building materials is at the Vanderbilt Commons. The new dorm buildings were constructed in a green manor, incorporating several of the aforementioned techniques. Seven of Vanderbilt's buildings are now LEED certified for environmental friendliness ("Vanderbilt University..."). The type and amount of insulation can affect the amount of energy consumed/ wasted for heating and cooling the home. Organic insulations made of substances such as mushroom spores are the best choice for efficient, environmentally friendly insulation ("Environmentally Friendly...").

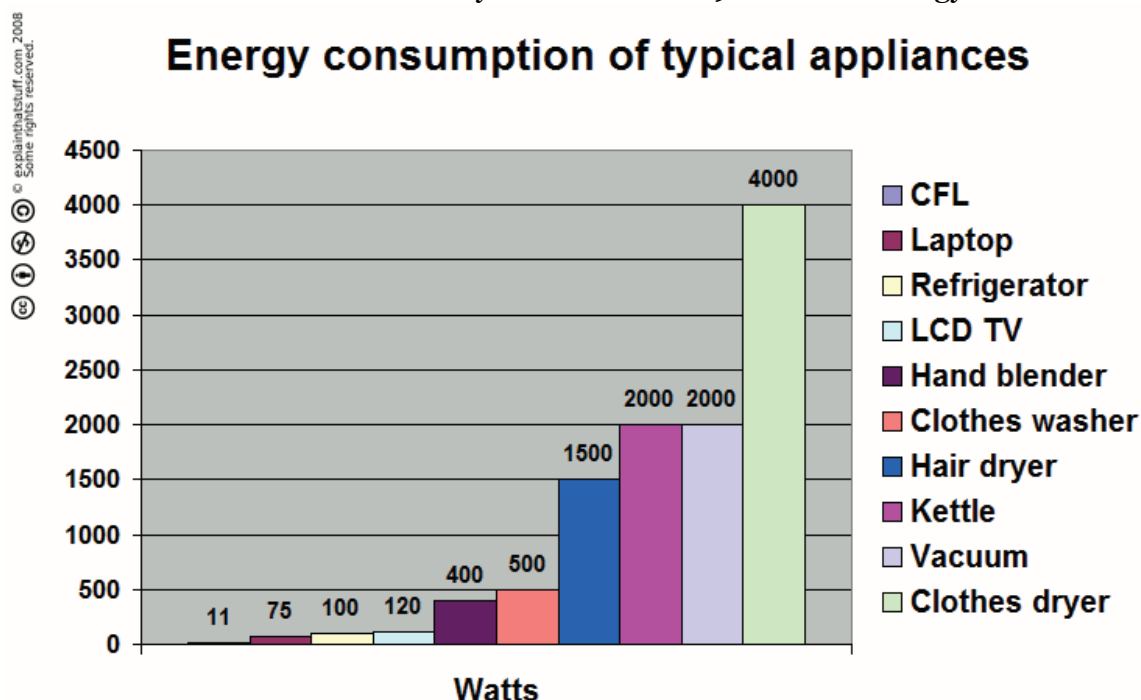
The different types of water heating and disposal in a house greatly affect the sustainability. Grey water recycling systems can be implemented into homes to recycle the wasted water. Grey water is composed of waste water that is not heavily polluted. This water can come from dishwashers, tub water, drain water, etc... This water can then be used for irrigation for the lawn/garden ("Greywater"). Ground water sources can be tapped in situations where city water is difficult or costly to obtain. Wells can be dug, but should only be used as potable water. Using the ground water as irrigation potentially extracts water from the water table faster than it can be restored. If this occurs, in times of drought, we will have no reserve water supply for crops, lawns, etc... Septic tanks in certain areas can be much more environmentally friendly than sewer systems. If the proper low phosphate detergents and other cleaning agents are used, a septic system can promote healthy yard growth. It stores and breaks down all waste that enters it. The purified water and the nutrients within it then get transferred into the soil within the leach field, or the area into which the septic tank drains.

Water heaters generally are large energy sinks within the household if not designed for proper efficiency. Flash water heaters are tankless heaters that heat water as is needed. Many of the heaters can be installed in different areas of the house, allowing for a constant flow of direct hot water. This saves energy when compared to tank heaters that constantly heat water even when not in use, and it allows for an endless supply of hot water (Water Heating). Solar water heaters are among the most efficient currently in use and are divided into active and passive systems that can be implemented into most any house. The main difference is that passive systems have no pumping mechanism. Passive systems generally have a reservoir that is heated directly. These can even be gravity fed water systems, using no electricity in the process. Active solar systems contain separate tanks and heating units. The water is pumped from the bottom of the tank through the heating unit, and back into the tank, where it remains at the top as hot water ("Solar Hot Water").

Heating and cooling a house is a large part of the energy cost of a home. The three primary ways to heat and cool a house are solar, gas, and electric, arranged by their environmental impact from least to greatest respectively. Solar heating of a house is the most environmentally friendly. Thermodynamic panels are used to capture the sun's energy. Much like a solar water heater, a pump is used to pump the air in a house through the heating mechanism and then back into the house. This is an incredibly energy efficient and environmentally sound way to produce heat ("Solar Heating"). Gas and electric heaters work on roughly the same principles. Hot air is pumped by a heating unit and then is pumped through the house as needed. Natural gas has the advantage of being cheaper and more plentiful than oil and is more environmentally friendly due to the innate advantages such as burning clean and continuing to operate while the electricity is out ("Gas Heater"). Electric heaters rely on electricity from the power plant, which in America, is most likely coal fired, and thus has a large impact on the environment.

Lighting and electricity usage is naturally another part of building a sustainable house. CFL's, or compact fluorescent lights, are an easy way to start using environmentally friendly lighting. These bulbs can replace incandescent bulbs, have a longer lifespan than incandescent bulbs, use less energy,

and have a much smaller carbon footprint. The primary disadvantages to using these bulbs are the higher cost and the fact that they contain mercury, which can complicate proper disposal (“Compact Fluorescent Lamp”). LED’s, or Light Emitting Diodes, are another alternative to traditional incandescent bulbs. They produce more light per watt than traditional bulbs and they emit less heat. Many TV’s are now LCD and are much more energy efficient when compared to their predecessors (“Light-emitting diode”). Motion activated and timed lights help save on energy costs by lowering the wasted energy of lights left on. In 1992, the United States government created a program, which was quickly implemented world-wide, to create and label energy saving consumer products. Using these Energy Star devices within a household can save anywhere from 20-90% of the energy consumed



(“Energy Star”).

Houses don’t have to stop at saving energy; they can go on to produce it as well. Several houses have begun installing photovoltaic cells on their roofs to charge a generator, which they use as the source of power for the home. The same can be done with personal wind turbines, which can be placed on the roofs of houses, supplementing the electricity from the power plants (“Electricity Generation”).

These few steps can make all the difference. All it requires is the will and capability to make the change. By following these guidelines, houses can be built much more sustainably with the same comfort that people today are used to.

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Chapter 9: Sustainable Landscaping

Jared Sninsky

In the last decade or so a green revolution has been sweeping the nation most recently fueled by the idea of sustainability. Sustainability emphasizes striking an ecological balance and reducing depletion of natural resources. However, amidst the titanic goals of reducing global warming and carving into our carbon footprint we often forget that to live sustainably we don't need to look any further than our own backyard. Through sustainable landscaping it is possible to reduce pollution, conserve resources, and encourage biodiversity by working with nature instead of fighting against it.

I. Reducing Chemical Pollution

The use of chemicals in traditional landscaping, primarily pesticides and fertilizers, have many detrimental effects on nearly every aspect of the environment. Although pesticides are intended to solely target pests and harmful organisms, often these chemicals are vaporized into rain, leached into the soil, or leaked into ground and surface water. For example, in certain parts of the United States organophosphates, synthetic organic compounds from pesticides that contain phosphorous, have been detected in rainfall at concentrations of 10–50 µg/L, many times more than the EPA drinking standard of 0.1 µg/L (Pretty 13). Similar concentrations have been detected in ground water. These organophosphates have been known to transfer up 1500km through moisture in clouds and dispersed in precipitation (Pretty 14). Pesticide use not only threatens human health but also the ecosystem and wildlife within it. Organophosphates can directly contaminate wildlife food sources and have been known to disrupt hormone balance resulting in behavioral and physiological alteration. It is estimated that 60-70 million birds are poisoned per year by organophosphate pesticides (Sustainable Landscaping).

Compost can be used as an environmentally friendly alternative to chemical fertilizers and in many aspects is more effective. Compost provides an environment for microbes and fungi that work to decompose organic matter into humus, a stable organic matter broken down to its furthest point. Humus increases the nutrient content in soil and “has been known to promote higher yields of agricultural crops”(EPA: compost). It has also been shown that components of compost (humic acids) bind to heavy metals, preventing polluted runoff of toxins; compost even degrades poisonous pesticides to more stable safer forms. In addition, compost effectively absorbs moisture reducing erosion and conserving water. Waste that can be composted makes up approximately a quarter of the municipal solid waste stream; reuse of this waste further contributes to a sustainable lifestyle (EPA: compost). Compost is easily created using a variety of household waste including fruit and vegetable products, grass clippings, and even dryer lint.

One of the main reasons fertilizer and pesticide toxins run-off from residential landscapes is the inability of the landscape to absorb that water. It is important to recognize that patios and other outdoors surfaces are still an integral component of a residential landscape. Many surfaces such as driveways and patios are predominantly impermeable and designed to channel water away from the yard. Not only does this not conserve water effectively but it also results in erosion and the spread of chemicals into the watershed. However, permeable hardscapes provide a green solution to this problem. Materials such as gravel, woodchips, and certain porous concretes allow water to seep into the ground and reduce run-off and erosion. Permeable hardscapes work to absorb the water into the ground where the soil acts as percolator and leeches out harmful chemical compounds.

Often considered the most important aspect of green landscaping, the planting of native flora species yields a plethora of benefits for the environment. However, native species' most important

characteristic in regards to reducing chemical pollutants is their ability to naturally ward off pests. The definition of native plant species as given by the EPA is “plants that originally grew in a region before humans began introducing species for agriculture and ornamental purposes (Better Backyard). Consequently, these native plant species have had millions upon millions of years to adapt to the predators of a specific region through evolution. For instance, many plants produce secondary compounds, chemical substances that aren’t necessary for a plant’s survival yet protect it against predators. The most notable example is caffeine, a substance produced by nearly 100 varieties of plants that is found to paralyze many species of insects, acting as a natural insecticide. In conclusion, native plants that have evolved natural protection against herbivores require little or no insecticide and therefore result in less pollution.

II. Water and Energy Conservation

Traditional landscaping consumes vast amounts of resources including millions of gallons of water per year. It is estimated that in the East of the United States 30% of water consumption is due to landscape irrigation while this percentage more than doubles in the arid regions of the American West (EPA Sustainable Landscaping). The United States encompasses a vast array of climates and environments meaning that each unique environment is suited for an equally unique flora. However, more often than not we attempt to cultivate plants in environments where they were never meant to grow. “Hardiness zones” divide up the United States geographically based on average annual low temperatures and give an indication as to what trees and plants will thrive in those climates. It is also important to consider annual precipitation when choosing the most effective plants for a particular climate zone. For example, maintaining a yard full of turf grass in Phoenix, Arizona would require vast amounts of energy and resources since turf grass is not adapted to deal with the extreme conditions of the arid southwest.

Xeriscaping, literally translating to “dry landscaping,” is the practice of landscaping using techniques that maximize water efficiency and conservation (Better Backyard). In spite of the stereotyped image of xeriscaping as a yard full of gravel and cacti, a properly planned xeriscape can display a bounty of colorful plants and succulent floral arrangements. The most pivotal aspect of xeriscaping is the use of native drought-resistant plants generally determined by their “small, glossy, silver-grey, or fuzzy leaves- all characteristics which help them save water (Xeriscape).” These native plants have evolved to survive in response to natural precipitation levels and therefore need little to no extra watering. Xeriscaping also includes the construction of terraces and concave planting beds to reduce erosion and conserve water. The use of low-flow and drip irrigation directly targets the roots of the plant and reduces moisture evaporation; the slow flow rate reduces pooling and stimulates efficient root absorption. These low-flow drip irrigators reduce water usage by 50% when compared to traditional sprinkler systems. Studies have shown that xeriscaped landscapes can reduce water consumption by 50-75%, not only reducing run-off and the water bill but also improving property value by an estimated 15% (Xeriscape).

Water consumption often eclipses the issue of energy waste in regards to the maintenance and display of a traditional lawn. Many landscape lights waste energy since they are on throughout the night and often run on high wattage bulbs. However, a more sustainable alternative is the adoption of solar powered lights, which save electricity and money. Even the instillation of landscape light timers can drastically reduce energy consumption by rationing electricity. Another method of conserving energy involves using landscape trees to take advantage of the elements of the seasons. Strategic tree planting can be used to save energy in unconventional yet highly effective ways. In the Northern Hemisphere, planting large deciduous trees on the south side of a house provides shade in the summer while allowing sun to enter the house during the winter when the tree has lost its foliage. An outdoor A/C unit that is shaded by shrubs and small trees will operate with more efficiency and

consumes less energy. In mountainous and coastal gusty regions, strategically planted evergreen trees can provide wind protection and in turn reduce heat loss up to 50% (strategic planting).

III. Encouraging Biodiversity

In a time when wildlife habitats are being wiped out at unimaginable rates it is vital that homeowner landscapes provide a habitable environment for native wildlife. The easiest way to attract native wildlife is to establish native plant life. Additionally, it is important to diversify a landscape's native plant species to include trees, grasses, and shrubs, thus attracting a wide array of organisms. Inviting pollinators such as birds, bees, and butterflies not only fills a yard with vibrancy but also facilitates the reproduction of flowering plants. Pollinators are responsible for helping to fertilize 90% of the world's flowering plants (Native Plants). It has been reported that "birds were 54% more abundant in native sites" with "66% more bird species" when compared to traditional suburban landscape areas (Native Plants). These bird species also prey on a plethora of insects, further decreasing harmful pests and the need for insecticides. Additionally, in areas between large expanses of grass and adjoining backyards the construction of "greenways" and natural buffers provides refuge for wildlife.

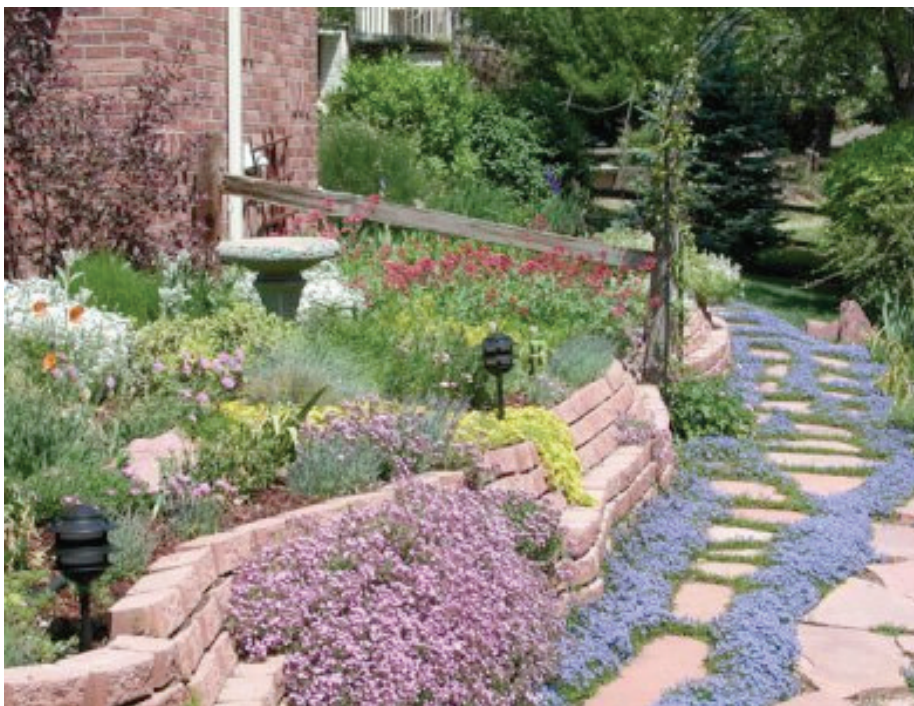
Although they may appear pretty and exotic, invasive plant species can induce copious amounts of damage on an ecosystem and upset its delicate balance. Invasives often take over ecosystems, choking out natives in the same niche and eliminating plants that many native animal species depend on. Even the displacement of one native species of plant by an invasive can send a ripple effect of negative impacts through an interconnected ecosystem. Thus, by eliminating invasive and exotic plant species in your landscape you are not only encouraging native plant growth but also promoting local wildlife.

The process of creating a more sustainable backyard yields many indirect benefits to the environment as well as the homeowner. Foremost, the use of native species and reduction of turf area makes lawn maintenance virtually superfluous. Considering that the average American spends 40 hours per year on lawn maintenance (Sustainable Landscaping), it is clear to see that sustainable landscaping saves time and energy. Since mowers and edgers are not needed in greenscaping, millions of gallons of gas can be saved each year, leading to reduced air pollution and a smaller carbon footprint. As is now apparent, greening your landscape not only leads to a more sustainable backyard but also a more sustainable planet.

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Chapter 10: Build Green Cities

Paul Chakkaphak

The latest reports from the United Nations estimate that as of the year 2008, over half of the world's population lives in urban areas, and that by 2050 this figure will rise to approximately seventy percent. According to the report's analysis, this will occur as part of a trend in which "the urban areas of the world are expected to absorb all the population growth expected over the next four decades while at the same time drawing in some of the rural population". The United Nations also estimates that in the same time span the number of cities with populations of at least ten million will increase from the nineteen of today to a total of about twenty-seven (The Associated Press). Figures such as these clearly demonstrate the prominent role of cities in modern human life and society, and suggest that they will only become more important in the future. At the same time, it is likely that the high population of cities will coincide with high material needs and consumption rates there as well. As much, such estimates also define the role of urban centers as focal points of human-generated environmental issues and their causes. However, this trend also offers an immense opportunity for the advancement and implementation of the green movement on a wide and effective scale as environmental solutions may be localized and focused without reservation on the urban model. In light of these two conditions, it is therefore clear that cities will and must become epicenters for the development of sustainable living throughout the global community. As it stands, a discussion on sustainable living must address the means and methods by which cities of the future will meet the pressing issues that rest at the center of the sustainability movement.

An ideal approach to these issues – which include but are not limited to the overproduction of carbon dioxide, the mismanagement and subsequent loss of water, and the lack of sustainable waste practices – would almost certainly involve the introduction of an entirely new and adapted urban model. Specifically, one that is able to meet the demands of sustainability and reduce our impact on the Earth through the introduction of fundamental changes to our way of living. Indeed, plans for such "new cities," outfitted with innovative and sustainable means of energy production, transportation, and waste management, already exist and are underway. Examples are evident in projects such as Treasure Island in San Francisco, Dongtan in Shanghai, and Masdar in Abu Dhabi (Biello), which are all intended to set precedent for sustainable planning to come. Notably ambitious among these, the Masdar enterprise involves the joint projects of a research-oriented university with direct support from MIT, a manufacturing hub for the development and production of green technology, and the development of a city free of vehicles, greenhouse gas emissions, and net waste ("Masdar Plan").

However, the majority of the world's countries do not have the wealth or desert space of the United Arab Emirates, or therefore the capacity to simply create an urban utopia with optimized architecture, layout, and utilities. In fact, Abu Dhabi has only managed to fund the Masdar project as a result of the revenue it gains from the sale of its highly unsustainable petroleum ("Masdar Plan"). Instead, municipal governments are often limited in their ability to address issues such as the environment by the size of their budget and the responsibility they hold to providing the basic services that fulfill the pressing needs of their citizens. In the vast majority of cases, and particularly in the already developed world – which will continue to provide a dominant portion of the urbanized population for decades to come – the sustainable cities of the future will come mostly from the foundations of the cities we know today. As a result, their success will depend on the measures their governments take to adapt their existing infrastructures to ones capable of maintaining sustainable life. In addition, the fiscal and logistical limitations of the municipal government will necessitate the involvement of a citizenry capable of effecting the changes dictated by the government, one able to

recognize and apply sustainable practices through mediums inaccessible by government. Therefore, it can be said that cities of the future will achieve sustainability through the joint fulfillment of two requisite standards: that their citizens be provided with the capacity to live an environmentally-friendly lifestyle, and that municipal governments be willing, able, and active in the application of fundamental changes to urban operation that favor the advancement of the green movement.

The means through which the cities of the future can achieve sustainability are generally well known. Those aspects of our society at the heart of our current environmental crisis – the overuse of fossil fuels, the mismanagement of water, etc. – are largely recognized and understood to be negative, while in many cases the responses to these conditions are already being discussed, researched, and implemented. For example, it is generally accepted that anthropogenic emissions of greenhouse gases, such as carbon dioxide, have and will continue to induce global climate change, which may seriously disrupt the processes of the planet and thereby our ecosystems and way of life as well (Vaitheeswaran 8). Correspondingly, it is also largely accepted that this situation may be prevented through the restriction and eventual elimination of fossil fuel-based energy production, the curbing of high deforestation rates – to which the IPCC (Intergovernmental Panel on Climate Change) attributes one-third of such emissions - and the regionally-specific application of alternative energy sources to coal such as wind, solar, geothermal, nuclear, and hydroelectric (Denmark 527). As a result, the crux on which the success of urban sustainability rests will instead be the processes and mediums through which these known means are effectively implemented in the city setting.

Two examples relative to this topic, the curtailment of greenhouse gas emissions, present separate, but equally necessary precedent for the progress that will be required for the effective modernization of the urban model in the decades to come. The first involves the city of Los Angeles where in the 1960's the quality of air was consistently amongst the worst in the United States as a result of the smog or "ozone soup" that pervaded the city. Recognizing that the situation stemmed from the city's mismanagement and overuse of fossil fuels in vehicles, city officials issued a series of mandates involving, amongst other things, the use of unleaded and low-sulfur gasoline, three-way catalytic converters, and on-board diagnostics for cars in an attempt to reduce vehicle emissions in the city. These measures were so effective that, despite the drastic increase in both Los Angeles' population and the amount of vehicle-miles driven by its citizens since that time, ozone levels in the city have fallen by two-thirds since the 1960's (Vaitheeswaran 13).

The success of Los Angeles presents a prime illustration of the positive effect that government-run municipal programs may have in the movement towards sustainability in the urban setting. Indeed, the presence of the municipal government will be necessary in numerous key aspects of the effort to reduce emissions. City-led public transportation initiatives as well as municipal mandates restricting driving amount, capacity, etc. have the ability to reduce the levels of vehicle use, and thereby vehicle-produced carbon dioxide, on a large scale. It may be possible that, eventually, public transportation will achieve a level of advancement such that vehicles will be unnecessary altogether, as will be the case in the prototype city of Masdar where cars are prohibited ("Masdar Plan"). Government involvement may also figure heavily in the promotion of sustainable alternative energy sources, through programs involving the adoption of new technologies as they become available and the employment of adequate infrastructure needed to sustain such technologies, as well as the use of mandates or tax incentives to encourage the private sector along with the general public to pursue the alternatives. This scenario has already proven highly effective in the introduction of photovoltaic-based power systems in nations such as Germany and Spain, where the technology has become a legitimate and widely used energy source due to feed-in tariffs (Reed).

The second example involves the city of Portland, whose long-standing attention towards sustainability and the environment has perennially earned it the distinction of being named among the greenest cities in the United States and the world by many prominent organizations involved in assessing such standards. This must be attributed, in some part, to the thriving bicycle community that has developed in the city since its establishment of a network of bike lanes in the early 1970's. In

the decades since, this network has been extensively expanded to encourage the continued growth of bicycling in the city as part of a municipal effort that has prioritized sustainability and harbored a focus on public transportation, green space, and environmentally-friendly development as well. Portland's bicycle community, fostering the nation's highest percentage of workers who commute to work by bike, has become so advanced that it has evolved a sub-culture of bike industry, research, riding, and media that has itself become well established as a significant element of the city's function and economy. A visible, active, and involved example of sustainability in the city, this sub-culture has led Portland, the government, and its citizenry to become interested and implicated in a larger green movement (Yardley).

While similar to the example given of Los Angeles in its description of a successful approach to the reduction of carbon dioxide emissions, the precedent set by the city of Portland does not directly involve government action. Rather, its success demonstrates what a citizenry empowered by its government can lend to the sustainability of a city. As Portland's flourishing bicycle culture indicates, the people of a city are not only capable of utilizing the opportunities provided to them, but also of expanding a sustainability movement in sectors independent of government control and tailoring it to the specific settings of a region. Because a sustainable urban lifestyle must be adaptable to the widely varying issues and cultures of the world, the involvement of their residents will be imperative to the green cities of the future and their capacity for sustainability. Consider that the success and popularity of the bicycle movement has led to the public's call for action towards other highly necessary environmental measures, such as the addition of parks, green space, and greenways to the city, all of which serve to offset carbon emissions and thereby stand as a prime requirement for all urban areas. However, consider also that the burden exists with the people to make use of and thereby realize the potential of programs such as public transportation. With that said, programs to educate the public on sustainable living, active government-citizen cooperation, and the application of publicity and advertising for public transport, alternative fuels, conservational practices, etc. will likely be highly advantageous to the developing cities of the world today.

When applied in conjunction, the efforts of the municipal government and the capabilities of the public should provide an effective model will likely play an integral role in the progression of urban sustainability. In the examples provided, these methods were utilized in an effort to address anthropogenic green house gas emissions and indeed, because it is now internationally acknowledged as a leading cause of climate change and because cities are hubs of energy consumption, the issue must be considered highly pressing for cities (Solomon 1-10). However, cities will not become green solely through the eradication of such emissions, as unsustainable practices are evident throughout the current aspects of urban living. The model of government involvement and an active citizenry should and must be applied to the efforts to accomplish the modernization of these practices as well.

Amongst these efforts will certainly be those to localize the systems involved in the operation of the city, including minor industry and food production. The current convention of importing products and goods from outside sources can be considered unsustainable through multiple avenues of thought. Prominently, the transportation needed to accommodate the practice requires a vast amount of energy and adds heavily to the aforementioned emissions problem. In addition, it also denies urban regions of the ability to plan for green space for food production, the chance to regulate the operation of industry in terms of environmental impact, and the benefits associated with success in local economy. The sustainable cities of the future must therefore consider limiting or removing the event of this process a necessity. While government-generated incentives may be used to encourage the development of sustainable local production and food sources and to entice the public to support such enterprises, individual citizens must also be tapped to pursue autonomy. Though currently absent in society, the advent of local food sources such as personal or community-run gardens would greatly encourage a localized economy. At the same time, the municipal government must be open and nurturing to local innovation and individualistic thinking, a matter which evokes the establishment of strong and environmentally specific public forum to facilitate discussion on policy, technology, and

government mandate. Should this effort of localizing be successfully adopted, the economic rewards could be considerable for the urban region, as was evident in the example of Portland.

The discussion of government mandate and public involvement excludes and overlooks another key medium through which the cities of the world will achieve sustainability. Should a city be certified “green” and establish a genuinely sustainable means of facilitating life, it will no doubt feature a radically improved model of physical infrastructure: energetically efficient buildings, industries, and homes to reduce dependence on fossil fuels along with the means to recycle and manage both wastes and water so as to conserve the environment’s limited resources. While prototype cities such as Masdar have been able to design and construct as to allow for the maximum accomplishment of these stipulations, the majority of municipalities will not have such a luxury and will face an extremely difficult task in adapting efficiently (“Masdar Plan”). A catalyst for this transition may rest in the effects of the global economy. As the need for sustainability becomes more pressing, resources more scarce, and governments more involved, the cost for operating and living unsustainably may encourage business and homeowner alike to facilitate and fund the modernization (Vaitheeswaran 16). Although a highly disputable concept, it is absolutely true that energy use must be moderated in sustainable cities, and in fact the model has already proven effective in enticing major corporations to adopt sustainable practices without government mandate. An example is evident in the international automaker Nissan, who recently concluded the construction of an environmentally responsible headquarters in Cool Springs, Tennessee. Though ignoring the highly touted yet tedious LEED (Leadership in Energy and Environmental Design) building standards, the company found it economically beneficial to implement sustainable design and building practices. Interestingly, a portion of the capital saved was used to restore wetlands near the construction site (Williams).

While of itself, this discussion may not include every step, medium, or model related to the development of green, sustainable cities, it must be considered that such is the defining point of the sustainability movement. An increasingly necessary purpose in light of the current trends and upcoming trends of the world’s population distribution, the goal of rendering the urban population environmentally responsible will be achieved only through the joint implementations and successes of multiple processes: government involvement, the empowerment of the citizenry, and the influence of the global market. As is evident from the precedents set by the examples provided, these factors have the ability to adapt to the specific situations of any city in any region and, if regulated properly, establish a lifestyle of environmental sustainability.

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Chapter 11: Vanderbilt University and Sustainability

Yong Je Ko

As environment pollution becomes a globally discussed issue, sustainability is emerging as one possible solution to the problem. Following the trend, Vanderbilt University also has been seeking to achieve sustainability through establishing a special project called SustainVU that has been relieving the pressure on the university and regional environment with various methods such as reducing energy consumption and increasing recycling on campus. In addition, many of the university's students formed several student organizations to assist the school in reaching its goals while many other individuals also made considerable efforts to do the same. As a result, Vanderbilt University has been incredibly successful lately; however, the university and its students must not stop at this point and they should continue on their efforts to improve the university even more.

In an effort to transform the old campus to an eco-friendly one, Vanderbilt University operates a project called SustainVU, a program that improves sustainability throughout the university which proved itself successful in several areas. One of its biggest achievements would be the expansion of recycling to reduce wastes on both Peabody and the Main Campus. A large number of recycling containers placed in various areas encourage students to recycle items such as papers, plastic water bottles and aluminum cans. Moreover, the school is now capable of recycling small batteries, cardboard, and glasses as well. With such development, Vanderbilt University generated a total of \$27 500 through recycling in 2006 only in its Medical Center alone¹. Despite these successes, SustainVU still faces several problems in recycling, mainly due to the recent economic crisis. For instance, vendors have started to reject certain types of materials such as glass because the recycling process is not efficient enough to make financial profit from it. This means that Vanderbilt University cannot recycle a significant amount of wastes, resulting in both financial and environmental loss. Another rapidly growing problem is a decreasing demand for recycled goods. Cardboard boxes used to be one of the most lucrative recycled products; nevertheless, because of the economic recession, transportation of goods has dropped significantly, thus, causing a decrease in usage of cardboard boxes as well. So the cardboard market shrank, thus the demand for the goods to be recycled diminished, too in result, inevitably interfering with Vanderbilt University's vision of expanding recycling in the university. As shown, the global economic recession has become a major obstacle for the university; to maintain the splendid successes so far, SustainVU needs a solution that will encourage recycling both in and out of the university.

Another brilliant accomplishment of SustainVU is receiving LEED Gold certifications for the Commons Center and three residential houses as well as three other houses that qualified for the silver level. The Leadership in Energy and Environment Design (LEED) Green Building Rating System is a nationally accepted certification program that rates buildings according to factors such as their environment-friendly designs and energy efficiency.² To earn the gold level, Vanderbilt University utilized 26.4 percent of recycled materials in building and 53 percent of construction substances were bought in the region³. The Commons Center is estimated to be 28 percent more efficient in energy usage than other similar buildings and it is predicted to save about 900 000 gallons

¹ Lewis 2

² LEED

³ Lewis1

of water annually through various fixtures like waterless urinals.⁴ With these achievements, the university greatly elevated its asset values for the building, gained fame by providing an energy-efficient campus model for other universities, started to receive tax incentives from the federal government and is now saving a huge amount of money spent on energy. Even though the university had to demolish the old Hill Center, consult with many construction experts for a long time and utilize building materials that are not the cheapest ones available, both the financial and non-financial benefits to be earned exceed the costs of the green buildings.

Not satisfied enough with the victories at the Commons, SustainVU is now attempting to increase the energy efficiency and conservation of the entire university. One of the most visible changes it made was substituting incandescent bulbs to fluorescent bulbs that are considerably more electricity efficient. Furthermore, electricity consumption has also diminished in newly designed buildings by using daylights to the maximum capability. Rooms that control the lighting depending on whether they are occupied by people or not, are contributing to the decrease as well. In addition to saving electricity, Vanderbilt University is also seeking to reduce the amount of water used everyday. Showers in residential halls are installed with instant-heater so that the residents do not waste cold water while waiting for the water to heat up. Moreover, waterless urinals and automatic taps are added to minimize the unnecessary usage of water in many on-campus buildings. SustainVU encourages carpool, too, among the faculty members of the university and its hospital to decrease emission of greenhouse gases. The medical center is now equipped with various fixtures such as plate and frame heat exchangers and new chillers⁵ that increases the energy efficiency. With these efforts, Vanderbilt University seems to be determined to make the university as sustainable as possible.

Along with the school, a small but significant group of students also participates eagerly to construct a green campus. These students join many student organizations that are related to the environment, and co-operate with SustainVU. By doing so, positive interaction with each other is achieved. For instance, SustainVU receives detailed feedbacks on their actions from the students' points of view whereas they also offer broad guidelines and advices on what the student organizations are capable of. This enables the students to accomplish an unbelievable amount of work: they collect certain types of wastes that can be recycled to deliver them to vendors and they also hold several events in attempt to raise awareness of keeping the campus green. One student organization, Students Promoting Environmental Awareness and Recycling (SPEAR), annually holds an energy competition between freshman residential halls, which encourages freshman students to be actively involved in the school's vision of sustainability. Nevertheless, it is also true that most of these organizations face both a lack of financial and human resources to be more successful. Often, students avoid joining these clubs because many of them require physically tiring work and the most of the benefits gained from working with them are spiritual and non-materialistic. Consequently, the few that joins the clubs are constantly challenged with various sorts of difficulties, resulting in some of the already under-numbered participants quitting. To improve such situation, Vanderbilt University can offer an increased funding for them so the organizations can buy better equipments and gears which would remove a significant amount of responsibility on the students. However, because the university is under an economic pressure as well, such suggestions seem unrealistic; therefore, giving different types of advantages to the students and the organizations could be a solution. One example would be rewarding the students with the right to use certain facilities like a library or with a small amount of academic incentives to the students. If the university wants many students to be actively involved in such organizations, it will have to invest in those organizations eagerly and show that it is highly interested in this matter.

⁴ Lewis2

⁵ VUMC

Until now, both the students and the school made considerable progress over the last few decades to increase the eco-friendliness of the university; however, many areas still remain to be improved. As a freshman of Vanderbilt University, I witnessed several scenes in which just a small change could result in a big success. For instance, many freshmen often use their fourth meal plan of the day to get water. Currently, if any students want to buy water with their meal plans, they have to buy water in 20 OZ plastic bottles only. Therefore if students require only water, they have to get three small bottles of water instead of one big bottle. This of course, produces a huge amount of empty plastic bottles and even though some of them do get recycled properly, many more are wasted with other garbage. The school can solve this problem by simply purchasing water in bigger bottles and letting it be on meal plan for those who want water only. Moreover, dining halls use plastic containers that are hard to be recycled. Even though those containers may be cheap, bio-degradable containers or easily recycled plastic containers would benefit the school more in the long term from the view of supporting the campuses. Smaller Vandy Vans would be more efficient on week days or in early mornings because only a few students use the vans at those hours. Furthermore, if the university's bathrooms are equipped with sensors that distinguish whether they are being used or not, the light bulbs will not have to be on constantly, saving a large amount of electricity. The university also must consider the fact that there are many more students on the main campus than on the Peabody campus. Even though starting from improving a small part is important, now that they have achieved their goal on Peabody, Vanderbilt University now has to concentrate on re-modeling the Main campus which would ultimately affect more people. As a result, many more students and faculty members would be attracted to the university's schemes and be eager to help them. Because many students spend their 24 hours of a day on the campus, they often have many suggestions on how the school can easily increase energy conservation and efficiency; instead of inviting experts from outside the university, Vanderbilt University has to also listen to the voice of these students.

To hear what the students have to say and to see what they are capable of, the university can increase the level of communication between them and the students. Instead of setting new rules that limit the students, the university can take actions that would encourage the students to voluntarily save energy. For instance, it can make saving energy competition between residence halls more attractive by rewarding the winners properly. It would be more effective to encourage student participation than having posters around and sending emails about it. Perhaps, those posters and the emails can focus on the prizes of the competition rather than the competition itself. Moreover, the dining-halls can charge for plastic containers that are used for food take-outs. Even a price as small as 50 cents can affect a large group of students to be aware of the school's struggle to make the campuses sustainable and to join the university. Similar method was amazingly successful in Korea in decreasing a number of plastic bags used. Furthermore, the university can notify students in each rooms of the amount of electricity they consumed every month. Currently, this is being practiced to at least some graduate students; however the bills are very simple so many find those receipts pointless. One possible answer to this problem is to first extending the range of the recipients too the undergraduates and to add charts and graphs instead of having texts only. By doing so, the residents obtain a clearer idea of the level of their energy consumption, possibly comparing with the national average or an ideal level that the university sets. Evaluating electricity bills also lets the students to analyze their usage of electronics every month, providing an opportunity for them to realize how some electricity was unnecessarily spent. Compensating the students who participate in reducing wastes, attend information sessions on environment and reduce energy consumption with very small academic credits could be another solution. They can be minor advantages that would not be as important as to affect the GPAs of the students but significant enough to be documented on students' records; however, because this may raise complaints from many students who participate in other activities, the university can ask the Vanderbilt Student Government (VSG) to co-operate in this issue. Through this, the school can also demonstrate its interest in the students' opinions and suggestions; this can inform the students that their ideas are being considered by the school and therefore,

motivate them to be more enthusiastic about improving their environment. It is important that students voluntarily take actions instead of being forced to do such things which means that the university will encourage them through only indirect methods of prizes and punishments.

Vanderbilt University and its students collaborated with each other to improve the school's sustainability in various ways. Some of them were as big as building the new Commons Center whereas some were small but effective like replacing the old bulbs to energy-efficient fluorescent bulbs. Students enthusiastically volunteered in reducing energy consumption and promoting recycling on campus. However, we must not be satisfied at the current level of achievement because numerous of measures still can be taken to improve the situation even further. By assisting each other more closely, the student body and the university executives will be able to accomplish their goals effectively.

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Chapter 12: How to Build and Run a Green Country

Sam Fogarty

Ultimately, the prospect for humankind to fully live sustainably will rely on large-scale efforts of entire nations to coordinate efforts to build green infrastructure, regulate and influence the economy to become green, and encourage green living. There are some aspects to modern life that can only be run efficiently on a large, countrywide scale such as transportation. For this reason, it is important to use the power and influence of the government to promote sustainable living through subsidies, regulations, taxes, and building projects.

A sustainable infrastructure is the foundation of a green country. As environmentalist Alex Steffen points out, Non-renewable energy consumption is a major drain on the environment, releasing carbon emissions through transportation and energy generation, and contributing to the destruction of our environment. ⁽¹⁶²⁾ It is vital for a country to construct systems to produce energy cleanly from renewable sources and to use energy efficiently. In our current capitalist economy, the explicit cost of using oil and other fossil fuels to power our lives is cheaper and more convenient than that of renewable energy. For instance, as Reuters News, the cost of energy produced by wind is 9 to 12 cents per kilowatt-hour, whereas the cost of coal energy is only 3 to 5 cents per kilowatt-hour. Unfortunately, the costs of using fossil fuels to power our economy do not outweigh the implicit cost of the damages they cause to the environment and the ultimate depletion of our finite reserves. To offset this discrepancy, a government should tax fossil fuel energy, like coal power plants, and subsidize green energy production. These initiatives will offset the cost difference, making it economically viable for energy companies to produce green energy, which would allow businesses to abandon fossil fuel energy for more environmentally friendly alternatives. As Steffen suggests, instead of building coal plants to fuel our thirst for energy, energy companies should resort to constructing wind farms, solar power plants, and hydroelectric dams. As the number of suppliers of green energy rise, the cost of green energy will drop and allow it to become more competitive with the free market price of fossil fuel energy. ⁽¹⁷⁵⁾ Additionally, a competitive price will entice power companies to invest in new technologies that produce the renewable energy even more efficiently, which would enhance the sustainability of the country.

After green energy production, implementing green transportation methods is key to slowing the depletion of our resources and decreasing our energy dependence. From a national perspective, a government must construct public transportation that is both clean and desirable. Governments should provide grants to states to build efficient, green, public transportation. Author Robert C. Post notes that light rail transit systems, which rely on electricity to power trains, are already in use in many metropolitan areas like Sacramento and Denver, and should continue to be constructed across the country. ⁽¹⁴⁰⁾ Because the train systems run on electricity, that power can be generated from renewable sources like wind and solar which are both efficient and clean making the movement of people nearly harmless to the environment.

One major contributor to environmental damage and resource depletion is the personal automobile. Governments should implement efficiency and emission standards on cars to reduce their dependence on oil and decrease pollution. Some of these methods of regulation have already been implemented and proven successful. For example, as reported by California's Air Resources Board, the state's high emission standards have been shown to be very effective in reducing air pollution. To promote a switch to more energy efficient vehicles, the national government needs to subsidize the production of hybrid vehicles in order to equalize their cost with those of purely combustion engines. New research must be funded by government grants in hopes of achieving greater fossil-fuel energy independence.

The national government could also begin charging for private vehicle usage. As reported by Steffen, This strategy has already been implemented in London and resulted in a 30% decrease in vehicle usage in the first year alone. (263) Instead of using less efficient modes of transport like personal vehicles, citizens are pushed to make better use of the more sustainable public transportation already in place.

As discussed in chapter 3, the costs of consuming food in the way we do now are huge. From massive energy waste in producing red meat to huge transportation costs in moving food from one place to another, our daily food consumption is far from efficient. To promote more sustainable food production, the national government must implement policies that make it far more financially advantageous to consume sustainably. Since locally grown foods have far less of an impact on the environment due to transportation costs, taxes should be imposed on foods contingent on the distance the goods were transported in order to promote purchasing locally grown foods. Taxing fuel would have this same effect. Secondly, since meat, especially red meat, costs so much energy to produce, the national government could tax the meat industry in order to raise prices and decrease consumption, lowering the pressure on the environment.

A major contributor to unsustainable energy usage is the over-production and consumption of goods by irresponsible, purely profit seeking corporations. Due to unregulated capitalism, it has become common practice to produce poor quality goods that break down easily and must be replaced. This is called planned obsolescence and is a strain on our finite resources. To prevent this unsustainable practice, national governments must generate legislation that outlaws the practice and allows for the justice system to investigate and prosecute companies that use planned obsolescence as a profit making strategy.

There is also a culture in the US and other wealthy nations of replacing items that break rather than fixing them. This practice is detrimental to a nation's sustainability and could be curtailed through national campaigns that educate people on the benefits of fixing, reusing, and recycling goods rather than discarding them.

Another effort that could be coordinated on a national level is the centralized planning of cities as described in chapter 11. Because the general planning of a city, the location of business districts and residential districts, can contribute to the sustainability of the city, it is important for a country to promote responsible and planned building. Governments should offer grants to cities that plan their construction in a sustainable way.

While there are general policies and tactics that can be implemented everywhere to promote sustainability, all countries have different flaws in their lifestyles and economic practices that contribute to the overall environmental damage and resource depletion. In order to properly assess and quantify a country's sustainability, the Environmental Sustainability Index (ESI) was developed. As explained by a journal on Environmental Sustainability, this index takes into account 68 different variables, which are compiled into one number indicating a countries sustainability and environmental impact. This number can then be compared to other countries. (122) However, there has been some serious criticism of the index. Some claimed that the choice of variables and the method of compiling the number was poor and biased. Others believed that one number could not adequately describe the plethora of problems that different countries face and over generalized the problems most nations face in achieving sustainability. (135)

Subsequently, the Environmental Performance Index (EPI) was developed which focuses more on the actions of humans and outcomes of their activity. The Yale University board that produces the index describes how they begin by evaluating basic environmental indicators like water quality and emissions per capita. The indicators are then clumped into broader and broader categories, from policy categories to objective categories. This way, the EPI can be more easily used to affect political policy than the ESI could due to its more specific evaluation of the sustainability of a nation. For example, if a politician observes that a drain on the country is air pollution, he can refer to the specific elements of his country's actions that are contributing to its in-sustainability such as indoor air

pollution and direct legislation to improve that specific aspect of life in his or her country. Nations wishing to achieve greater sustainability should use the EPI to target specific problems and make policy changes accordingly.

Ultimately the ability of a country to become green depends on the willingness of its' citizens to strive for and participate in sustainable living. A government's job is to create an atmosphere where green living is possible and desirable; where the sustainable option is not only the morally correct choice but also the financially advantageous choice. It is the responsibility of a country's leaders to have the long-term prosperity of their people in mind when passing legislation. With so much of our lifestyle dependant on non-renewable resources, it is vital that governments' strive for long-term sustainability of our way of life. Without effort on a national level, vital radical change will never take place, our purely capitalist economy will run into a wall, and the comforts we all take for granted may be stripped from us.

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Chapter 13: How to Run a Corporation Sustainably

Erik Werner

As the purpose of an animal is to instinctively propagate and perpetuate its species, so is the fundamental purpose of a business to continue existing to provide its goods and services for future generations. With America unfortunately in a recession, it is impossible for a modern business to continue to operate profitably in these times of economic difficulty without paying special attention to sustainability and environmental responsibility. Not until recently has it become apparent how much of an effect environmental impact can have on a corporation's longevity, and the fate of the two will only become increasingly intertwined in the future. With the issue of sustainability looming on the corporate horizon, it is important for corporations to take steps now to work towards creating a sustainable future.

One of the key paradigms of sustainability is efficiency. The first logical step towards creating a sustainable business is to form a detailed plan of action, and the most efficient way to accomplish this task is to assign a dedicated sustainability staff. A recent survey of businesses featured in a Cambridge University sustainability digest suggests that a majority of corporations currently have no dedicated sustainability staff (The Vandiver Group, Inc). Moreover, recent studies show that companies that do employ a dedicated sustainability staff enjoy higher returns, stronger sales, and more enthusiastic investment (GLOBE-Net). Next, in order for this team of environmental experts to operate effectively for both planning and implementation of plans, a significant budget needs to be appropriated. While this investment may seem unwise in the current economic state, and reducing sustainable development may seem like a sensible way to cut costs, once again data proves that businesses that use environmentally responsible manufacturing or produce green products and services are consistently outperforming their peers (GreenBiz Staff). Sustainability is changing business, and an increased investment now is the smart way to prepare for the future. Where in the past environmental operations were the first to go during hard times, now more than ever corporations are realizing the importance of being considerate to the environment. Major name brands like Wal-Mart and Coca Cola are making large investments to reduce their environmental impact (O'Conner). Creating a "green team" with a concrete sustainability plan will encourage both investors and consumers alike, putting green corporations at a huge advantage. Not only does increased environmental research and marketing mean increased consumer appeal, but it also prepares the company to deal with the investor aspects of going green, among other major issues. Over seventy five percent of corporations today say that sustainability is or will be a major issue to them in the near future (The Vandiver Group, Inc). In order to reap the benefits of creating a sustainable business, an immediate plan that can effectively communicate ideas is a necessity.

The next step in creating a sustainable business is to refine the business environment, where improvements can be made in small, but worthwhile steps. Simple measures can yield immediate results while requiring little upfront investment. Upgrading office computers to newer, more environmentally friendly technology can increase productivity while reducing electronics energy consumption. The adoption of video conferencing alone can reduce the time and expense of traveling for meetings, as well as save the jet fuel required for transportation. Unplugging electronics or turning off computers that aren't in use at night can generate substantial energy savings. The EPA estimates that Americans waste over one billion dollars of power every year by not unplugging unused electronics (Shapley). Additionally, making efforts to move towards a paperless office would work to both decrease printing and paper supply usage, while increasing productivity by consolidating and organizing information digitally. Paper and cardboard alone comprise over one-third of America's waste stream (US EPA). While a truly paperless office might not be a realistic goal, a reduction in

paper usage coupled with an effective recycling plan has huge potential for reducing waste, saving the environment, and saving money. An action as simple as placing paper recycling bins at convenient locations around the office is all it takes to start effective reduction of office waste, save money, and become eco-friendly.

Once the work environment has been changed, the things that are worked on may then begin to change. The greatest changes towards sustainability must start in the design phase for improving future versions of the company's product or service. Since the first industrial revolution, profit and the path of least resistance have been the driving forces behind the industrial process, and these two key elements have always been easiest to achieve using a linear design system (McDonough and Braungart). The industrial machine has developed into a system that refines resources into a product that is used, and then discarded. The inevitable result of this flawed scheme is copious waste, as well as limitations imposed by the finite nature of natural resources. Neither of these is consistent with sustainability. In fact, to achieve sustainability using this approach would be a formidable, if not impossible task. Instead, a complete rethinking of the system is necessary. Products need to be redesigned from the ground up with sustainability in the minds of development teams. Since research and development on improving companies' current products is a continuous process, a successful transformation will by no means be immediate. However, if sustainability is given greater weight in the design process, future generations of products can be produced in an environmentally friendly manner. The solution is to create longer lasting products from natural, eco-friendly materials that could better serve the purposes of the consumer. By creating more reliable, longer lasting products, companies can reduce waste as well as build consumer confidence in their brand name, and creating reusable or biodegradable products plugs up holes in a leaky linear design system that is currently hemorrhaging money and waste (McDonough and Braungart). Products designed with non-renewable resources will not only become more expensive to produce as resources become scarce, but also are impossible to produce indefinitely. By incorporating sustainability into the design of new and improved products, companies will have a reliable means of producing a profitable product in the future.

In order to create a truly sustainable business, the final and largest necessary change is to build sustainably. Whether building product or new facilities, a plan that uses eco-friendly, highly efficient, or recycled materials, will pay off in time. Sometimes, it may seem like making investments in environmentally friendly technology will be more costly. Often times a greater initial investment will pay off over time, but even more often a complete rethinking of the way we do things is necessary, rather than minor upgrades or improvement. This is where the manufacturing aspect of business becomes important. As new governmental pollution limits inevitably come into effect, trying to add clean features to out dated, polluting manufacturing processes only provides a temporary solution. Rather than invest in life support for old technology and ideas, an entirely new approach to the problem can save both money on initial investment, as well as long-term costs. As Albert Einstein once reasoned, "If we are to solve the problems that plague us, our thinking must evolve beyond the level we were using when we created those problems in the first place"(qtd. In McDonough and Braungart). Every day, intelligent engineers rely on a principle called whole-system engineering, a process that incorporates all aspects of a design with relation to one another, and can often result in making a system much more efficient by shedding unnecessary components (Hawken, Lovins and Lovins). Rather than "bolt on" sustainable changes to old ideas, a complete redesign focused around the intent of the product being manufactured and sustainability can result in a lower initial investment, plus savings over time from efficiency. This equates to less waste, and more money. For example, Apple Inc. has recently accomplished this with its MacBook portable computer line. By switching to a newer manufacturing process and incorporating new eco-friendly technology, they have managed to create a product that is more useful and desirable to consumers, while being less wasteful and harmful to the environment (Apple, Inc). Additionally, changes in design like shipping a product in smaller, recycled packages can have a big impact on the environment as well as save corporations

money. Smaller packaging means more of a product can fit onto a single plane or truck for shipping, saving fuel and transportation costs. Because packaging is thrown away anyway, using recyclable materials can even further reduce the environmental impact of the wasteful cycle of consumerism. As an added benefit, companies that switch to environmentally friendly manufacturing or other use of renewable energy or materials are most likely eligible for some sort of government incentive, like tax credits. Tax credits can be used to save money by reducing taxes, or sold to other companies, making sustainable behavior not only more economically friendly, but potentially profitable.

Running a corporation does not have to be environmentally destructive. Often, the interests of corporations and the environment are the same. In the long term, respect for the environment will not only help corporations to survive, but also create positive momentum towards environmental responsibility. They can begin the transformation towards sustainability now by taking steps that are not only profitable, but also good for the environment.

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Chapter 14: Waste Reduction

Maggie Pan

Recently, it has become difficult to go into a store or other public setting without encountering the word “green” or other words related to the health of our environment. Very commonly, these words are printed on products to appeal to consumers as a way to do their part in keeping the environment livable for generations to come. While these goods may be favorable alternatives to their less environmentally-friendly substitutes, it is possible to make an even more positive impact on the effort to sustain our environment by reducing waste.

In the United States alone, an average of 4.39 pounds of waste is produced a day by each individual, filling 63,000 garbage trucks with waste each day. The citizens of the world currently generate a copious amount of waste that can harm the environment, but through simple lifestyle changes, the volume of waste can be greatly reduced, which will lead to a cleaner and healthier future (“Waste Reduction & Recycling Program”).

Many people do not see waste as being detrimental to the health of the environment and future generations, but waste is more than just unused items or organic matter that is thrown out and taken away by a garbage truck. Creating an abundant amount of waste means that resources are being used inefficiently, and with our limited resources, it is very important to use our resources efficiently so it is possible to provide for future generations. Further, throwing something out does not mean it will disappear—what is thrown away must go elsewhere. The two most common destinations for waste are landfills and incinerators, each with detrimental effects on human wellbeing and environmental health.

With the limited space we have on Earth, it is important to utilize what the space as efficiently as possible by using it to cultivate crops or generate other useful resources. Instead, much of the land on Earth has been dedicated to landfills where instead of developing new resources, resources are thrown away. The loss of land to landfills along with the growing population will reduce the amount of land per person in the world to use for housing, food production, waste disposal, and other needs to a mere 3 acres by 2020 (Tammemagi 7). This is not only an inefficient use of land, but also a hazard for the health of the biosphere, which includes the human population, in the form of pollution. Rainwater that infiltrates a landfill will produce a leachate that contains toxic contaminants such as heavy metals, DDR, and benzene; if the landfill is one of the 56,250 landfills across the country that has a leak, the contaminated liquid will percolate down into the ground and pollute the groundwater (Tammemagi 8).

Waste incineration is another commonly used form of disposal that is a much better alternative to landfills. Because the incineration of waste recycles waste to energy in the form of electricity or useful steam and heat, incineration slightly reduces the use of nonrenewable resources used for energy such as gas, oil and coal. Incineration also means less waste goes to landfills which reduces our use of land. Although more favorable than landfills, incineration has its drawbacks as well due to the generation of air emissions. The emissions from incineration pollute the atmosphere with toxic organic compounds such as dioxins and furans that are harmful to human health, and we therefore cannot rely solely on incineration as a method of protecting the environment and our health (Tammemagi 153).

Despite the copious amount of waste already generated and the harm it has inflicted on the Earth and sustainability, while it may not be possible to reverse what has been done, it is possible to prevent further resource depletion. To do so does not require dramatic changes, but rather some simple modifications that allow people to maintain their current lifestyles. The steps involve reducing consumption of goods, reusing goods already in possession, recycling whenever possible, and composting organic waste.

People across the world are currently not doing as much as possible to reduce waste. To reduce waste, the first and most effective step to take is to reduce the consumption of goods. Although many people think that recycling is the only step to take in reducing waste, in actuality, it is the last step to take since it is least effective. Reducing the sheer amount of items that one purchases is important because it targets both the waste produced when the consumer throws the good away and the large amounts of waste that are generated in the production, processing, and transportation of the good (Porter and Claas 122).

Only a fraction of the waste stream comes from consumers; the rest of the waste is from production of the good. In fact, a third of the waste produced today is from the packaging of items (“Reduce, Reuse, Recycle”). Since waste is not created by only a final product, altering the production, packaging, and use of products, also known as either pollution prevention or source reduction, saves more natural resources and reduces more waste than any other methods of waste reduction. Components of source reduction include reducing packaging, developing durable and easily repairable products, material substitution and implementing economic incentives to encourage less waste generation, and making selective purchases (Porter and Claas 122). As further incentive, source reduction not only helps reduce the use of resources and waste, it lowers costs for the producers and prices for the consumers (Porter and Claas 126). Although most of these components are actions that the producers must make, the last step, making selective purchases, is one that the consumer can easily take.

This does not mean that people should stop purchasing goods altogether, but rather that people should make purchases with discretion based on the necessity of the product. If an item is a nonessential item, it is probably best to avoid the purchase, as it is very likely that the item will end up on its way to a landfill after little or no use. Essentially, our community must reevaluate our needs and be able to distinguish them from our wants. A good way to put this into practice is to wait at least one day between seeing the item and making the buy. After some time and consideration, one may realize that the item is simply a luxury, or even impractical. Such items include those on the market that have yearly upgrades such as cars, computers, and even clothes. These items have often been created with planned and perceived obsolescence in mind, where industries design items to be thrown away and exchanged for new upgrades. Although these goods are essential and must be in possession, the purchase of new models to keep up with current trends is not essential.

Deciding when to buy something is critical in reducing waste, but even once the necessity of a good is determined, one must choose between many substitute goods and pick the most environmentally friendly of the options. This does not mean that one must spend more money on the advertised sustainable alternatives, although if it’s financially reasonable, that is the best alternative. Instead, buying environmentally friendly items is as simple as avoiding the purchase of disposable items such as plastic utensils and Styrofoam cups. Disposable goods are currently highly used, but if more people were to take the little time and effort to wash and reuse the non-disposable alternatives, numbers such as the 2.5 million plastic bottles thrown away each hour would be lowered (“Waste Reduction & Recycling Program”).

Another way to reduce the consumption of resources is to go digital whenever possible. Currently, 37.6% of the waste stream is paper (“Waste Reduction & Recycling Program”). Much of this paper waste could be easily avoided by making use of the technology available today. Instead of printing everything out whether for safekeeping or distribution, the files of the documents should be saved and emailed. Also, in schools, when assignments are due, rather than having the students print out their assignments to physically hand in, they should be able to electronically submit the assignment to avoid the consumption of paper resources and reduce waste. As nice as it can be to receive hardcopies, the sustainability of the Earth and its resources must be kept in mind.

There are times, however, when it’s not possible to reduce consumption, such as with already-owned items, but in these cases, it is still possible to lower waste by practicing reuse. Like reduction, reuse avoids the discarding of goods and decreases resources that would be used in the production,

packaging, and transportation of new goods. This may mean reusing one's own good in a new, creative way or passing the item on to someone else to use.

To reuse an already-owned good oneself may take a bit of creativity, but once an idea is in place, it is simple and easy to perform. Some ideas for reusing goods include saving jars to fill with food, keeping used paper to use as scratch paper, or saving worn and ragged clothing to use for cleaning. Sometimes it can be better to pass the item on to somebody else, though. Used clothes, for example, can often still be worn by others. This form of reuse, in which goods are passed on to others, is facilitated by the many thrift stores available around the country where donated goods are re-sold at low prices. Individuals can also practice resale by holding a garage sale or selling used items online at auction sites such as eBay. This form of reuse is not one-ended, however, and many people may be surprised at the things they may find up for sale.

There are times when neither reduction nor reuse are possible, though, and an item must be disposed. When this occurs, the last resort to reduce waste is to recycle. Recycling diverts waste from landfills and turns materials that would otherwise become waste into valuable resources. This step is currently very popular and is often considered very critical in making the Earth sustainable for future generations, but in actuality is one of the least effective since only the resources used in the final good are saved. Nevertheless, recycling is still very important and effective. Considering recycling's efficacy, the 10% of solid waste that is currently being recycled is not enough—more can be recycled. The effectiveness of recycling some goods is astounding. Recycling an aluminum can, for example, saves 96% of the energy used to create a new can from aluminum ore and produces 96% less air and water pollution ("Waste Reduction & Recycling Program"). Numbers such as these show just how important it is to take the time to recycle waste.

One type of waste that is often overlooked is food, lawnmower clippings, and other organic wastes. While naturally biodegradable, in modern landfills, these items are often inhibited from degrading as they would in nature due to the structure of modern landfills. When food waste and yard clippings make up 24% of the solid waste stream, it becomes very important to practice composting. Composting is the decomposition of plant remains and other once-living materials into a product that can be used to fertilize land without harmful environmental impact. It is effective in reducing waste since no pickup or treatment by a municipal system is required, as it is an at-home practice. In the process, complex organic molecules are broken down into smaller molecules by microorganisms that release the energy and nutrients in the plant and animal tissues (Tammemagi 53). Despite its usefulness in reducing the waste stream, many people don't compost because it seems too difficult, time-consuming, or downright foul, when in reality, composting is a simple, low-technology, and low-cost process. Aside from the initial construction of a compost pile, there is usually very little maintenance involved. As further incentive, the substance created from composting is very healthy for the soil and can be used to promote the growth of plants, which may be the one step in reducing waste that can actually reverse damage that has already been inflicted on the supply of natural resources.

Although our lifestyle habits do not reflect it, there is a finite supply of resources available that we are using up faster than it can be restored. At our current rate of consumption, there will not be enough resources left for future generations to prosper and enjoy the quality of life we have today. One of the many steps that can be taken to increase the quality of life for future generations is to reduce the amount of waste in ways that have been previously described. Although several cases have shown that completely eliminating landfills is without a doubt impossible with current technology, the waste stream can be dramatically lowered. The little effort that it takes to carry out the necessary changes is minimal when compared to the positive return. The current generation will be healthier due to reduced pollution, and future generations will have the opportunity to thrive the way that we have.

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Chapter 15: Supporting Sustainability through Business

Michael Speaker

Over the past century, the world has seen extraordinary advancements in technology that, along with increased consumption, have caused us to damage our environment. After about one hundred years of unsustainable development, we must now pay the price for our actions; the decisions we, the citizens of the earth, make in the coming years will determine the severity of that price. Either we can continue our unsustainable habits and leave an uninhabitable world to our children, or we can take steps now to live sustainably. We must give attention to both the businesses that drive our economy while contributing enormous amounts of pollution to the environment, and the consumers who collectively contribute the majority of our greenhouse gases. Business owners have the opportunity to change the culture of the business world, where excess is encouraged and where profitability can seem correlated to a businesses' ecological footprint. Consumers must also have opportunities to buy green products and support green projects to allow our nation to advance toward sustainability. The truth is these two groups are connected, for companies can reduce not only their own but also consumers' ecological footprints by using green manufacturing processes and producing green products.

The main drawback to green technology is price: investing in green technology usually requires greater investment in the short term, which is often an unpalatable concept in a society where short-term gains typically drive decision-making. Thus, in order to motivate most businesses to adopt greener principles and techniques in their daily operations, the changes have to be financially advantageous for the company. As stated by Hendry and Vesiland, greening a business can have two effects financially: improving the reputation of the company in the eyes of consumers and reducing expenditures (254-255).

An individual consumer has a limited ability to help the environment on a daily basis. Therefore, when environmentally conscious consumers get an opportunity to buy a product that is "green," they are prone to buy that product over the competition's because it makes them feel like they are contributing to the conservation of the environment (255). Many companies, like Apple Computer Inc. have made efforts to improve their environmental images. In recent years, Apple has successfully curbed its carbon footprint through investment in greener materials and technology while removing many of the toxic materials, like PVC and mercury, from their products. They have also created an industry leading recycling program: in 2008 the total weight Apple recycled equaled 38.3% of the total weight of products the company sold in the past seven years (www.apple.com). These actions, while helping the environment, also have a higher purpose for Apple. They allow the company to receive environmental ratings like ENERGY STAR and EPEAT (Electronic Product Environmental Assessment Tool), which they can use as marketing points to sell more of their products.

Even oil companies, like Exxon Mobil, have been trying to improve their environmental images. In recent years, Exxon Mobil's reputation had been diminishing as global warming gained publicity and oil prices rose. Popular sentiment was that Exxon cared only about money, even at the expense of the environment. As a result, Exxon has recently introduced an extensive marketing campaign that highlights its ventures in research on alternative energy sources and other sustainable approaches. The *Wall Street Journal* highlights how Exxon is in the process of expanding the capacity of its carbon catching plant in Wyoming by 50% to capture six million metric tons of carbon emissions, which it contends translates to the annual tailpipe emissions of 900,000 cars (www.WSJ.com). In a world where the environment is at the forefront of everyone's thoughts, a company cannot risk its reputation if it wants its revenue to remain intact. Reputation is thus an effective tool for motivating companies to go green.

From a marketing standpoint, greening a company can have considerable economic advantages, but it can also have a significant effect on the company's expenditures. A company's number one priority is to make money, and green products and technology provide a special opportunity for companies to cut long-term expenditures by reducing resources. Hendry and Vesilind offer an example: Polaroid saw an opportunity to cut down on the many environmentally unfriendly and expensive chemicals it used in production. The company's initiative cut consumption of its most toxic chemicals by 37%, which saved it the \$19 million it would have had to spend disposing of the chemicals (254). Even though safe waste disposal protects the environment, the disuse of toxic chemicals altogether is much more environmentally and economically advantageous.

One market in dire need of greening is information technology. Joel Makower cites a study that found that if the IT world were to go green, it could potentially "eliminate 7.8 metric gigatons of greenhouse gas emissions annually by 2020, equivalent to 15% of global emissions today" (www.Greenbiz.com). This is because many of the dot-coms such as Google and eBay, have data centers that use more power than small cities (www.Greenbiz.com). Makower gives one specific example: in 2008 Hewlett Packard pledged to reduce the energy consumption of its data centers. In order to do so, it closed 79 of its 85 centers, making its remaining six much more efficient (the six after the renovations had twice the computing power the 85 had before). This resulted in the reduction of 60% of their energy consumption and a savings of \$1 billion annually for Hewlett Packard (www.Greenbiz.com).

Although the actions of Polaroid and Hewlett Packard are admirable and worth emulating, most businesses cannot have as profound of an environmental effect because of their smaller sizes or different markets. Especially small businesses, but large corporations as well, have to do "the little things" that together make big environmental differences. One action that almost all businesses can take is to handle office equipment (e.g., printers, copiers, and fax machines) in a greener manner. This is significant because office equipment presents many environmental problems: it contains and its production used hazardous substances, it consumes large amounts of energy when devices remain on while not in use, it releases harmful airborne toxins that can cause respiratory problems, and its designs often make recycling difficult (NAGPI, 1). The purchase of new technology or efficient planning can reduce or solve all of these problems.

New printers and computers do not contain the many harmful substances, such as mercury and PVC, that NAGPI outlines (as discussed earlier, Apple has taken significant initiative on this problem). In order to curb energy consumption, NAGPI suggests that businesses select products that are ENERGY STAR certified because they are usually at least 30% more energy efficient than other products (3). NAGPI also suggests that companies buy recycled ink cartridges, which are typically cheaper. NAGPI states that King County, Washington alone saved \$450,000 in 2004 after [its government offices] decided to purchase remanufactured ink cartridges instead of new ones (3).

Furthermore, reducing the amount of paper a company uses can greatly reduce a company's costs and have an even greater benefit for the environment (NAGPI, 1). Trees are a necessity for life on Earth because of their ability to release oxygen and absorb carbon dioxide. The more paper businesses save, the fewer trees have to be cut down, which results in less carbon dioxide in the air. Businesses can reduce paper usage by phasing out paper-based communications in favor of email and digital communication. Although these simple changes may seem insignificant in helping the environment, examples like King County show that if these changes take place on a grand scale, they will have an enormously beneficial effect on the environment and companies' financials.

While Hendry and Vesilind concluded that the present motivation for businesses to go green lies in financial opportunities, they also acknowledge the power that legal mandates have over businesses' drive to turn green. They state that companies will disregard the financial advantages or disadvantages of switching to green technology if federally or locally mandated to do so, because the consequences of breaking the law are far greater than the revenue reductions that might result from complying with the law (254). Thus, the future of an environmentally friendly business world lies not

only with the profitability of green technology but also with government involvement. The American government has already been extremely successful at influencing companies to produce green products with its ENERGY STAR compliance standard. The numbers do not lie: “Americans, with the help of ENERGY STAR, saved enough energy in 2007 alone to avoid greenhouse gas emissions equivalent to those from 27 million cars — all while saving \$16 billion on their utility bills” (www.energystar.gov). Federal, state, and local legislatures have the opportunity to lead this country in the right direction towards sustainability; they have the power to influence businesses to invest in technology and products that will reduce their ecological footprint.

At the end of the day, businesses only partially contribute to the world’s pollution; consumers contribute the rest. In order for the nation to one day become sustainable, citizens need to be active in supporting green businesses, green products, and green initiatives. Programs and companies must educate people about environmental problems and, more importantly, show them how to reduce their ecological footprint.

For example, the automobile industry has been very active, recently, in presenting consumers opportunities to reduce their carbon footprint; today almost all major car companies offer various types of “green” vehicles: electric, hybrid, diesel, and more. Automobile companies have steadfastly been producing these “green” vehicles because of consumer demand; the current oil and climate crisis have caused consumers to be more environmentally conscious. With continued research and time, the majority of the world will hopefully drive environmentally friendly cars, a necessary step towards sustainability.

Furthermore, because of the importance of green research and its reliance on funding, consumers must have the opportunity to support companies dedicated to the advancement of green technologies; carbon-offsetting companies do just that and more. The company Carbon Footprint Offsetters educates consumers on their carbon footprint and informs them how to get involved in preserving the environment. The company offers a simple carbon calculator that allows people to gauge the size of their ecological footprint. It then allows them to offset their footprint by buying renewable energy certificates (RECs), which fund renewable energy producing companies and emission reduction projects (www.offsetc02.ca). These types of civic involvement programs are multiplying daily, and many have partnered with airline companies, such as JetBlue and Delta, to give flyers the opportunity to reduce their carbon footprint. These types of endeavors are vital for getting people active in saving the environment because they simplify the process for consumers.

Lastly, contractors have made significant strides toward the development of green building techniques that have recently translated into the formation of green communities. Homes and buildings are huge consumers of energy because they require constant ventilation, lighting, and electricity. Consumers must have access to green housing alternatives in order to resolve the problem of excessive energy usage in homes. Fortunately, many companies now either support green construction or are involved in the actual construction of green buildings and communities. One example is the Green Communities Initiative, which funds the construction of green housing (Potera, 1). In 2004, the initiative pledged to give \$550 million over five years to several developers, which they hope will translate into the production of 8,500 green homes (Potera, 1). In order for developers to receive the money, their home plans must meet strict requirements on water conservation, clean indoor air, use of environmentally friendly materials in construction, and proximity to public transportation (Potera, 1). Carol Potera explains the group’s mission: “Our goal is to transform the marketplace and shift the way we build to achieve health, environmental, and economic benefits in communities...” (Potera, 1). The Green Communities Initiative is just one of hundreds of organizations and companies around America that are working to make homes and offices environmentally sustainable.

Businesses have to offer consumers opportunities to green their lives in order to help green our planet. Initiatives like green communities and carbon offsetting are steps in the right direction, as they allow consumers to get involved and be proactive in the conservation of our planet’s resources.

Similarly, businesses have to become accountable for their actions and take initiative to reverse their negative effects on the environment. Not only will environmentally sound behavior increase customer goodwill, but it will often directly result in cost reductions, as it did for Polaroid. Lastly, the government needs to play a role in aiding the environment by passing legislation that encourages green activities while punishing major environmental offenders. In light of global warming, pollution, and deforestation, now is the time for the United States, its businesses, and its citizens, to lead the charge toward sustainable living.

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Chapter 16: Survivalism: What if the Worst Happens?

Andrew Youssef

Oil is one of society's most valuable commodities, yet a future without it may not be too far around the corner. Over the past half-century, oil production has skyrocketed (as shown in Fig. 1), and it is apparent that this cannot continue indefinitely (Bates 2). William Marsden, a writer for *The Gazette*, estimates that the world's oil supply will be exhausted in slightly less than four decades. This figure, however, assumes the reported stores of oil are correct (a quarter of which are said to be overestimated) and that oil consumption remains constant (which seems unlikely due to the exponential growth of consumption over the past few decades ("World Oil Consumption, 1950-2004")), so the actual date may be much sooner (Marsden). Since the global oil supply may soon become depleted, it is vital for everyone to begin preparing for this change immediately.

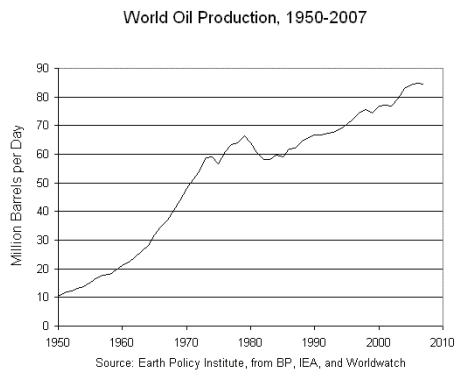


Fig. 1. "World Oil Production, 1950-2007." Chart. Earth Policy Institute. 15 Nov. 2007. 11 Feb. 2008 <http://www.earth-policy.org/Updates/2007/Update67_data.htm>.

In his insightful book, *The Post-Petroleum Survival Guide and Cookbook*, Albert Bates warns readers that they will have to soon end their oil dependence and instructs them to get ready for this monumental change. Society is setting itself up for disaster with its immense oil dependence, therefore, he urges people worldwide to begin changing the products they buy and the activities they do to reduce their dependence now. He then recommends everyone to formulate plans for living without the resource altogether since there is a limited supply (112-128).

Substitutes for oil

Initially, Bates explains that it is important to get substitutes for products that rely on oil. He encourages people to create lists of products in their houses that are oil-dependent to see what replacements they will need (111-12). For example, many common household items such as glue, glasses, and a variety of toiletries would be included in this list ("Products Made from Oil"). If a substitute can be found for an oil-dependent product, then it should be used, in order to start adjusting. Otherwise, people should always have an extra supply of the irreplaceable products in order to be equipped for the future.

Finding new products that do not rely on oil is important, but Bates notes that there are also some lifestyle changes that people need to make to reduce their oil dependence (168). Instead of having children play on the computer all day, for instance, encourage them to play outside. Likewise, adults should also partake in more oil-free activities. For example, instead of taking a leisurely drive around town, wasting gas, take a bike ride. It is essential for people to begin changing their lifestyles now to begin adapting (Bates 168).

Short-term survival

Additionally, Bates explains that it is important to make plans for living completely free of oil that can be quickly implemented (122). At first, a short-term plan should be formulated in case of a sudden oil shortage. In his book, Bates outlines the essentials for the short-term which include having an adequate supply of water, enough food to eat, and ample health-related products (122).

People's primary concern should be having enough water stored. Paul Tawrell explains in his informative guide *Camping & Wilderness Survival* that water is absolutely vital because if it is not found, death will quickly ensue (459). Tawrell recommends that enough water should be stored so that each person can have at least two quarts per day (459). Bates mentions that the ideal place to store this water is in black, opaque plastic containers that have been washed out. If additional water is needed, and cannot be taken from the tap, it can be obtained from clean freshwater sources, but it will need to be treated before being consumed. He advises having chlorine or iodine tablets on hand for treatment. Adding a single tablet (of either chlorine or iodine) per quart of water should make it safe to drink (29-35).

Another concern people should have for the short-term is having enough food. Bates suggests that enough food should be stored so that everyone has two thousand calories worth each day (122). He advises that it should be kept in a location that is dark, dry, and has a relatively low temperature. In his book, Tawrell describes many methods for storing food outside. One such method is called the food silo which requires a small plot of land to be hollowed out and then filled with rocks for a foundation. The food (fruits or vegetables) is then placed over the rocks and covered with straw. Finally, sod is planted on top of the hay, and the food below will remain well preserved (453). In traditional indoor storage, some food will last for years including canned vegetables (two years) and dried pasta (up to five years), while others will only be good for a couple of months like chips and cookies (two months each). If power is lost, Bates suggests that before these stores of food are eaten, people should first consume the contents of their refrigerators since that food will be the first to spoil. After that, the food in the freezer should be eaten, and then, at last, the stores of food can be used. This method will maximize the amount of food available (102-5).

Moreover, many health-related products and an array of health resources are also vital for the short-term. In his book, Bates offers a lengthy list of medical supplies to stockpile, including assorted medicines (like aspirin and ibuprofen) and equipment for injuries (like bandages and tweezers) (123-4). He also discusses first aid, which is essential to know, especially when outside help may not immediately be available (Bates 199-222). Although it would be beneficial to learn the different first aid measures, a copy of first aid instructions should suffice (Bates 124). Books such as *The Post-Petroleum Survival Guide and Cookbook* which covers some general first aid instructions (Bates 199-222), and the *Camping & Wilderness Survival* book which extensively covers first aid using many illustrations should be available for reference in case of emergency (Tawrell 979-1060). There are, Bates notes, other necessities for the short-term in addition to water, food, and health-related products such as having a source of light and a way to contact others (123-4).

Long-term survival

In addition to having a short-term plan prepared, people should also be ready to institute a long-term plan in the event that oil becomes entirely unavailable. For long-term survival, a complete lifestyle change will be required. One of the best methods for survival would be to take up farming, because farmers are mostly self-sufficient and can, for the most part, maintain their way of life without oil. Before making the full transition to a life without oil, however, people will require the same essentials that were needed for short-term survival, except on a grander scale. For instance, as people adjust, it will be necessary to have plenty of water stored, enough food stored to last until

farming yields enough to eat, and enough medicine to last until the home-grown remedies that Bates suggests can be used (122-25, 218-22).

To begin preparing for the long-term, water should be stored in large amounts, since it may become inaccessible. Bates suggests an easy and affordable way of storing large quantities of water by using storage drums, which can be purchased from soft drink companies. These containers should be prepared analogous to those used to store water for the short-term. He mentions that an alternative to the mass storage of water is to obtain rain water for drinking (35). This would work well since it is free and sustainable, however, people should ensure that they always have a backup supply in case unexpected weather conditions arise, such as drought. Tawrell suggests a variety of other locations to search for water in more arid regions, including under sand dunes and, if necessary, inside barrel cacti (194-5). Also, to ensure the cleanliness of the water, it is important to practice the water treatment techniques discussed for the short-term (Bates 31-3).

Another obvious necessity for long term survival is food. Although eventually people should be able to grow their own, it is advantageous that everyone has some stored and available to eat while their plants begin to mature (Bates 81-107). Additionally, if oil becomes unavailable in the winter, an inopportune time for planting in most regions, it will be important to have some food to count on. When it is time to begin planting and farming, Bates lists many tools that would be useful, from obscure items such as adzes (similar to an ax ("adze")) to commonplace ones like wheelbarrows (Bates 125-7). Once people are able to start growing their own food, they can supplement this with food from a local market (as discussed in the "Simpler Way" method below), and those who are unable to plant their own food will also be able to take advantage of this (Trainer 301).

The third essential for the long term is medicine (Bates 123-4). In his book, Bates lists a variety of plants that have medicinal properties, and classifies each one under the ailment it cures, and what part of the plant is used. For instance, he writes that the root of horseradish, in addition to eight other plants, can help relieve a stomachache. It is important to be familiar with these plants to identify them in the wild, or to grow them if traditional medicine becomes unavailable (218-22).

Instead of just planning for the future of life without oil, however, action can begin now through what author Ted Trainer calls the "Simpler Way." This plan emphasizes working together to create a completely different society that is much more home-based. Everyone would contribute to their city, and it would mostly sustain itself. Some people would grow food and sell it at the market, while others would make an assortment of crafts for the citizens to buy. There would be little need for imports, except for some advanced technologies that the city could not produce. It is important to note that these citizens are not opposed to using technology; they just eliminate it from domains in which it is unnecessary and more rewarding not to use it. Although this approach seems idealistic, if there is enough cooperation among citizens, it has great potential (300-8).

Amazingly, some people are already living oil-free lives, and they seem to be doing well without it. Nelson Lebo, for example, has lived a life almost completely free of oil for nearly two decades. He remarks "I'm peak oil proof," knowing he has nothing to worry about when the end of oil arrives. At his home in New Hampshire he eats homegrown food and his main form of transportation is a bike, both sustainable practices (Conaboy). Another man, Doug Fine, has been living without oil for two years, and he surprisingly admits "I'm the happiest I've ever been" (Linthicum). This goes to show that happiness is not sacrificed by giving up oil, which is what the "Simpler Way" emphasizes (Trainer 300). These sustainable ways of living need to be practiced more widely, because in the future, this will be the only way to live.

Overall, it is important for people to understand that they cannot continue depending on oil, leading an unsustainable life. They must begin to reduce their dependence now by altering the products they use and the activities they do. Additionally, by making plans for the short-term and long-term, they can prepare themselves for this new life. Fortunately, many have already proven that this adjustment to a sustainable lifestyle is possible, and even pleasurable. In conclusion, the end of oil is approaching, and it is crucial to be ready for it.

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