Introduction

Is it possible for humans to coexist with nature? Thousands of years ago, we did. Humans farmed and worked the earth and gave back to our planet just as much as they took. Post-industrial revolution, however, our world is very different. The innovations of this time period caused a shift from rural farming into cities, and it became much more efficient to mass-produce products. Since then, ecological farming has been pushed out in favor of factory farming, small businesses are becoming a thing of the past, and industries are built on ideas of endless resources and linear product life spans. This lifestyle of constant extraction has come at a great cost: if the whole world lived as Americans do, we would need around five Earths to sustain us.[1] There simply are not enough natural resources to maintain humans as we are living in the present. We need to return to the old ways of thinking to design a whole new way of living as well as a new structure to the economy of goods.

This requires creating a super *evolved* society that follows the laws of nature that say waste cannot exist – every material must be used to its fullest potential with as little energy use as possible, and every output must be a useable input for another system. The way products are currently being produced needs to change and the limits of technology need to be pushed to modernize the techniques that were used so many years ago. Instead of thinking of products as linear objects that travel from raw materials to consumers to landfills, where they will remain for eternity, we need to think in terms of closed loop cycles. This means eliminating the concept of waste even before the product has been made, and designing it as an object that can either be infinitely recycled within its own system, or safely returned back into the earth or into another system.

Think about a carpet. Right now, we buy a carpet in a store, use it in our home, and then throw it away when it gets worn out and has holes in it. But what if, when your carpet got worn down, you could simply snap off the super durable bottom, return the top patterned part, and buy a new top to snap back on? Even better, what if your old carpet top could be reused to create a new carpet top to be snapped back onto another person's carpet bottom, and so on and so on? What if this cycle got to the point where no new raw materials ever had to be extracted to create a new carpet, and the carpet industry was just a beautiful cycle of perpetually recycled carpet tops?[2] This is a closed loop cycle.

Over the course of several billion years, nature has evolved into a working system of many closed loops where every output of one organism can be and is used by another organism as an input, thus eliminating the creation of waste. There is no extraction of raw materials, no excessive energy is used, and everything is in balance with everything else. In human made products and systems, this is referred to as cradle-to-cradle. An object is born out of raw materials, created, and, instead of ending up in a landfill (cradle-to-grave), ends up as the raw materials for another product to be born from. When this type of design is utilized, we can come close to an idea that is now only a myth.

Sustainability is the ability to continue behaviors indefinitely and it currently does not fully exist in any human-made system. Some product cycles have come close, however, like the redesigned carpet. These are the ones that have set aside the common human obsession with

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[1] Elert, Emily. "Daily Infographic: If Everyone Lived Like An American, How Many Earths Would We Need?" *Popular Science*. Popular Science, 19 Oct. 2012. Web. 25 Apr. 2015.

[2] McDonough, William, and Michael Braungart. Cradle to Cradle: Remaking the Way We Make Things. New York: North Point, 2002. Print.

virgin materials and realized that pre-used and recycled do not have to mean low quality. Many companies have heard the call from consumers to be more ecological, but have failed to fully meet the challenge. There are a plethora of "eco-friendly" products on the market that consumers use to essentially buy their conscience, but when these products are examined from their birth to death, they can turn out to be pretty harmful. Often, the product itself may be less bad than its non eco-friendly counterparts, but its packaging and production very damaging. A truly eco-friendly item must be ecological from its materials through the production process through its use and through its reuse, not death. In order to achieve this ideal of sustainability and to be able to always leave enough resources for future generations, we need to embrace the power of closed loops, embrace zero waste, and try to emulate nature's time tested and perfected system of working.

Humans have damaged the environment to the point where it's not enough to make "eco-friendly" products in an attempt to be less bad. We must strive to be good; every aspect of our lives needs to be ecological and economical from start to finish. Society must be recreated as an extension of nature, rather than always at odds with it. We need to save the environment, not in the name of nature, but in the name of humans. For, regardless of what happens to humans, whether we survive or not, nature and its natural cycles will continue to exist. If we, as a human race, want to be able survive and thrive indefinitely, we need to change now.

Part One:
Food and Water

UNPACKING FOOD

Walking through a grocery store can often feel like being on a website with thousands of pop-up ads. Packaging and labels are filled with phrases like “free-range”, “certified organic”, “cage free”, “natural”, and “humane”, all coupled with bright images of a beautiful landscape or smiling families or happy animals. This is all an attempt to ease the conscience of the consumer who knows that what they’re buying might not be as good or wholesome as it seems, and to give the consumer who suspects nothing a pat on the back for doing the right thing. However, these types of labels are full to the brim with misconceptions and require a lot of unpacking for the consumer to truly understand what he or she is buying. We need to take a closer look at what backs up these meat and produce labels to become informed buyers.

One of the mislabels that I see most often and seems the most reassuring is “free-range.” The United States Department of Agriculture (USDA) defines a free-range animal as having been provided “shelter in a building, room, or area with unlimited access to food, fresh water, and continuous access to the outdoors during their production cycle.”[1] On the surface this sounds great! All the food and water an animal could ever want, and they can go outside whenever they want! But when we look a little closer, we start to realize how vague this definition is. The phrase “continuous access to the outdoors” could be interpreted many different ways by a factory farming company, and nowhere in the definition does it say that the animal must be allowed to actually go outside. A chicken’s access to the outdoors could be a small door in the corner of the “building, room or area” that is barely big enough for a chicken to fit through and is kept locked at all times. Access to the outdoors is provided to the animal, but it does not mean that this access is realistic or even used. The USDA also says that this outdoor place “may or may not be fenced and/or covered with netting-like material,”[2] which is a round-a-bout way of saying that this outdoor area does not have to even be the outdoors. Because of all this wiggle room, “free-range” has become a phrase with little to no meaning.

“Cage-free” is similarly weightless, with a definition of being able to “freely roam a building, room, or enclosed areas with unlimited access to food and fresh water during their production cycle.”[3] If you have learned anything, you will be weary of this definition. The lack of cages in a room means that more animals can be stuffed into it with nothing taking up extra room to separate them. Sure, the animals can walk around, but only by pushing through a swarm of other animals. This tight packing of animals provides the perfect place for disease to be spread and means that the animals are forced to live in extremely dirty environments.

“Natural” and “humane” labels continue to be vague. Natural meat, poultry, and egg products must be “minimally processed and contain no artificial ingredients.” How much is minimally processed? That is for the factory farm to decide. The definition also includes nothing about the farming practices required, nor does it provide regulations for food products that do not

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[1] "National Organic Program." *Agricultural Marketing Service*. United States Department of Agriculture, 17 Oct. 2012. Web. 28 Apr. 2015

[2] *See Above*

[3] *See Above*

include meat, eggs, or milk. As for humane meat, there is not a single regulation under the USDA that defines the term. [1]

"Certified organic" actually holds more weight than the previous terms, but it is still far from perfect. While there are specific regulations as to what goes into organic crops and meat, such as ensuring there were no pesticides or genetically engineered organisms (GMOs) added, there are no rules about the treatment and ecological standards of the food production process. Certified organic food can and does produce just as much waste and pollution as non-organic food. [2]

All of these labels have been created to allow the food industry to preform at the highest, most extreme level of efficiency, while making sure that the consumer never gets too suspicious of the ecology of the process. Each of these mislabels, plus more, allow the food industry to use practices that create unhealthy food that we unknowingly put into our bodies and ecologically harmful practices what we are unknowingly supporting. This industry can only get away with this because consumers are uneducated about what they are putting into their bodies and how it is affecting the world they live in.

Our support of the global food economy has allowed us to expect to be able to obtain any food we could ever want at any time we want it. This means being able to import apples in the dead of winter instead of only in the fall, and lamb in the fall when it's only really in season during late spring. This expectation is not in line with the Earth's natural ecology, and forces the Earth to produce food when it is not supposed to, damaging soil and natural cycles. It also means that the majority of our food is nowhere near fresh, as it has been shipped across countries and oceans to get to out dinner tables.

SOURCING LOCALLY

There are many problems with a reliance on global economies and trade instead of being able to be self-sufficient. In a global economy, big corporations are able to set up shop in nutrient rich countries, extract the available resources, and ship them back to whatever country they came from. This leaves the host country depleted and usually very poor. Take Africa, for example. According to the International Food Policy Research Center (IFPRC), the Democratic Republic of Congo has the land and ability to feed the entirety of the African continent, which is currently filled with malnourished families living in poverty.[3] If this is true, then why is Africa one of the poorest continents? The answer is that richer, developed countries abuse their power to use Africa's land to their advantage – extracting resources for themselves and leaving the continent and its people with nothing.

An economy centered more locally would solve this problem. Not only would Africans be left alone to flourish, but they would also be allowed to farm their land, which would provide food security and save countless families from starvation. The United Nations Conference on Trade and Development Review of 2013 (UNCTAD) explains that along with improving lives and food situations, switching to ecological farming worldwide would provide huge amounts of

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[1] "National Organic Program." *Agricultural Marketing Service*. United States Department of Agriculture, 17 Oct. 2012. Web. 28 Apr. 2015

[2] "Organic Standards." *Agricultural Marketing Service - Home*. United States Department of Agriculture, 23 Apr. 2015. Web. 28 Apr. 2015.

[3] Ulimwengu, John, Cleo Roberts, and Josee Randriamamonjy. "Publications." *Resource-rich Yet Malnourished*. International Food Policy Research Institute, 2012. Web. 29 Apr. 2015.

plants that would work to reduce air and water pollution. Local ecoagriculture would be able to absorb excess labor in ways that urbanization cannot. [1]Unfortunately, our food system is currently pretty far away from reaching this ecological ideal.

The way the majority of our produce and meat is currently being farmed is profit driven and extremely harmful to ecological and human health. Both meat and produce are mostly being farmed and raised in factory settings, where the main issue at hand is creating a system that works to produce as much food in as little time as possible at whatever cost. This mindset leaves a lot to be desired and results in food that is low in quality, bad for consumers' health, and bad for the health of the environment. In order to fix this, we need to fundamentally change the way that the food industry is set up.

INDUSTRIAL FARMING

Consumers often overlook issues with the mass production of produce as it is currently. Plants do not have feelings, so there is a lack of moral struggle in buying factory-farmed produce over ecologically farmed produce. However, there are more issues to consider as you are walking down the rows of fruits and vegetables at your grocery store. This produce is grown in monocultures, meaning that only one type of plant is grown per plot of land, so that the company can focus on one plant at a time. Growing in monocultures, however, overworks the soil and makes it unproductive after only a few growing seasons. UNCTAD indicates that, during the twentieth century, cultivated soil has lost around 30-75% of organic matter.[2] Because the soil is now insufficient for growth and cannot provide the correct nutrients to the produce, companies are forced to add fertilizers to force the plants to grow. Not only do these fertilizers end up in the stomachs of the consumer by directly eating the product, but they also will end up as run-off into the local water systems, and then in the water that the consumer is drinking.

Along with fertilizers, monocultures force companies to use pesticides to keep their crops alive. In any community, be it comprised of plants, humans, or animals, low diversity means high susceptibility to disease and sickness. When plants are grouped together by type and not allowed to intermingle, not only does the whole operation require more land, but any disease or bug that effects one plant will affect the whole plot of crops. This could lead to a huge loss of product, which no company wants, and therefore the company will use pesticides and chemicals to try and combat these issues.[3]

Grain feed for factory farmed animals is grown the same way. Pesticides and fertilizers are needed to keep the crops alive in the poorly constructed monoculture system. These chemicals remain with the plant and with the animal that eats it. This means that when we eat factory-farmed meat, we are also eating all of the chemicals what were used in the feed.[4] Growing food in this manner – with pesticides and chemicals and in monocultures, all of which

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[1] Wake Up Before It's Too Late: Make Agriculture Truly Sustainable Now For Food Security In a Changing Climate. Rep. N.p.: United Nations Publication, 2013. United Nations Conference on Trade and Development. Web. 29 Apr. 2015.

[2] Wake Up Before It's Too Late: Make Agriculture Truly Sustainable Now For Food Security In a Changing Climate. Rep. N.p.: United Nations Publication, 2013. United Nations Conference on Trade and Development. Web. 29 Apr. 2015.

[3] Troy. "The Advantages of Polyculture vs Monoculture." *Organic Farming Blog*. N.p., 04 Mar. 2013. Web. 28 Apr. 2015.

[4] "11 Facts About Animals and Factory Farms." *11 Facts About Animals and Factory Farms*. DoSomething.org, n.d. Web. 29 Apr. 2015.

cause soil to be overworked and have low productivity – treats the earth like a self-renewing resource. But soil is a natural system, and therefore needs other natural inputs, such as organic matter and nutrients, in order to remain useful. By treating it as a disposable resource that requires no upkeep, we are forgetting that human-made and external inputs are not enough for soil to sustain itself with.[1]

Just like with plants, animals are very susceptible to disease when forced to live very close together with a lack of diversity. Joel Salatin, owner of Polyface Farms, explains why factory farmed animals provide the perfect place for bacteria to grow and infect the food that is going into your body. These animals are housed in dark rooms with little room to move, which mean that bacteria can move easily from animal to animal, and cannot be sanitized by the sun (the number-one sanitizer in nature). They are also fed food and chemicals so that they produce liquid waste that can be easily washed out of the pens with water. However, the cages often go long periods of time without being cleaned, and the animals end up living in their own waste, which provides even more opportunities for infections. The chemicals suppress the animals' natural immune systems, making it harder to fight the bacteria that are ever present in their cages. All of this poor planning means that when an animal gets sick, which happens extremely often, the producer is forced to pump their animals with hormones and drugs that will then end up in the consumers' bodies.[2] While this saves some of the animals, many animals become even more diseased and die, or become even more diseased, barely survive, and then end up in our stomachs.

Factory farms are able to absorb the cost of the massive amounts of profit lost to diseased animals because their product is being produced at such a high quantity. It is for the same reason that factory farms are able to exploit labor and be so ecologically harmful: any cost, internal or external, is spread out over every piece of meat sold, so only a few cents from any cost ends up being applied to the price of the product that ends up in the grocery store. This is why grocery store meat is able to be so inexpensive. However, the cost of hamburger meat if there was not a huge amount of product for external costs to be spread over, and if taxpayers were not helping to subsidize costs, would be around $35 per pound.[3] This is a ridiculously high price, and factory farms would not be able to continue if the system were set up like this. On the most basic level, for a practice to be able to always be profitable, the price needs to reflect a balance between the economic cost and the environmental, social, and health costs that will occur.[4] Because factory farms produce so many of the last three costs, but the market price does not reflect this, there is no way for them to continue to be profitable in the long run.

Industrial farms are not just a poorly constructed system, harmful to humans and to animals, but they create devastating amounts of water pollution as well. As mentioned previously, the animals are forced to produce liquid waste, which is then washed out of the pens

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[1] Wake Up Before It's Too Late: Make Agriculture Truly Sustainable Now For Food Security In a Changing Climate. Rep. N.p.: United Nations Publication, 2013. United Nations Conference on Trade and Development. Web. 29 Apr. 2015.

[2] Salatin, Joel. "Showing Dissent: Lunatic Farmer Joel Salatin Digs In." Interview by Tracy Frisch. Sun Magazine Oct. 2012: n. pag. Print.

[3] "Short List: What's Wrong with Factory Farming?" *Short List: What's Wrong with Factory Farming?* Organic Consumers Association, n.d. Web. 29 Apr. 2015.

[4] *Wake Up Before It's Too Late: Make Agriculture Truly Sustainable Now For Food Security In a Changing Climate*. Rep. N.p.: United Nations Publication, 2013. United Nations Conference on Trade and Development. Web. 29 Apr. 2015.

with water. Not only does this use huge amounts of water, but the large amounts of contaminated water are too much for the land to handle, and will end up in local water systems.[1] This kills water ecosystems and means the waste could potentially end up in our houses' drinking water. This polluted water is often shipped to water treatment plants and is therefore not returned back into the local water cycle. This destroys the closed loop cycle that is usually created by ecological farming.

Along with polluting water, industrial-farmed animals require huge amounts of water in general. The production of one pound of meat requires 2,500 gallons of water, while the production of one pound of wheat (used to feed the animals) requires 25 gallons of water. If, during a drought, every family were encouraged to eat ten pounds less meat, instead of told to take shorter showers or stop watering their lawns, the amount of water saved would be equal to the water consumption of an average household per year.[2]

ECOAGRICULTURE

So, is there a way to produce all the food humans need in a way that honors closed loop cycles and natural inputs and outputs? The answer is yes; while 99% of our produce and meat is grown on factory farms, 1% is being grown on ecological farms. These farms incorporate many different aspects of nature to create an ecosystem that ends up being healthy and efficient in ways that factory farming could ever achieve. The main aspect of these farms is the polyculture that is created, not just with different plants grouped together, but by creating a diverse group of plants and animals that work together to create the system.

On theses smaller scale farms – which embody what we wish the average farm behind "organic" labels look like – animals are raised outside and are free-range in the purest sense. By being outdoors, it is harder to bacteria to find a place to fester and infect, so automatically few to no hormones and vaccines are needed to keep the animals healthy. Ecoagriculture farms, as discussed in the UNCTAD, "seek to improve agricultural systems by mimicking or augmenting natural processes…"[3] and are constantly creating beneficial biological interactions between humans, produce, and animals. Nutrients and energy are recycled, produce and livestock intermingle to create a high diversity setting, and productivity is improved through polycultures (more than one plant or animal being raised together).

I learned about Polyface Farm, located in Virginia, during the first few weeks of the semester and it dramatically changed how I felt about food. This is one of the most well known examples of a true ecological farm and it the sole reason that I decided to start eating meat again and become a "selective omnivore"[4] (I only eat meat that is reliably obtained from an ecological farm). Instead of being fed by grains, cows graze in the pastures, chickens eat grass and bugs, and pigs are free to play and help turn compost. The animals' waste provides essential nutrients for the soil, and instead of being left for the animals to live in, it creates the perfect closed loop cycle. The animals get energy and food from the grass, and the grass is able to grow because of

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[1] "11 Facts About Animals and Factory Farms." *11 Facts About Animals and Factory Farms*. DoSomething.org, n.d. Web. 29 Apr. 2015.

[2] "Short List: What's Wrong with Factory Farming?" *Short List: What's Wrong with Factory Farming?* Organic Consumers Association, n.d. Web. 29 Apr. 2015.

[3] Wake Up Before It's Too Late: Make Agriculture Truly Sustainable Now For Food Security In a Changing Climate. Rep. N.p.: United Nations Publication, 2013. United Nations Conference on Trade and Development. Web. 29 Apr. 2015.

[4] Foer, Jonathan Safran. Eating Animals. New York: Little, Brown, 2009. Print.

the animals. Pastures are also rotated between different types of animals and plants to keep the soil from becoming unproductive in the way that monocultures create. This rotation is key to making the system work, and is the reason that so many farmers have failed to perfect ecological farming.[1]

Grass is an important part of eco-farming and it is what makes these farms so ecologically sound. Grass is a huge carbon sink, meaning it is extremely helpful in extracting carbon dioxide pollution from the atmosphere. If all of the 16 million acres of land currently being used to farm grain feed for animals was converted into grass pastures to raise animals, 14 billion tons of carbon dioxide pollution would be sequestered from the atmosphere.[2] 14 billion tons. That is a huge amount. This amount of grass would remove more carbon dioxide from the atmosphere than if no one in the entire world used a car for the next two years. Grain does not create a closed loop cycle in the same way that grass does – it is produced off site and never gets nourished by the animal it is nourishing. We need to normalize rotational pasture farming systems for this very reason.

Grass is not the only environmental asset to ecological farming. The set up of an ecological farm with every plant and animal connected to the earth and ground in some way means that any water used will be returned back into the local water cycle. In a factory farm, water is often relocated into a foreign water cycle, leaving some ecosystems depleted. In ecoagriculture, water used to grow crops is returned directly back into the earth with out being contaminated. As for animals, although about the same amount of water is required as factory-farmed animals, the water from ecologically raised animals is more likely to end up back into the earth from animal waste compost.

Probably the biggest turn off for buying ecologically farmed meat and produce is the price, which is always higher than the prices you see at the grocery store. What consumers need to realize is that they are paying for quality. By buying food that has fewer chemicals and fertilizers and pesticides and additives from the start, you will end up with fewer health issues later in life. It is much less expensive to pay $20 per chicken from an ecological farm than to pay thousands of dollars in hospital bills to treat the cancer/E.coli/salmonella/heart disease/diabetes[3] you got from eating cheap food. Ecoagriculture at its best has achieved the balance between economic price and environmental, social, and health costs.

This system does not need taxpayers to pay off the external costs because there are so few. An ecological farm does not have to pay huge fines for pollution, or run the risk of being sued over health issues. Because of their set up, these farms improve the land by replenishing nutrients through compost and animal waste, and keep water in local water cycles by making sure it stays clean and can be returned safely back into the soil. Ecoagriculture comes as close to true sustainability as any human made system might be able to, and the more we support the system and our local farmers, the closer we can get to a world in which food stability and green culture are to be expected. Once we have perfected the ecology behind what we put into our bodies, we can work on perfecting the structures that we shelter our bodies in.

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[1] Pollan, Michael. "Pastoral Grass." *The Omnivore's Dilemma*. New York: Penguin, 2006. 121-273. Print.

[2] Pollan, Michael. "Pastoral Grass." *The Omnivore's Dilemma*. New York: Penguin, 2006. 121-273. Print.

[3] "Factory Farming and Human Health." Farm Sanctuary. N.p., n.d. Web. 03 May 2015.

Part Two:
Shelters

Think about all of the rooms in your home. There are probably several bedrooms, a couple of bathrooms, a living room, kitchen, dinning room, and more. Now think about how many of these rooms you use on a regular basis, and to go further, how many of these rooms are actually necessary. If you had to, you could probably live in a home with just a kitchen, a bedroom, a bathroom, and possibly a living room. And, in fact, the need for this type of minimalist living is becoming greater and greater.

As I was researching shelters, I was thinking about how closed loops and cradle-to-cradle ideas could be applied. In nature, mutualistic relationships between animals and their homes are very common. Ants will often make their homes in the base or branches of trees and in return, protect the trees from herbivores, thus ensuring that their home remains constant. This type of self-sustaining closed loop does not really exist between a human and its human-made shelter. While there has been a huge consumer call for greener housing and buildings, there are still a lot of problems with the way the housing supply and demand is set up. Right now, people with enough money are demanding huge houses filled with unnecessary rooms, whereas families with less money might barely be able to afford a small apartment. These huge houses have a huge environmental impact. Most obviously, the larger the house, the more materials are needed to build it. Wood, and brick are some of the most common materials used when constructing a house.

MATERIALS AND INSULATION

Wood requires deforestation to collect the materials; trees that would otherwise be taking carbon dioxide out of the atmosphere are being cut down and used to build the homes we live in. Fewer trees and plants also leads to land erosion and an increase of runoff into water systems, which is one of the leading sources of water pollution and water ecosystem collapse. Once the trees have become a house, they are susceptible to decay and rot from fungi and termites if not cared for and built correctly.[1] The problems with brick houses stem more from an energy standpoint. Brick is a very poor insulator so a brick house takes much more energy to maintain a warm or cool temperature. It is easy for moisture to seep in through the clay and cause paint and wallpaper inside a home to peel.[2] The extraction of clay needed to produce bricks is also damaging to soil and the earth.

Energy use and poor insulation are also problems with the large houses that are commonly being built. Even a medium sized house requires a lot of energy to heat and cool because of the way that rooms are sectioned off, which keeps air from flowing easily throughout the house. Energy cost is also related to the insulation in a house's walls. One of the most commonly used materials for insulation is polystyrene, which is more commonly known as Styrofoam. While Styrofoam is a great insulator and is waterproof, it cannot be recycled in any way and is extremely flammable. To counteract the flammability, the material is often coated in a chemical called Hexabromocyclododecane (HBDC). HBDC in your walls can seep into your

[1] "Construction Materials (Wood, Concrete, Steel)." *Construction Materials (Wood, Concrete, Steel)*. Exponent: Engineering and Scientific Consulting, 2010. Web. 29 Apr. 2015.

[2] "The Ugly Truth About Brick Houses." *This Old Crack House*. N.p., 11 Dec. 2005. Web. 29 Apr. 2015.

air vents and through the plaster, creating unhealthy breathing air inside a home.[1] Some common health problems associated with Styrofoam products, not just insulation, are insomnia, nervousness, and issues with hemoglobin levels.[2]

The way that architects and constructors think about insulation is not ecologically sound either. Insulation, when used alone, only blocks the passage of temperatures from the inside of a shelter to the outside, and vice versa, but it does not store temperature.[3] This means that it is helpful when bringing a room to a certain temperature, but is not very good at retaining that temperature. A house that is only using insulation will require more energy to keep rooms at a stable temperature.

The "ideal wall" would be one that incorporates a blockade of insulation coupled with a dense mass. Dense mass includes materials such as packed earth/clay, stone, and concrete, and it absorbs and stores temperatures in a way that insulation cannot. Because of a lack of air within the mass, temperature is allowed to seep into the mass and be contained.[4] When this dense mass is placed on the inside face of a wall, with insulation on the outside face, a perfect balance is struck. The insulation – which can be made of plaster, straw, and even recycled denim, cotton, and paper – keeps varying temperatures out of the shelter, while the mass retains the temperature in the room and releases temperature back into the space in order to keep conditions stable. By using this duel method in a regular house, energy only needs to be used in the initial stage of adding heat or cooling to a room, and then the dense mass and insulation can work to maintain the desired temperature. Adding a rooftop garden to your house can act as packed earth for dense mass and as natural insulation, helping cut down on energy costs as well as food costs!

HEATING AND COOLING

Even with the correct insulation, large houses can still use up a lot of energy to heat and cool. Is there a way to keep your home at a stable temperature without using any energy at all? I was surprised to find that there actually is, by using free energy available to us from the sun to create passive solar energy. This type of heating and cooling is an extremely simple concept that can be applied to almost any conventional shelter.

All passive solar energy requires is building your home in a way that absorbs sunlight to heat your home in the winter, and provides shade so your house can cool in the summer. *Building Green* by Clarke Snell and Tim Callahan explains how easy this can be. By putting a wall of uncovered windows on the south facing side of your home, you can take advantage of the low angle of winter sun. The thermal dense mass and insulation help store and retain the sun's energy to heat your home. Creating a shaded porch on the north side of the house blocks the sun at its high summer angle and protects the walls from becoming hot and adding unwanted heat into your home. Lowering shades on your south side windows adds to this effect, and presto! You can cool your house without costly air conditioning. Again, the insulation keeps out heat and the dense mass releases cooling energy to stabilize your home during the summer. [5]This type of passive energy is something anyone can apply in their home, and the renovations required to

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[1] "5 Most Common Thermal Insulation Materials | Thermaxx." *Thermaxx Jackets*. N.p., 28 June 2011. Web. 29 Apr. 2015.

[2] "Health Effects." Polystyrene & Health Homepage. N.p., 4 Mar. 1996. Web. 04 May 2015.

[3] Reynolds, Michael. *Comfort in Any Climate*. Taos, NM: Solar Survival, 2000. Print.

[4] Reynolds, Michael. *Comfort in Any Climate*. Taos, NM: Solar Survival, 2000. Print.

[5] Snell, Clarke, and Tim Callahan. Building Green: A Complete How-to Guide to Alternative Building Methods: Earth Plaster, Straw Bale, Cordwood, Cob, Living Roofs. New York: Lark, 2005. Print.

add the windows and porch would pay for themselves when you never have to pay an energy bill again.

WATER AND WASTE

Effective water use is another criteria that is preventing conventional homes from being ecologically friendly. Most of the water we use in our houses does have to be fairly fresh. Drinking water needs to be free of contamination, and sink and shower water should probably be clean as well, since you use it to clean yourself. However, why do we seem to need clean, fresh water in our toilets? This water is not going to be used for anything other than carrying our bodily waste from the toilet bowl into a septic system or something similar outside of our house.

Grey water is water that has been used, but does not contain any fecal matter, versus white clean water and black water, which has been contaminated with this matter. Grey water reclamation is the effort to reuse water in places that do not require fresh water.[1] Toilet water is the perfect example of a place where recycled water would be welcomed, since black water is usually what is created when water leaves the tank. Toilets can use anywhere from 1.6 -7 gallons of water per flush, which is a huge waste of fresh water. Imagine if your showers and sinks could drain into a grey water holding tank, and only that water was used to flush your toilet; we would cut down on about 27% of our home water usage.[2]

Grey water can also be used for irrigation, and in relation to shelters, as a way to water a backyard garden. Making sure your grey water is safe to water plants with is trickier than making sure it is safe for toilets. In order for you to be able to reuse water from sinks and showers as irrigation, there cannot be any harmful soaps or chemicals present. Some of the most common ingredients in soap that make in non-usable are sodium, chlorine, and boron. Low-phosphate soaps are also more plant-friendly in grey water than ones with high levels of phosphates and nutrients.[3]

Water conservation is important everywhere, but especially in places like developing countries with rapid population growth. The less water that is used, the less water needs to be transported to homes and businesses for use, and the less waste water is created during water treatment.[4] Water is not an infinitely renewable resource. Ground water is being used up and there are fewer and fewer available sources of fresh water. Around 760 million people do not have access to clean drinking water around the globe.[5] This makes it even more imperative that we focus on conserving and reusing any water that we can.

WASTE MANAGEMENT

Once we have made it so that our toilets are not wasting fresh water, we need to consider what happens to our waste instead of just flushing it out of sight and out of mind. It is imperative that the waste that leaves our homes is taken care of ecologically. When you flush the toilet, the

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[1] Lamb, Robert. "How Gray Water Reclamation Works." *HowStuffWorks*. HowStuffWorks.com, n.d. Web. 29 Apr. 2015.

[2] "Toilets." *Conserve H2O*. Regional Water Providers Consortium, n.d. Web. 29 Apr. 2015.

[3] Lamb, Robert. "How Gray Water Reclamation Works." *HowStuffWorks*. HowStuffWorks.com, n.d. Web. 29 Apr. 2015.

[4] Parrott, Kathleen. "Environmental Concerns and Housing." 24.3 (1997): n. pag. Housing Educators. Web. 29 Apr. 2015.

[5] "Millions Lack Safe Water." Water Facts: Water. Water.org, n.d. Web. 4 May 2015.

contents are moved either into a septic system or through sewers for sewage treatment plants to deal with. Upon its arrival to these plants, the wastewater is "cleaned" with chlorine and chemicals, further disinfected, and then the sludge will most likely end up in local waterways or ground water. Not only does this create water pollution, but a lot of energy is needed to clean the water.[1] This energy use is a huge waste of resources and money, since there is a clear way to fix this human waste problem.

Human waste contains water, potassium, phosphorous, and nitrogen, all of which can help enrich soil and help plants grow. It is not a novel idea to harvest the power of human waste through humanure (human + manure) and compostable toilets. These toilets move waste into an aerated holding tank where the thousands of bacteria in our body start to decompose the waste and kill off pathogens and viruses. The smell is kept at bay by adding layers of sawdust after each use, and once the holding tank starts to fill, the humanure can be removed, added to a compost pile to continue to percolate, and finally it is used to grow food (possibly on the roof-top garden you are already using to help insulate your home ☺).[2] Through this process of humanure, we can help add back to the earth and come closer to a closed loop cycle. If we grow our own food, take in the energy from the produce, then use our waste to make more food, we will be able to sustain ourselves and continue to cycle nutrients from the earth into our bodies, and then back into the earth.

[1] Von Klan, Gwendolyn. "Poop Matters | The Daily Californian." The Daily Californian. N.p., 24 Apr. 2012. Web. 30 Apr. 2015.

[2] Von Klan, Gwendolyn. "Poop Matters | The Daily Californian." The Daily Californian. N.p., 24 Apr. 2012. Web. 30 Apr. 2015.

Part Three:
Consumer Goods

LINEAR TO LANDFILLS

Even if we can build ecological homes, we still need to consider what we are filling our homes with. Let us return to the carpet from the very beginning of this essay. Remember how it is currently being designed with a landfill as the goal for its final resting place, but how a much more sustainable system could be created? Well this is how the majority of the products that we buy are designed and used. *Cradle to Cradle* by William McDonough and Michael Braungart discusses how humans seem to have an obsession with virgin materials and products. An item is deemed less worthy if it has already been used once or if it is a few years old.[1] Society and industry have geared consumers towards this type of thinking in order to get them to buy into this system of constant extraction without giving back. This linear system is built on the concept that throwing something out when it gets old so that you can buy a new object is good, and the most profitable way to conduct business. This is extremely far from true.

Companies built in this way will eventually end up running themselves out of business. Extracting without replenishing resources means that at a certain point, the company will run out of raw materials. There will be nothing left to extract, and therefore no more products or money to be made. Natural resources are usually either non-replenishable, or take tens or hundreds of thousands of years to build back up, so any industry that uses without restoring cannot be sustainable.

Look around the room you are in and try to count all of the individual items in it. After only a couple of seconds it is clear that if you were to count them all, the number would be in the high hundreds, maybe even in the thousands. Now think about how many of them just sit around without being used. Every single one of these objects was made in a factory somewhere, probably in another country, probably with lots of chemicals, and the process probably produced tons of waste. It is these costs that we have to think about when we decide what to fill our houses with.

Similar to a super market, when walking through a store, it is extremely common to see mislabeling that advertises a product as "eco-friendly," which makes the consumer feel good about buying the item, but more than likely the product is not very ecological. First of all, there are not any real laws or certifications that a company needs to obtain before putting "eco-friendly" on a label. A product marketed as environmentally friendly could actually be a cradle-to-cradle type of product, it could just have recyclable packaging, or it could just have fewer chemicals in it then it might have otherwise.

WASTE AND MATERIALS

PRODUCT PACKAGING IS ONE OF the biggest sources of waste in the world of consumer goods. Why are shampoo and conditioner, things you only use for a few weeks at a time, sold inside plastic bottles that will remain on Earth for infinity years after you are finished with them? It does not make any sense. The same goes for plastic cups, plastic utensils, soda and other beverages, and a plethora of other products sold in packaging that will long outlast the product.

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[1] McDonough, William, and Michael Braungart. Cradle to Cradle: Remaking the Way We Make Things. New York: North Point, 2002. Print.

Some may make the argument that all of this plastic can be recycled, but this is just a way to ease the mind. Firstly, many people across the globe either do not care enough to recycle, or do not have access to recycling systems. Also, many towns, such as my hometown, only recycle a few types of plastic, which forces even the most diligent environmentalist to throw millions of plastic products into landfills where they will remain forever, slowly breaking down into smaller and smaller particles, but never decomposing. These microscopic plastic particles, especially those from litter, which are filled with chemicals and toxins that were never meant to be ingested, can eventually end up in our water, food, and soil. Plastic is like that annoying friend that follows you everywhere and cannot take a hint to get lost. We need to end this plastic culture that industries are so fixated on and find alternative materials to make our products out of.

There are many types of packaging and materials that try to be less bad by using mixtures of compostable or recyclable materials with plastics. The thinking behind this is that not all of the packaging is bad, so it must be more ecological. What this ends up creating is, as referred to in *Cradle to* Cradle, a Frankenstein material[1], or a material that cannot be returned in any way back into a system. Cardboard lined with a thin plastic layer is a great example of a Frankenstein material, as are chip bags, which are plastic lined with shiny metalized film layer. To understand this further, we need to understand the two types of systems that consumer goods are a part of: the biological and the technical cycles.

The biological cycle refers to the natural cycle, and every product that hopes to be returned into the biological metabolism needs to be able to be consumed by the soil and its microorganisms or by animals. Conversely, the technical material cycle is the industrial cycle and the products within it must be able to be effectively recycled or reused as new raw materials within the metabolism.[2] For these cycles to remain pure and as true cycles, there cannot be any overlap. A product that is a mixture of inseparable biological and technical nutrients cannot go back into either cycle, and it is these products that will end up in a landfill where they are no use to anyone.

When creating a product and deciding what materials to use, a company needs to design with the product's end of life as the driving factor for decisions. This end of life can go one of three ways. It is either returned back into the technical cycle, returned back into the biological cycle, or is designed so that it can be dismantled, with some parts returned to each cycle separately. This last option is probably the most realistic and requires a new level of thinking about design that very few innovators have reached. The general rule is the fewer materials used, the better and more ecological the product will be. If both technical and biological nutrients are used, product disassembly needs to be user friendly so that it can be done quickly and efficiently. Fewer product parts and fastenings that do not require fancy tools can make this disassembly easier and faster. [3]

RETURN AND REUSE

[1] McDonough, William, and Michael Braungart. Cradle to Cradle: Remaking the Way We Make Things. New York: North Point, 2002. Print.

[2] McDonough, William, and Michael Braungart. Cradle to Cradle: Remaking the Way We Make Things. New York: North Point, 2002. Print.

[3] "Designing Cradle to Cradle Products for the Circular Economy." Cradle to Cradle Product Design: Designing for a Circular Economy. Cradle to Cradle Products Innovation Institute, n.d. Web. 30 Apr. 2015.

If a company cannot find a way out of using plastic or Frankenstein materials, they need to find an efficient way of repurposing the material. One of these methods is making packaging easily returnable for reuse by a company. This could mean being able to return your shampoo bottle back to the company where is could be cleaned out and then reused and resold with new shampoo inside. By doing this, plastic materials do not run the risk of being downcycled in quality during the recycling process, and companies will not have to pay for raw materials and the creation of new packaging.

Another form of this idea can easily be shown with technology. Right now, when our phones or computers stop working, we dispose of them, and then buy a new one. What if, instead of creating all that technological waste, you could return your computer or phone and get paid the market value for each of its parts. The company would then dismantle the technology and reuse the materials to create new phones or computers. Although the company is paying for the materials, it would not have to pay for the extraction, transportation, or building of the parts. All this requires is that the company designs with this end of life in mind, making the technology easy to dismantle and making the parts durable for reuse. This same concept could be utilized with washing machines, refrigerators, and even cars.

The only cinch in these types of products is figuring out how to incentivize companies to want to change the way their products are created. Although we can see that ecological companies often have fewer costs to take care of than purely industrial ones, many big companies do not see the value in taking the time to redesign their product to have a more ecological end. Why should they put in the effort to change their business model if they are already making more than enough money already? This attitude is the effect of money driven economy – once a product is in the hands of a consumer, it is out of sight and out of mind and the company ceases to care about what happens to it. So, what if instead of selling a product, companies could lease a service?

For example, General electric could lease a household a washing machine and a dryer for 100 loads of laundry. Once this maximum is reached, G.E. would come and pick up the washer and dryer and lease them to another family. By adapting this business model, companies are responsible for the product if it breaks or malfunctions, and are more likely to create a longer lasting product. They are also responsible for dealing with it once it can no longer be used, and it would benefit the company to be able to reuse the parts to create new revenue. This type of restructuring is what industries need to adapt if we want to be able to reduce waste in consumer goods.

Part Four:
Incentivizing

THE CONSUMERS

The only reason that industries can get away with putting harmful chemicals in our food, creating mass amounts of waste and pollution, creating poorly-made products that do not last, and destroying the environment that is keeping humans alive is because consumers are willing to buy it. We, as humans and as consumers, need to educate ourselves about what is going on in the world around us. If every company released the full contents and health risks associated with every product, and released how much waste they create daily, and how much labor they exploit, consumers would probably not buy half the things they do, just based on moral reasons, let alone environmental ones. It is integral that we stop sitting idly by as the actions we do everyday slowly kill the human race. Stopping buying food and products that you know are wasteful puts pressure on the companies creating them and shows them that consumers want something else. Any company that is profit driven (which is basically every company) will make fast changes upon seeing this.

This pressure on companies is key in switching our economy from one that supports waste to one that embodies closed loop cycles. If industries are getting the message that all that consumers care about is price, then they will continue to produce cheap products in high quantities. We need to base our purchases on more than just price, and put ecology and sustainability at the top of our requirements. Right now, even if a consumer wants to support local economies, or buy ecoagriculture raised meat and produce, or change the layout of their home so it requires less energy, these changes are either more expensive than their counterparts, or there simply are not enough options on the market for consumers to choose from. Suppliers need to provide consumers with options and make it easy to do the right thing; otherwise they will always gravitate towards the cheapest practice. By making it clear that we want ecological answers now, these answers can become the norm and therefore easier and less expensive to buy. We need to use capitalism to our advantage to recreate the system into one that will benefit humans infinitely.

THE GOVERNMENT

Apart from consumer pressure, if utilized correctly, the government can be a key role in pushing industries in the right direction. By providing incentives such as tax breaks, money, or subsidies, companies are still given the choice to keep their current business model, but will be greatly rewarded for change. Some examples of incentives are: tax breaks based on the amount of carbon is sequestered on your farm, which is directly related to the amount of grass present in pastures; households could be paid for the amount of compost they produce, or could sell compost back to the community in systems such as CSAs; just the lack of energy needed to heat an ecologically built house should be incentive enough. Taxes could also be placed on things like pesticides, chemicals, and factory-farmed food to de-incentivize them to companies and consumers.

The key to all of this working, however, is education. No company will want to change if they do not understand why the need to. Providing all aspects of an industry, from the designers, to the producers, to the CEO of the company with a mean to educate themselves on the environmental impact of their actions will help them understand why change is essential.

HUMANIST VS. ENVIRONMENTALIST

All of this information has just been dumped on you, and it can be very easy to push it off, forget about it, and continue on with your life as you have been living it. In the name of the human race, I urge you not to. Because of the modern age's "unbridled consumption," scientist Professor Frank Fenner who studied and helped wipe out smallpox, has predicted that the human race will go extinct within the next hundred years.[1] 100 years. That is all we have left if society does not undergo a huge structure change right now. We cannot kid ourselves and say we need to change for the environment; nature and natural cycles will continue to exist and evolve no matter how much we screw up this planet. We need to change, because if we do not, humans face the very real threat of mass extinction.

If you are a humanist, if you value humans as creative and intelligent individuals who can think and act for themselves, then you are an environmentalist. Through pollution and waste, we are quickly creating a world that humans cannot survive in. Honestly, if the human race cannot wrap their heads around changing for the better, then it might be better if we do go extinct. We are not the most important organism on this planet, or even in the universe, so why are we any different than all of the animal species that have gone extinct because of our actions? The only reason we would survive is because we are actively working to do good, and to add back to the planet that has been struggling to sustain us for billions of years. People often think that environmentalism means cutting back on consumption, or living off the grid outside of society, or renouncing capitalism, but it does not have to be like this. We can create a world where goods and services, shelters, and even capitalism are ecological ideas and practices. It is all possible if we are just willing to work for it, and if the human race wants to survive, we have to work for it. We need to wake up before it is too late. Come over to the green side and help the human race create a world that we can live in.

[1] Edwards, Lin. "Humans Will Be Extinct in 100 Years Says Eminent Scientist." Phys.org. N.p., 23 June 2010. Web. 30 Apr. 2015.

Part Five:
The Future

It is the year 2067. You wake up in a bed made completely out of recycled materials, covered in organic and compostable sheets made in a factory where the water leaving it is cleaner than the water that entered it. Your pajamas are made of a similar material. You walk into the kitchen, which is being kept at a comfortable temperature by the wall of windows letting the morning sunlight in. Breakfast is eggs and bacon from the farm down the street that taste better than any eggs and bacon you can remember from before the ecological crisis of 2033. You wash your dishes, brush your teeth, take a shower, and listen to all of the water drain into your grey water holding tank. This tank is connected, not to your toilet, which does not require water because it composts waste, but to the irrigation system you have for your rooftop garden.

As you get dressed in clothes made out of the same organic and compostable materials as your sheets and pajamas, you think about the long day ahead of you. You work for the leading producer of graphene, a super strong material made of carbon that has replaced the need for plastic.[1] You walk out the door, get into your wind powered car, and drive to work on roads made out of solar panels that provide the whole city with cheap and renewable energy.

Your office building is low to the ground and built similarly to your house – it does not require any energy to keep it at a stable temperature. The windows that line one wall of the building mean that you never feel trapped and bored at work like you used to pre-2033. The refrigerator in the break room is on its last legs, and the repairman is coming by today to remove and replace the motor. Repairs have gotten much easier ever since refrigerators, along with most other products, were redesigned to be easily dismantled and upgraded. The day is coming to an end, you made a lot of sales today.

You say good-bye to your coworkers, walk outside and hear the city bustling around you. You unlock your car, use the solar energy the car has been soring throughout the day to give your car the little bit of starting power it needs to begin generating its own wind, and you are on your way home. As you drive back over the solar grid, you think about the fantastic meal your spouse is currently preparing at home: roasted chicken and mashed potatoes from the farm down the street coupled with sautéed spinach from your own garden. You sigh to yourself as you remember a similar drive home, almost 35 years ago, through a town strewn with trash from over flowing landfills. Even though you wish it had never come to it, you are a little grateful that the world reached crisis status; it forced huge changes on politicians, industries, and consumers a like. Finally, you do not have to lay awake at night wondering if you will be able to safely breathe the air outside your home, or drink the water being pumped into it.

As you pull into the driveway, enticing smells fill your nose and a smile breaks across your face. After so many years of worry, you are finally safe. The human race is secure and sustained; this is the world that will continue to exist for so many generations to come.

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[1] Fogelstrom, Mikael. "Graphene, from a Layer of Atoms to Applications." TED@BCG. Germany, Berlin. TED. Web. 4 May 2015.

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