

G. Challenges of Feeding the Global Population

While the global food situation has improved drastically over the past 70 years, humanity still faces the challenge of feed a rapidly growing population. In the 1800s, Thomas Malthus was concerned about humanity reaching a total population of 2 billion people. Despite humanity bringing the global fertility rate close to 2.1, demographers predict with demographic momentum will carry the total population to 10-11 billion by 2100. What challenges must humanity overcome to feed 10 billion people?

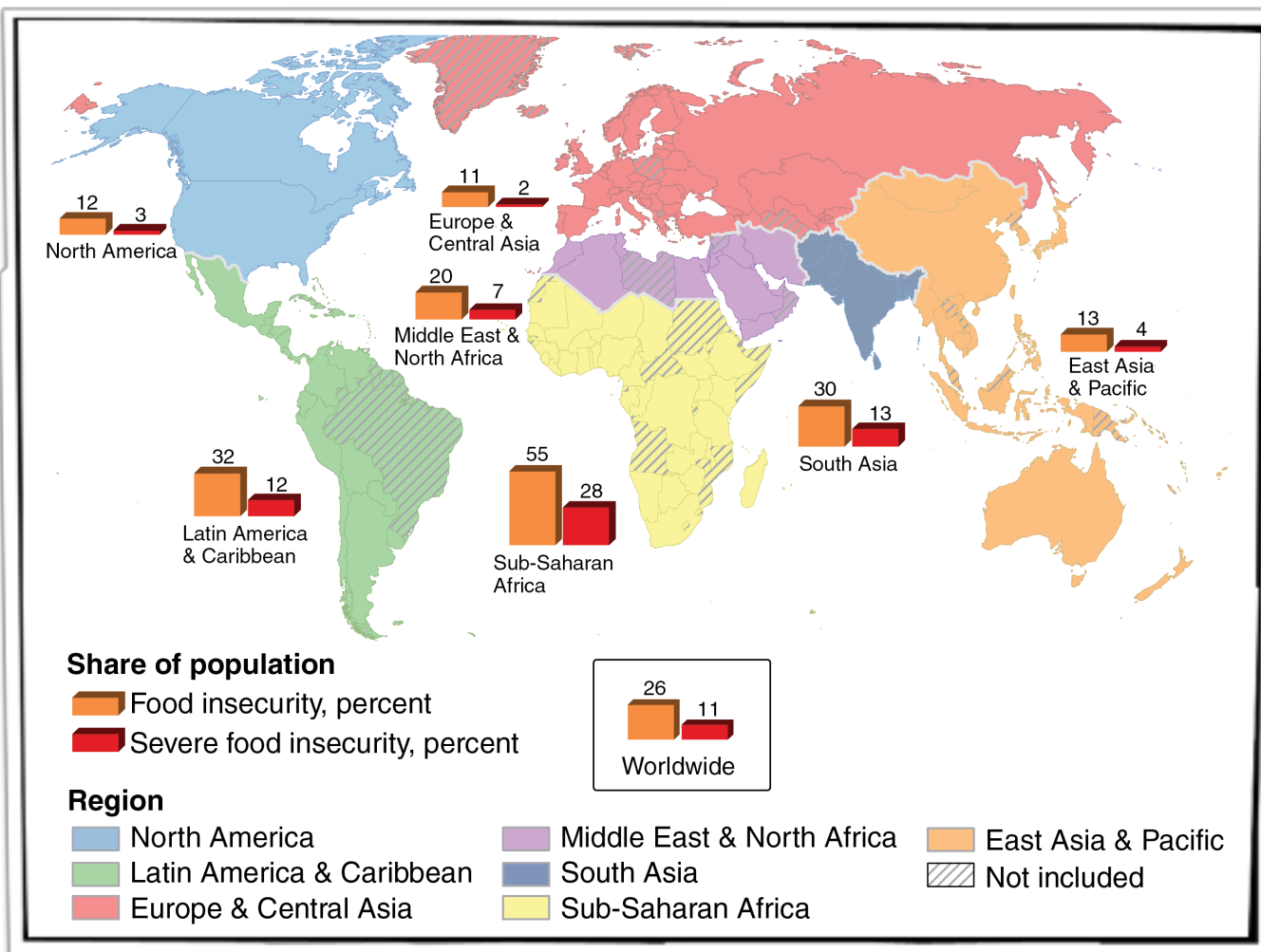
Barriers to Going Green. While the Green Revolution improves the output of farms, there are significant barriers a society must overcome to be able to implement it to achieve success. While some periphery states have successfully attempted to implement Green Technologies, others have experienced a “boom and bust” because they were no setup to sustain the annual requirements of the system.

- **Political Stability & Support.** The first barrier for periphery states to overcome is political stability. The government plays a key role in the development, implementation and annual sustainment of the green technologies.
 - **Protection.** Governments must ensure the protection of farmers and farm land from threats inside and outside the state. When a state is burdened with war, theft, violence, gang activity, or terrorism, farmers and government officials are not able to focus on being productive.
 - **Private Property Rights.** Governments must provide and protect private property rights. The farmers must know that they are in control of the land and the profits from the land. When farmers feel the state can come and take the land or harvests at any time, they are hesitant to put more time/money/effort into the property. The governments need to zone fertile lands for agricultural use and then provide and protect the farmers rights to the land.
 - **Subsidies.** Farming in the Green Revolution is expensive. Intensive subsistent farmers need financial assistance to purchase all the tools, machines, irrigation, seeds, and chemicals. For farmers living on \$2 a day or less, these tools and seeds are financially out of reach. If the state does not provide the impoverished farmers subsidies, the wealthy/elite will be the only ones who can take advantage of the new opportunities. This would create a permanent social and economic inequality.
 - **Infrastructure investment.** For effective movement of tools, people, and resources, there must be an effective transportation and communication network. The government needs to zone the land, hire the engineers and construction crews, purchase the resources... In a periphery society, there must be effective government leadership and organization of the limited resources to achieve the establishment of key networks.
 - **Trade Agreements.** The government needs to find markets for the influx of new crops. The costs of the Green Revolution is supposed to be offset by the profits made from exporting the surplus. Trade agreements and working competitive advantages secures the sale of the harvest. This money pays forward to purchase the next years crops and supplies. Without it, the society will experience a quick boom, followed by a massive “bust.”
- When the government is experiencing instability or corruption, these vital roles are left unfulfilled. If these are left unfilled, then the green revolution will either fail to launch or become a failed endeavor with massive debt consequences that crush the economy for the foreseeable future.



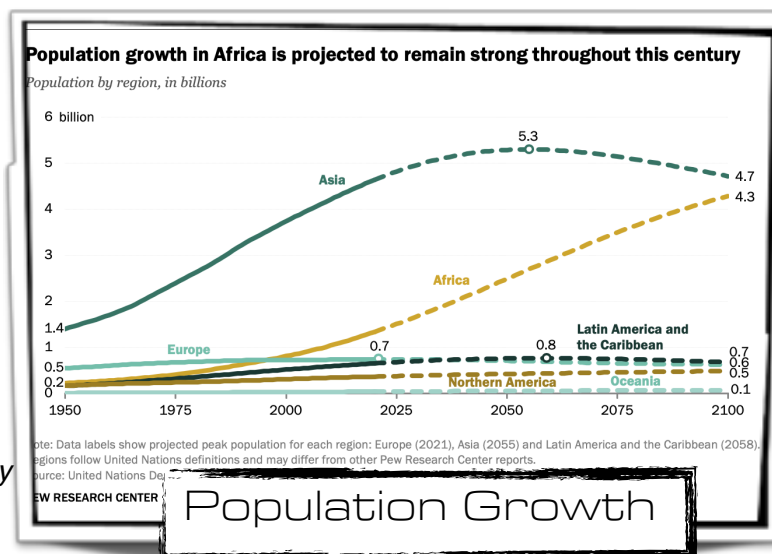
- **Financing & Credit.** Societies with low GDP and massive debt must find a way to finance the seed, chemicals and tools. Governments must secure development funding from organizations like the IMF and the World Bank. This can be difficult when the state already has massive debt from previous loans, or a poor credit score that hinders the ability to get outside resources. Revolutionizing the primary sector is nearly impossible to achieve and sustain without having access to the right financial tools... AND a well developed strategy for using the wealth in the correct ways.
- **Stable Market Economy.** The Green Revolution is built upon the ability to fund the tools for mass production through market based capitalism. Farmers need to be able to transition from being intensive subsistent farmers to commercial farmers, being able to sell their surplus to local, regional and global markets. When a society's has a dispersed, isolated, disconnected population that meets its economic needs through informal bartering, it is ill prepared to handle the trading needs of the farmers. When farmers cannot sell their harvests, they will not have the resources to continue to purchase the seed, chemicals, and energy to run a commercial farm. Governments need to allow free market principles, backed by stable banks, with a stable currency.
- **Reliable Transportation Network.** Commercial Green Agriculture is reliant on transportation. They need to be able to overcome the friction of distance in every aspect of the farming process. In a periphery society, the Green Seed, chemicals, gasoline, and farm equipment are all developed and exported from core societies. The state must have ports, rail/roads, energy stations, and lines of communication to get imported resources to the farmers. Similarly, increasing the yield of farmers is meant to help their local community AND to be able to sell for profit on regional and global markets. However, containers and transportation has be able to get to the farmer in order to get the harvest to the world. Periphery governments need to invest in the land and financial resources to build transportation, along with the skilled engineers to build them - if they do not have some already in their state.
- **Cultural Willingness to Acculturate (or Assimilate).** People hold on tightest to their cultural traditions. Periphery societies are home to diverse cultures, who have developed rituals, practices and techniques over thousands of years. These techniques are about survival, having served the culture for generations. However, for the Green Revolution to work, farmers (and their fellow citizens) need to be willing to set side their cultural practices in order to embrace the scientific methods and industrial tools required for the Green technologies to work. The most successful green revolution stories have witnessed mass assimilation to the industrial tools. Farmers have to be willing to be come more than farmers. They have to be scientists, researchers, marketers, businessmen...





Regional Food Insecurity.

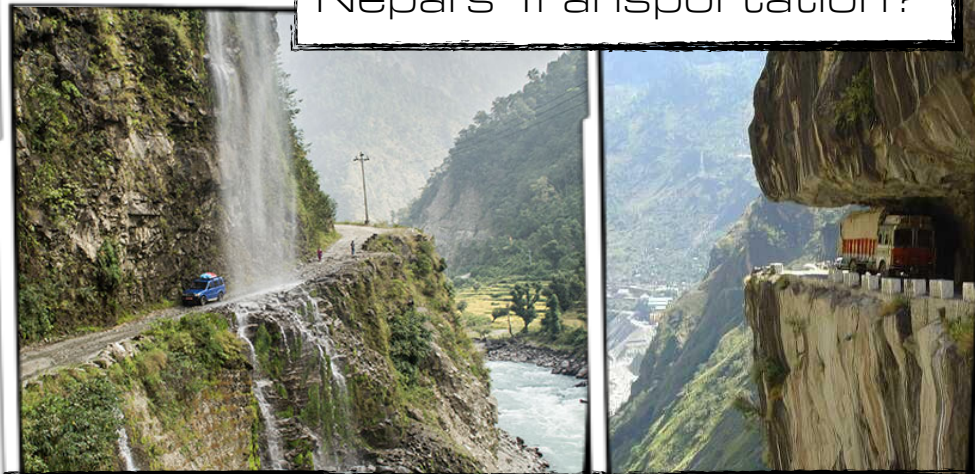
Food insecurity is defined as “The state of being without reliable access to sufficient quantity of affordable, nutritious food.” As has been discussed previously, regions with high food insecurity have systematic barriers that hinder their ability to provide the quantity and quality of food the populations need. One aspect is geographic. The areas of highest insecurity (Latin America, Subsaharan Africa, and South Asia) have tropical climates and arid highlands. Tropical climates have nutrient poor soil, plus struggle to grow the high yield cereal crops. The highlands are arid, prone to droughts and famines. For example, Somalia and Ethiopia have faced severe droughts that have lasted multiple years in 1984 and 2017. The region has started another drought cycle, with 8.4 million people expecting to need UN assistance in the year 2020. A second aspect is levels of industrial development. Many rural areas of these regions lack access to electricity, clean water, sanitation and roads. They have not been able to get access to the industrial tools necessary to increase farm production, nor access to affordable food crop imports. Finally, population increase. Asia and Africa are both in the process of experiencing a Stage 2-3 population boom. Asia started experiencing the Stage 2 population boom starting back in the 1950s. They are now at low Fertility Rates, waiting for demographic momentum to slow down their population growth. Africa started its developmental growth in the late 1970s. They are just now decreasing their death rates, preparing to boom over the next two years. Africa’s population is expected to double by 2050. This rapid population is taking place in some of the same regions struggling with food insecurities due to geographic or government barriers.



Systematic Food Distribution Problems. The world's farms are producing enough food to feed the world, but the food crops are not making it to the mouths of the 1 billion starting people on the planet. This distribution issues has a number of culprits. First, crops sell to the highest bidder. As a result, substantial portion of all the food grown in the world ends up being fed to livestock animals or to non-edible purposes. For example, over 90% of corn is distributed to either farm animals or to produce ethenol. Second, insufficient markets. Many rural periphery regions lack the supply chains for multinational corporations to be able to sell directly to the customer. They lack the established store fronts who sell the goods of many multinational groups. Instead, they have local farmers markets, where each farmer sells their own wares; or informally exchanges for their needs. Even if the society did start to open businesses, the people do not have the income to afford purchasing the food anyway. Finally, regional food insecurities is tied to poor transportation. Some states have poor transportation networks because it has been a lack of political focus, or because the geography makes highways or railways extremely difficult to install. Transportation is essential for getting food to insecure regions... however the region's isolation is a key reason for their insecurity to begin with.



Nepal's Transportation?

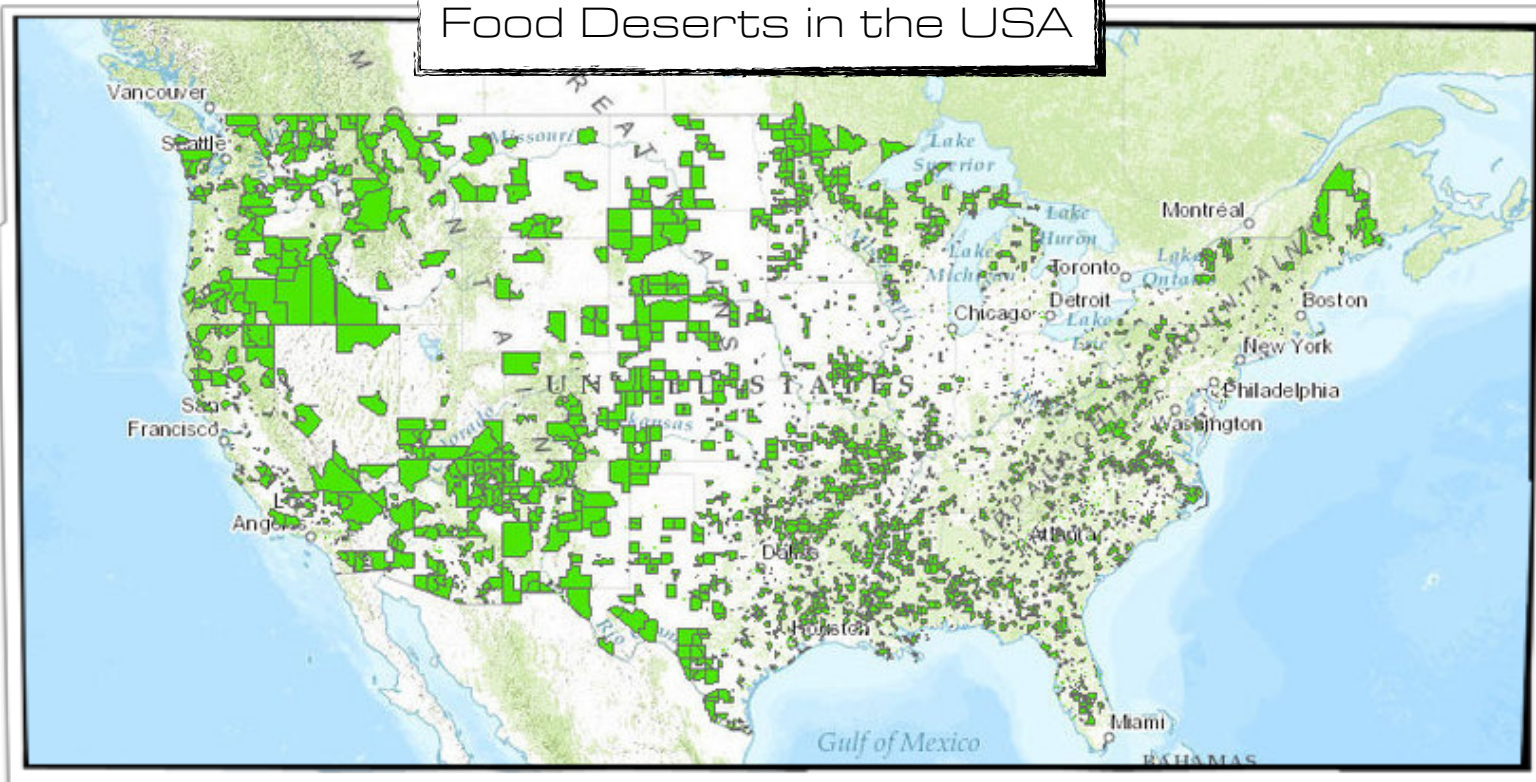


Application #1: What role is development and road infrastructure playing in Nepal's food insecurity?

Food Deserts. Food insecurity is not confined to the periphery. In the core, populations are 85-95% urbanized with interconnected roadways and telecommunication. However, that does not mean everyone is having equal access to the necessary quality and quantities of food to live a healthy lifestyle. Many urban areas in the core have food deserts. A food desert is defined as low income metropolitan/urban areas where 33% of the residence live more than 1/2 mile from the nearest grocery store (10 miles away in rural areas). In the USA, with the world's largest GDP, there are 6,500 metropolitan areas that have been defined as food deserts. These regions are home to 23.5 million people (7% of the US population). Geographers are able to determine where food deserts are located by mapping the spatial distribution of grocery store locations along with demographic data from the census. They can then measure the distance from the stores to the people. The geographers also map other factors like average income, race, and age to better understand who are living in these food insecure areas.



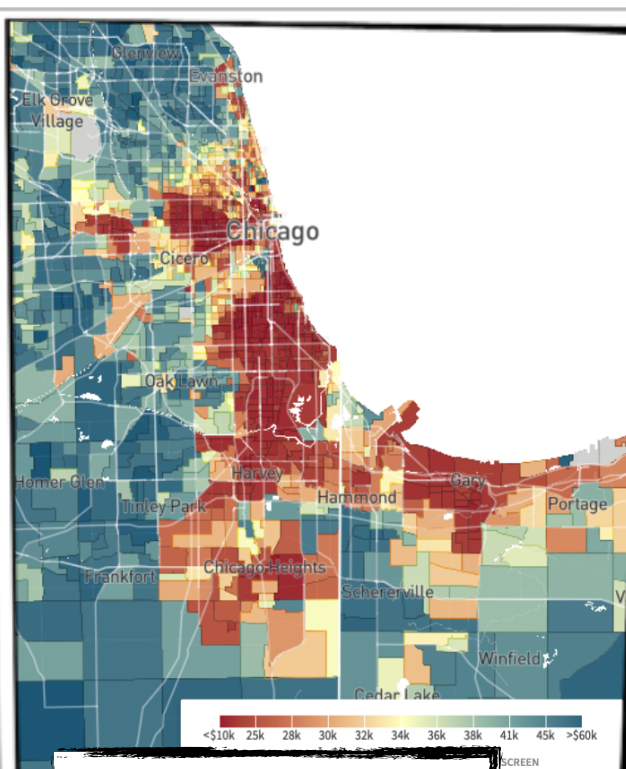
Food Deserts in the USA



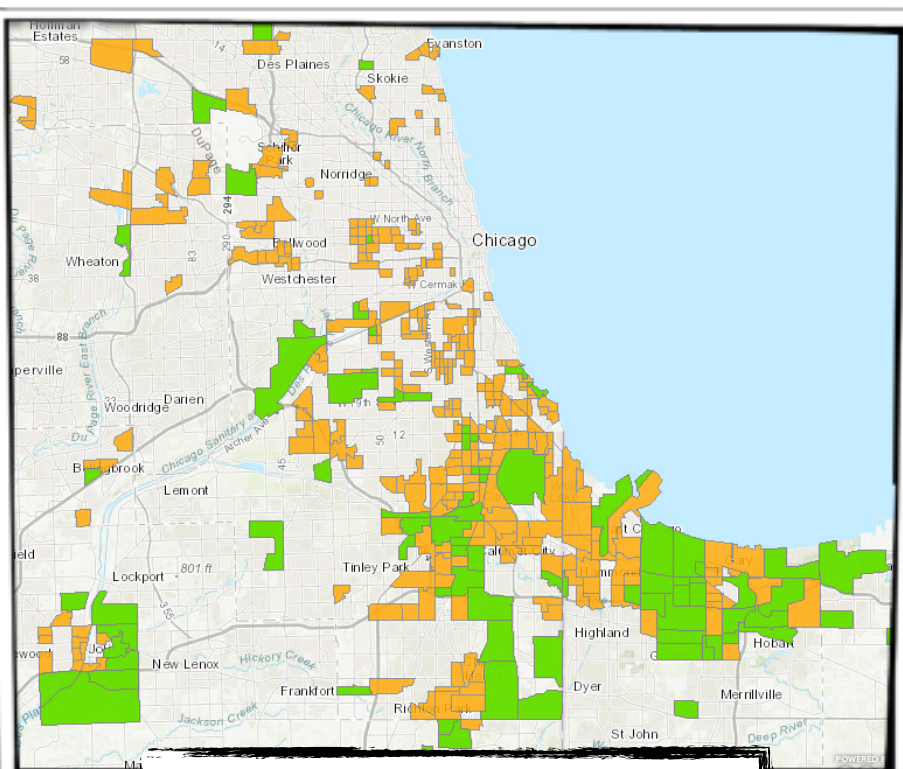
How can this be possible? The USA grows enough 838 billion pounds of Corn/Wheat/Soy and 82 billion pounds of beef/chicken/pork. That equates to EVERY PERSON in the USA getting 7 pounds of grain and 2/3 pounds of meat per person, and 8+ pounds of Fruits-Vegetables per day, every day of the year. With these numbers in mind, how can 23 million Americans living in food deserts without access to healthy food?

- **Economies of Scale & Subsidies.** Most of the unhealthy processed food in the USA (and the world) ties back to grain crops like corn, wheat and soy. These extensive crops are grown in massive quantities with comparatively little human effort, on the least expensive land in the USA. The result of high mechanization applied to farms over 2,000 acres is a product that is phenomenally inexpensive. For example: 1 ton of corn sells for \$37 (including shipping and packaging fees). This equates to 2 pennies per pound of corn. Comparatively, fruit and vegetables are very human labor intensive - especially harvesting. Humans are still need to pluck oranges and apples, strawberries and lettuce. This is slower, more costly and significantly less efficient. As a result, the cost is significantly higher. For example, Strawberries sell for ~\$2.50 per pound, Apples and Oranges for \$1.18. Compared to the \$.02 per pound of the corn, that is a phenomenal difference. Thus, the cost of corn, wheat, and soy based products is going to be significantly less expensive than fresh fruit (and with packaging, will preserve longer).

On top of the economies of scale is in the uneven distribution of government subsidies to farmers. Subsidies are payments from the government, using tax dollars to support a particular cause. Subsidies are used to support businesses and to help them be competitive on the global market. With government money helping to cover the bills, farms can sell at a lower price while still making a profit. In 2008, the federal government subsidized the commodity crops (corn, soy, rice, wheat, potatoes) with \$39.6 billion. Comparatively, fruits and vegetables only received \$4.7 billion. As a result, the cost of grain crops were artificially reduced, while the cost of fruit - which was already more expensive by nature, became comparatively more expensive. The result at the store: corn, wheat, soy and rice products give the customer significantly larger quantities of food per purchase, at a lower price than fresh foods. Corn, wheat, potatoes, and soy are the base ingredients for almost all of the high calorie, low nutrition processed foods. As a result, those processed candies, chips, carbonated beverages (pop/soda), and donuts sell in the grocery store for a larger quantity at a lower price compared to the fresh fruits and vegetables.



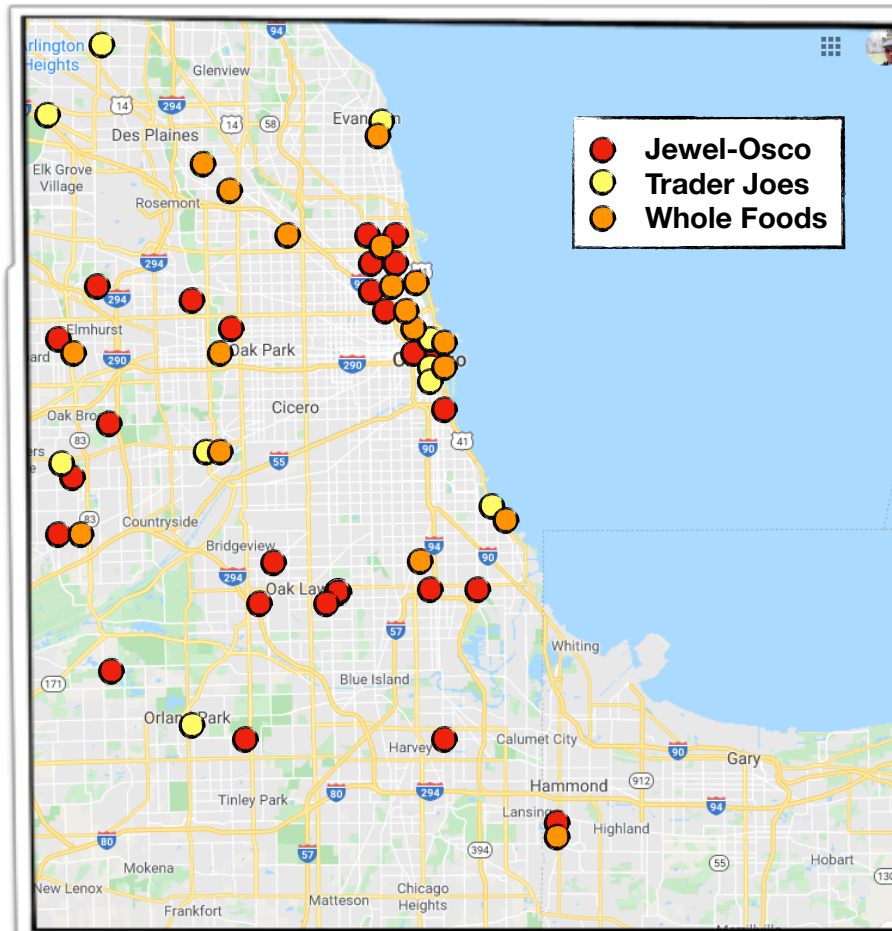
Chicago Income



Chicago Food Deserts

Application #2: How would you describe the spatial distribution of wealth and poverty in Chicago? What is the relationship between income & food deserts in Chicago? Why did the grocery stores place their grocery stores in these locations?

- **Uneven Distribution of Wealth.** The USA is number one in the world for GDP, but not everyone is experiencing the same levels of prosperity. For example, Chicago is the 3rd most-prosperous city in the USA, producing a GDP of \$680 billion. It is an urban area that is home to 10 million people. The wealthier areas average \$75,000 annually, while a few blocks away people are living on \$15,000 annually.
- **Chasing the Money.** The number one rule of business is to make money. Grocery stores/supermarkets are businesses, not charities. As a result, grocery stores locate themselves to where the greatest wealth opportunity is found. In modern America, the wealth has distributed itself in the suburbs - many miles outside of the CBD, where a car is a necessary requirement for transporting people and goods. The major grocery stores have positioned themselves to where there are dense populations of wealthy families. They are largely absent from the low income areas. The map displays the locations of a medium-to-upper scale grocery store in Chicago. Why did they choose these locations?



The stores that do choose to locate in the low income areas tend to focus on addictive substances like fast food chains, processed junk food, and liquor stores. All of these stores have high quantity products, that have an addictive element to them, for a low price. Beef and fries for \$2 sounds like more food than a carton of strawberries for \$2.50. If these corner stores and street vendors do have fruit or vegetables, they do not carry very many of them. Thus, the demand will be higher than the supply - justifying the stores charging 2-3x the price that the suburban grocery store for the same product.

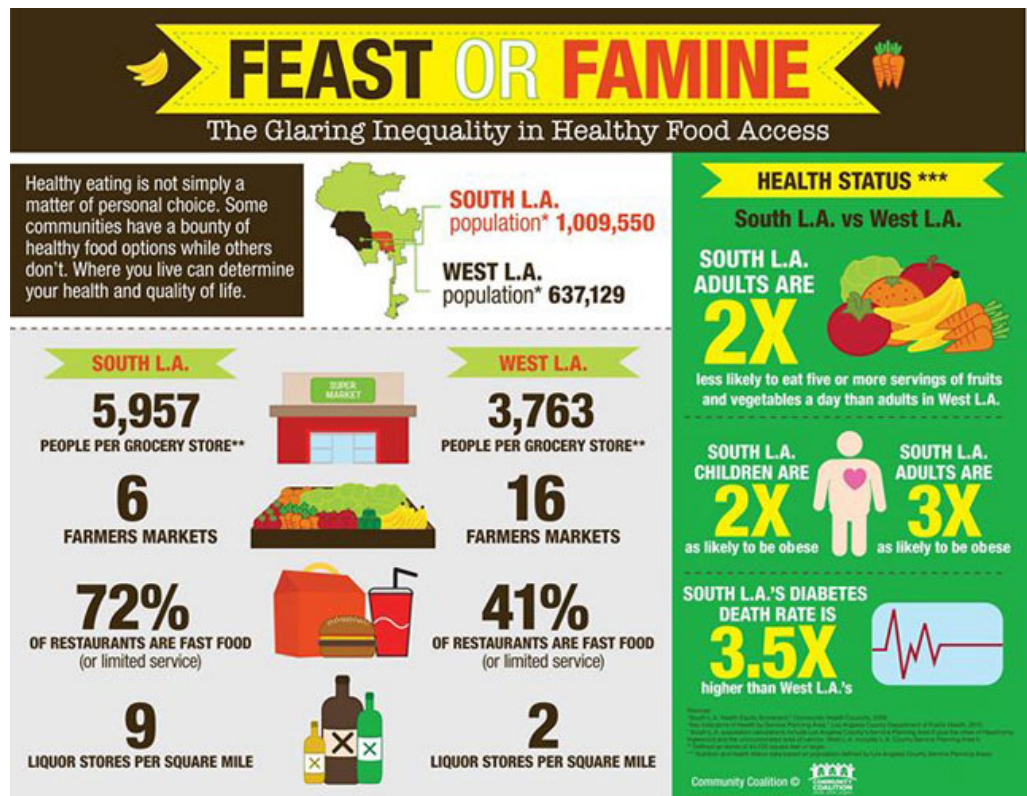
- **No Money, No Car.** Thus, improvised residents have two major major problems: how to get to the grocery store and how to pay for the food once they get there. For families below the poverty line, it is impossible for them to own a personal car. Just the cost of taxes and insurance for OWNING the car are \$5,000+ per year - not including parking, highway tolls, gasoline, oil changes, tires, etc, etc... For a family that is making \$15,000 per year (\$1,250 per month, \$312 per week), that is 1/3 of their yearly income. That does not include their other bills like rent, electric bill, water bill, etc. Without a car, 1/2 mile to a mile becomes a very long walk - especially carrying groceries. This is especially true if the person is elderly, an injured veteran, a person who is physically disabled, or a family with many small children. What if the nearest grocery store was 5 miles away or 10 miles away? What is their chance of even making it to the store? Would it be worth the hassle and effort?



How are any of these residence supposed to the grocery stores in the suburbs? One way to get around is public transportation like buses and subways. Public transit is functional when there is enough people paying to ride to support the costs of maintaining the transportation. Since the suburbs are built around owning a car, not many people ride the bus or train. As a result, not many buses or trains/subways are even built to come out to this area. As a result, even if a person from a food deserted wanted to take public transportation to these suburban grocery locations, they could not because of lack of access.

If the person makes the journey to the grocery store, they run into the problem of costs: they cannot afford to purchase the healthier foods. The average amount of money an American household spends at the grocery is \$165-\$345 per week (\$660-\$1380). That represents 50%-110% of their monthly salary (not to mention the cost of any transportation to go to and from the store). When faced with the choice of two big bags of potato chips or corn chips for \$2.50 or 1 package of strawberries for \$2.50... When a box of 10 Hostess Twinkies for \$2.80 compared to \$3.99 for a pound of organic apples? It becomes financially difficult to make the healthy choice, especially when corner stores and street vendors sell the packaged, processed junk food within walking distance of where they live. As a result, people determine their purchases by quantity they can acquire and the number of meals they can get from their purchase, not the nutritional value of their their purchases. This is why fast food chains thrive in lower income communities: a person can get a fully prepared meal for \$2-3, as opposed to one bag of apples or package of peppers.

The food a person can purchase becomes a status symbol in their community. In low income communities, food assistance programs - like Food Stamps, SNAP, or WIC - are commonly used. The ability to buy brand name food, luxuries deserts like ice cream and candy, and restaurant food - like McDonalds - become status symbols (similarly with name brand clothing, like Air Jordan shoes). The problem is that these junk foods, deserts and fast foods have addictive chemicals that make the brain develop an addiction, while distorting their tastebuds to natural food. Thus, when the family does go to the store, there are not many fresh foods available, the fresh foods are more expensive, they have a social stigma attached to them, and the family members (especially children) demand the sugary/processed foods.

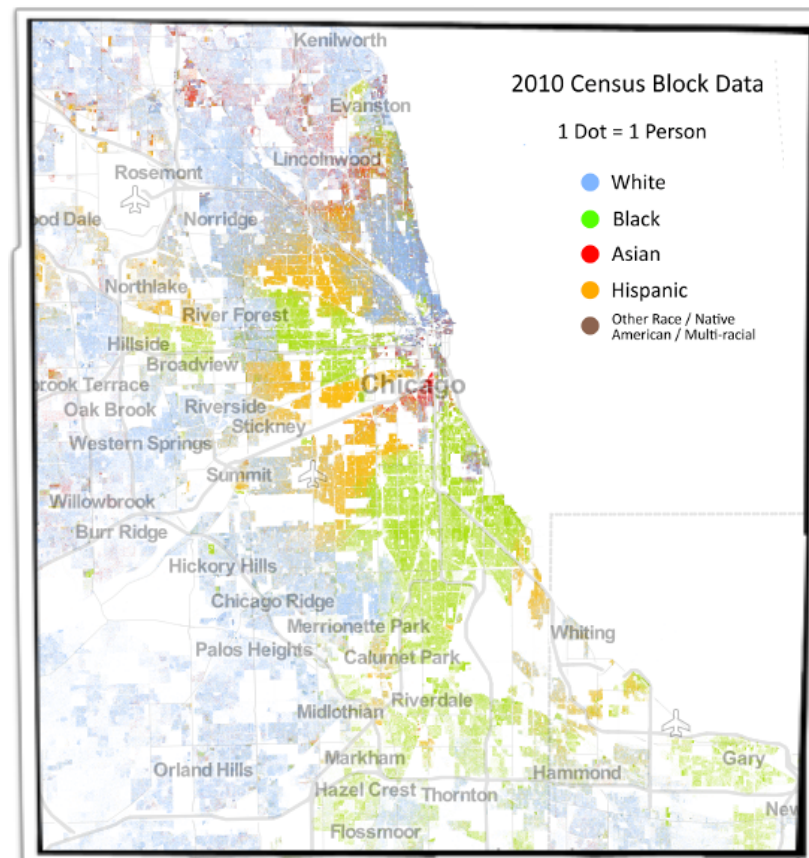


Food deserts have devastating effects to the afflicted communities.

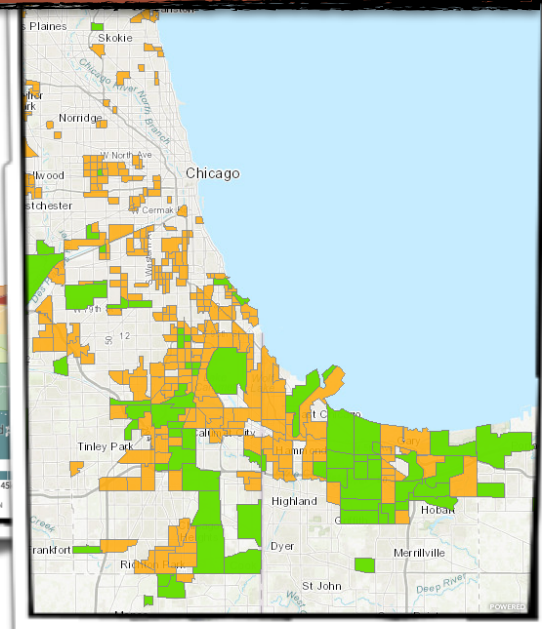
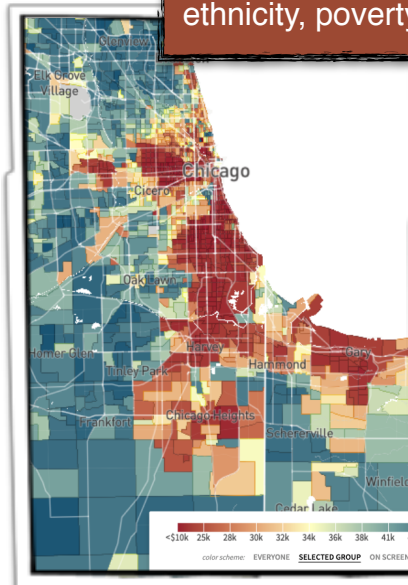
- **Malnutrition.** According to Maslow's Hierarchy of Needs, the number one human question is: where does my next meal come from. When people do not have enough food, or enough of the right nutrients in their food, it creates serious consequences. Malnutrition creates health crisis, as systems in the body do not function correctly. This is especially true of the immune system. When weakened, a person becomes susceptible to viral and bacterial diseases. Malnutrition hurts development in children. This can impact brain development, leading to long term learning disabilities. Malnutrition impacts focus and energy levels. This impacts a person's ability to be successful at school or at work. This has a long term impact on their economic earning potential. Malnutrition also impacts a person's willingness to participate in risky behavior. When a person is well fed and in a positive/sustainable situation, they act conservatively because they do not want to disrupt or change their situation. However, when people are not meeting basic human needs, they are at risk of dying or of serious life harm. Thus, a person is willing to take more extreme measures to ensure survival. They are willing to steal, break in, harm other people, get involved in gangs or drug trafficking. All of these actions may be illegal, but to the starving mind, "the normal system" isn't working for them.
- **Obesity.** Many food deserts have an abundance of calories, but lack access to healthful nutrition; leading to obesity. Food desert adults experience 25% more obesity than non-food deserts. 50% of children in "Head Start" programs from food desert locations were also identified as obese. Obesity creates its own unique set of health concerns. Obesity impacts the heart, leading to higher rates of heart disease, high blood pressure (hypertension), and stroke. People living in a food desert have a 20-40% higher chance of heart attack and death compared to the people living in non-food deserts. Obesity leads to Type II Diabetes. People living in severe food deserts experience 10% more Type II Diabetes than their non-food desert peers. 18% of cancers are diet related, leading to higher cancer rate as well. As a result of low income food deserts, the US Medical System spends \$190 Billion PER YEAR on additional medical costs related to obesity. That is \$20 Billion more than was spent on ALL fruits and vegetables in the entire USA.

- **Food Limitations.** Food deserts make it difficult for people with special food needs to fulfill their dietary needs. Muslims and Jews cannot food that contains pork or pig related byproducts. These are difficult to find in the food deserts. People with allergies and food sensitivities also have struggles. Lactose intolerant, nut allergies, allergies struggle to find food that meets their dietary requirements.
- **Minority Communities.** Food deserts have been shown to disproportionately effect people of color - particularly African-Americans. In the USA, 13% of the population is Black/African-American, 17% is Hispanic/Latino, while White/Caucasian is 63%. If there was equality in poverty, those same percentages would be found in other statistics. However, when looking at food deserts, Blacks make up 24%, Hispanic/Latino make up 20%, while Whites make up 48%. Even though White's make up the largest percentage of the population that are food insecure, Blacks and Hispanics make up a larger percentage of the food insecure compared to their total population percentage. To put the numbers differently, 25% of ALL Black AND Hispanic/Latino households are food insecure, compared to 11% of White households.

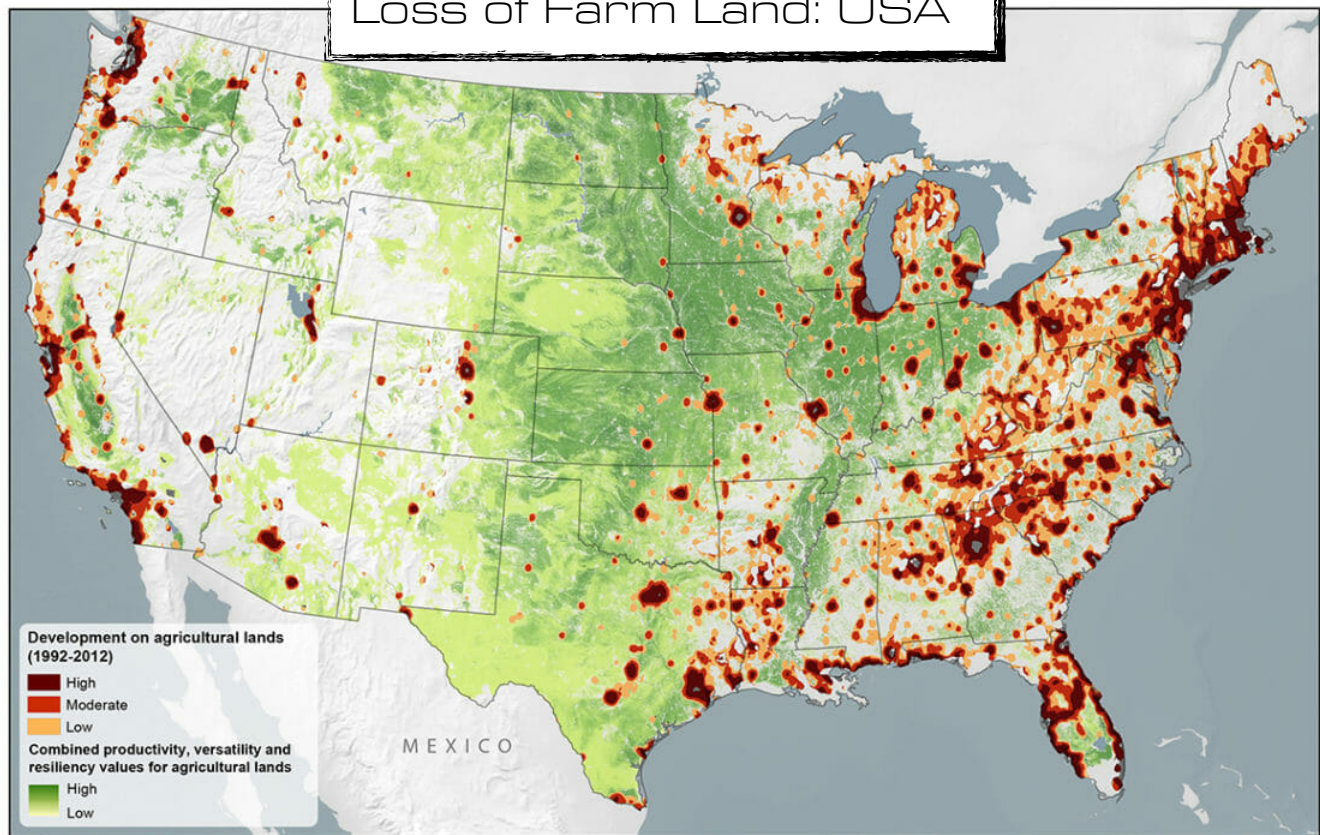
Social geographers have referred to the growing trend as "Food Apartheid." Apartheid was the systematic racial segregation policy that dominated South Africa from the 1940s through the 1990s. White neighborhoods have 4 times as many grocery stores as black neighborhoods, while there is a higher density of fast-food chains in the low income, minority neighborhoods. In Washington DC, predominantly minority neighborhoods have 1 grocery store for ever 70k residence. The primarily white neighborhoods had 1 grocery store for every 11k. When minority communities do have supermarkets, they often lack healthy food options. In Albany, NY, 80% of minority communities do not have access to low-fat milk nor high-fiber bread. This systemic poverty (or some call structural racism) is having devastating effects on minority communities. In Chicago, the death rate amongst black residents from Type II Diabetes is 2x as many as whites - with a life expectancy that is 15 years shorter on average. Similarly, in the USA 20% of Black children are obese compared to 10% of While Children. Without changes to the structure, minority communities will not have access to the same health and economic opportunities as their racial counterparts.



Application #3: What is the relationship between ethnicity, poverty and food deserts?

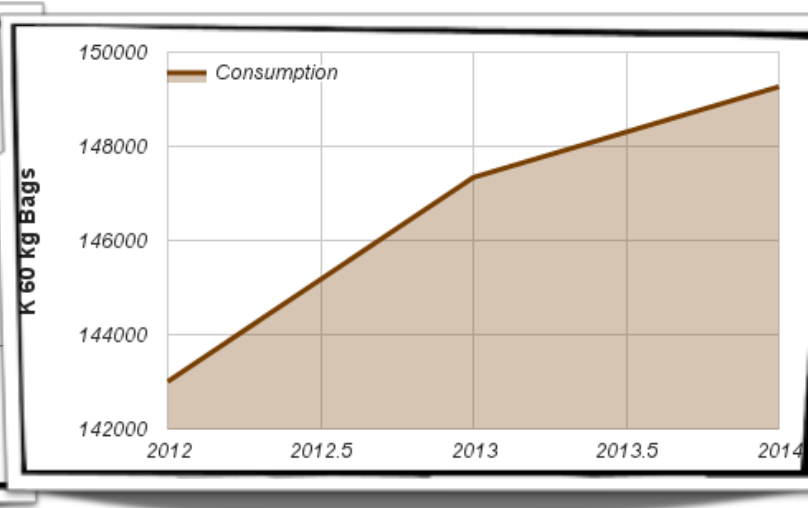


Loss of Farm Land: USA



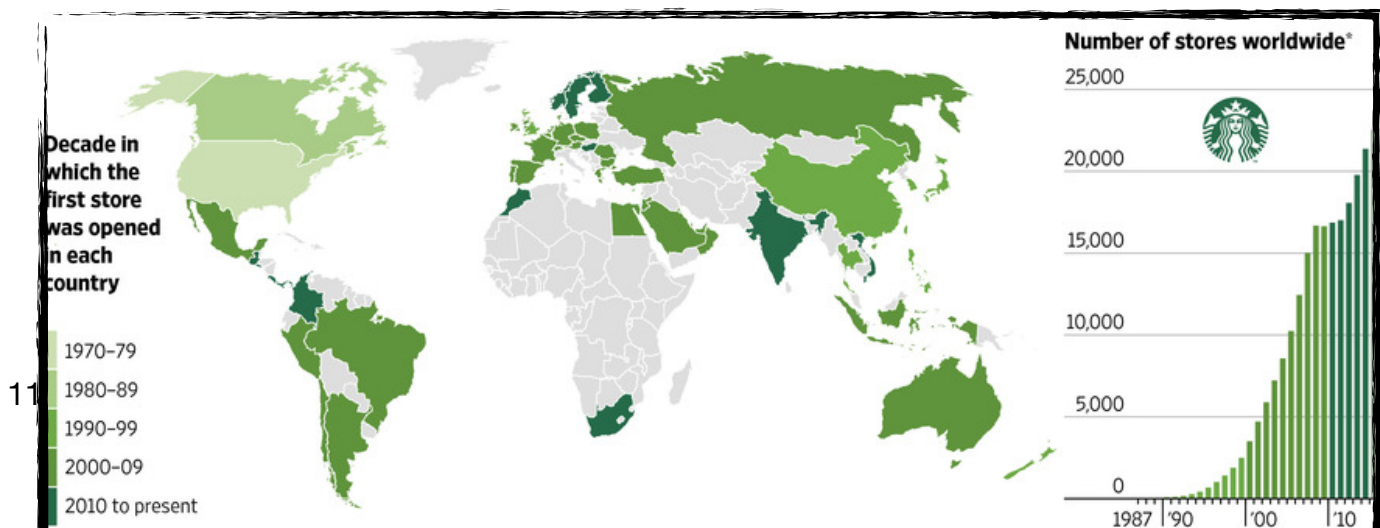
Loss of Farm Land. As the world progresses towards a population of 9-10 Billion people, humanity will need to cultivate more food... on less land. Despite the clear trend towards 10 Billion, America is losing farm land at an alarming rate: 31 million acres lost between 1992-2012. To phrase another way, 175 acres of farm land are lost... every hour. This is a problem because a decreasing amount of farm land means a smaller amount of food that can possibly be produced. This is also a problem because of supply and demand: less farm land means less supply. An increasing population means increasing demand. The result is higher food prices, which will price lower income communities out of being able to purchase adequate amounts of food. If farmland is so vital, why is so much of it disappearing?

- **Consolidation into Megafarms.** Due to the increasing costs to farm, small family farms are struggling to survive. Many are going bankrupt or selling their land. The result of this trend is primary sector-food based activities agglomerating west of the Mississippi River.
- **Aging Farmers.** The average age of farmers in the USA is over 60 years old. The younger generations do not want to take over the farm, instead preferring secondary and tertiary sector jobs in the city. The farms either go bankrupt, lay fallow, or are sold to land developers.
- **Urban Growth Meets Von Thunen.** Most of America's major cities on the East Coast were developed just before the Industrial Revolution. They were built on a model similar to Von Thunen - having to plan to grow their own food for their own population. Thus, prime farmland was located close to the urban center. The increase in the usage of cars, highways and the single family homes, urban centers have been exploding since the 1950s - sprawling across the landscape. The expanding cities have invaded into Von Thunen's 1st Ring: Market Garden and Dairy. As the urban spaces have been expanding, towns are rezoning their farm land to be usable for single and mixed use residential properties. Aging farmers or families with land they do not wish to farm decide that it is more profitable to sell their land for millions of dollars to home developers. The rich, fertile farm land becomes basements, driveways, backyards, parking lots, grocery stores, etc. It is no longer available for available to farm, decreasing the amount of food that can be produced.



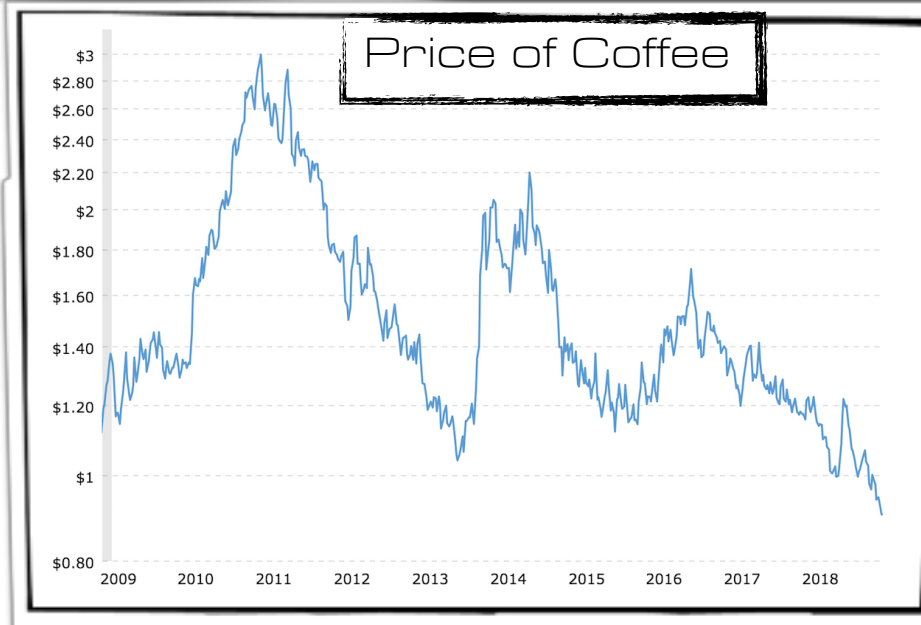
Curse of Cash Crops. Tropical zones are caught in a conundrum: need for food and the need for money. This region between the 20°N-20°S is mainly periphery or semi-periphery, with nutrient poor soil, and few native cereal crops. This region is also working through the aftereffects of being underdeveloped industrially due to colonization. Tropical regions have to decide: slash-and-burn to grow food crops to eat or cash crops to sell. The answer for many tropical societies has been cash crops. Cash crops tend to be luxury or non-essential items that grow in the tropical climates that core states are willing to be “good” money for on the global market. States can utilize the increased GDP to import cheap food from the states with mega farms for the citizens to consume. Cash crops tend to be vegetative intensive agriculture, taking place on plantations. Cash crops include but not limited to: coffee, rubber, tobacco, palm oil, bananas, citrus fruit, sugarcane, cocoa, cotton, and spices.

The case study of coffee mirrors the storyline of the other cash crops. Coffee demand has been on the rise since being diffused globally with the Columbian Exchange and colonization. With increased globalization and improved space-time compression, farmers in tropical regions have been able to use their arable land to specialize in growing coffee. By monocropping a cash crop, they could utilize their profits to import the other foods they need to survive. The combination of fertilizer and freight-boats allowed the production and consumption of coffee beans to rapidly grow. A large catalyst of this growth has been the new cultural trend: the coffee shop. The long working hours of industrialized societies has been matched by an explosion of multinational organizations like Starbucks, Caribou Coffee, and Duncan Doughnuts. Since 1971, Starbucks has grown from one store in Seattle, WA to over 17,000 stores globally. During the 1990s, two Starbucks opening every day across America. Now in China, one new Starbucks opens each day. These coffee shops not only feed the caffeine addiction, but also serve as catalysts for growth in other markets. A coffee shop does not only sell coffee, it sells a cultural experience - music, art, internet, t-shirts, coffee mugs, and beingcool meeting location. Other businesses use coffee shops as a marker for where they will want to open their own business, because of the increase in foot traffic (customers) brought in by brand names like Starbucks. A Starbucks doesn't just change a person's coffee intake, it changes the physical and cultural landscape of the community (with an extra shot of placelessness).





As the Asian markets, home to over half the world's population, develop and acculturate to the Western fascination with coffee; the demand is going to continue to increase. With cash crops like coffee, demand dictates all aspects of the commercial intensive process. The greater the demand, the more arable land gets utilized for coffee. This impacts the society by either further deforestation to create arable lands or having farmers switch from growing necessary subsistent crops for survival to growing commercial cash crops. Water rights could be diverted from subsistence food crops to irrigate the coffee plantations.



Tropical communities in the periphery are faced with difficult choices, without a definitely positive answer. There are risks associated with becoming dependent on a single commodity. When the market is strong, that single commodity will bring in substantial benefits. Employment and wages are increased, currency rates are stronger on the global markets to allow for improved purchasing power, investments are made into infrastructure and ports, all of which improve trade relationships globally. If the global price of the commodity drops, it will devastate the entire community. The drop will ruin the GDP, shrink the tax base, stall debt repayment, hamper social services, and halt infrastructure projects that were all reliant on the income generated through the agricultural exports. Most importantly, without the profits from the cash crop exports, the funds are lost to import food. This puts the food security of the entire society at risk.

If the periphery state never develops its secondary sector and the ability to industrial processing the cash crops, the primary sector products will be shipped overseas to be processed and package by multinational organizations in core regions. The multinational corporations will be the ones who buy the commodity raw at a low price and sell the value-added product on the market at a high price. The wages and wealth earning potential on the cash crop farmer will stay low, while the core countries will increase their earning potential. The largest profit will always be the ones to manufacture the final product, not to the coffee growers.

H. Food & Choice

In the midst of mega farm era, there has been a counter revolution birthed by the desire for individual choice. Thanks to the Green Revolution, the vast majority of people are no longer asking "where is my next meal coming from?" However, they are asking different questions about: Is this environmentally sustainable? Are GMOs and chemically grown foods healthy to eat? What about the people who make our food, what is their quality of life? These questions have shaped new movements within food production.

Sustainable Agriculture & The Birth of the Labels

While people were grateful for the Green Revolution in the 1960s, in the 1970s many people became concerned about how their food was being produced. People started to ask questions and organize around the health and environmental concerns of industrialized farming. As air pollution, water poisoning, and e coli outbreaks worsened, pressure grew on government institutions to take action to create alternatives to the chemical based agriculture. In 2002, high consumer demand prompted the passage of federal laws, giving birth to official/formal food labels:

- **Organic**: No GMOs, no ionization radiation, no sewage sludge, no chemical pesticides/herbicides, limited use of approved synthetic chemicals fertilizers, no growth hormones in animals.
- **Free Range/Cage Free**: Animals are given greater space to move, graze
- **Grass Fed**: Animals are fed grass instead of corn or grains that are unnatural to their diet
- **Wild Caught**: Caught in the fishes natural environment by fishermen

The birth of labels have created its own wave of positive and negative effects.

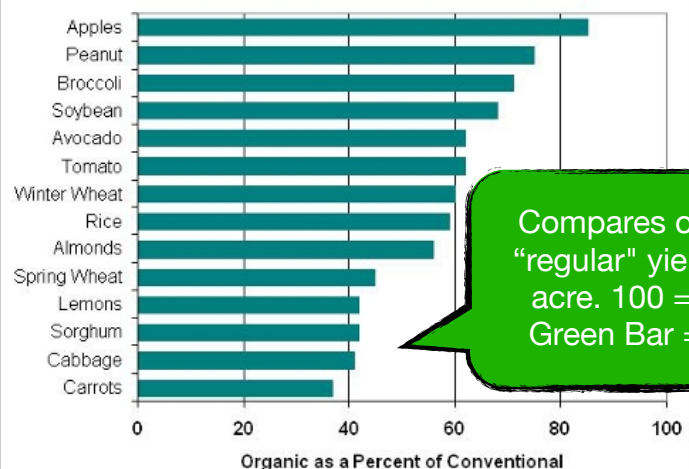
Positive Impacts

- **More Environmentally Sustainable Practices.** The limited/minimal use of chemicals and poisons is safer for the environment. Less air pollution and water pollution are created. Less pollinating insects (like bees) are impacted.
- **Increased Biodiversity.** Most organic farms have to rotate the crops they plant, needing greater biodiversity in their fields to keep their soil fertile.
- **More Humane for Animals.** Animals eat the food their bodies had evolved to eat and grow and their normal rates. For example, cows evolved to eat grass.
- **"Healthier" food being sold.** The reduced chemicals improve the safety of the food that is being fed because it was not exposed to poisons.
- **Support for Small Farmers/ Herders.** The increase in the demand for foods with labels has created a niche market where small family farmers can thrive. Mega farms rely on chemicals and genetic engineering to achieve economies of scale. The small, traditional practices nature of their farm IS the selling point of their farm. This has even created a market for other animal meats like buffalo, elk, emus, as well as wild grains.

Negative Impacts

- **No Economies of Scale.** It is nearly impossible for specially labeled foods to mass produce to create the low-cost products that mega farms can. Herding elk and buffalo, or allowing cows to graze on grass fields will never be able to compete on the meat market price-per-pound with feedlot cow-beef. Organic corn will never out produce GMO corn. This will always result in "labeled" foods having a significantly higher price.
- **Higher Prices Limit Purchasing.** Because the labeled foods do not achieve economies of scale, their food is much more expensive. For example: normal apples are \$1.50 per pound. Organic apples are \$2.30 per pound. Ground beef is \$3.75 per pound, while Grass Fed is \$7.35 per pound. Elk meat can cost \$18 per pound. While these may be "healthier" they are only accessible to the rich who have the extra funds to spend on the labels. They are only found at grocery stores in high income communities, limiting the health benefits to just the rich.
- **Less Land Efficient.** Organic creates less food, using more land. To feed 9 billion people would require MUCH more land than we use now.

Comparison of Some USDA Organic and Conventional Crop Yields in 2008



Compares organic vs. "regular" yield size per acre. 100 = Regular, Green Bar = Organic

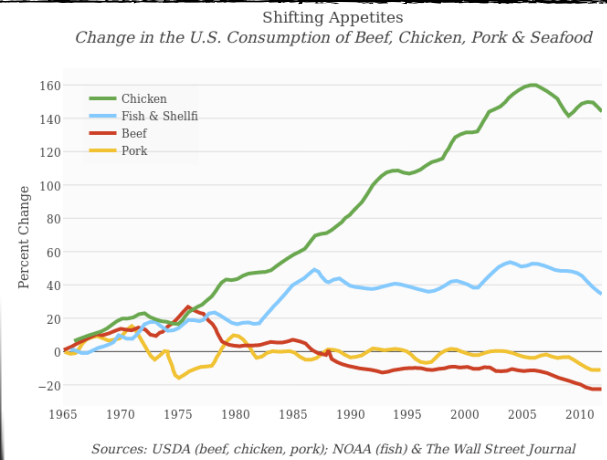
% Change in Consumption

Dietary Change: The Story of Chicken. People's purchasing habits have a strong impact on the food that is produced. As seen above, the demand for organic labeled products impacted what foods were produced and HOW they were produced. The impact of consumer demand is most evident in the story of chicken.

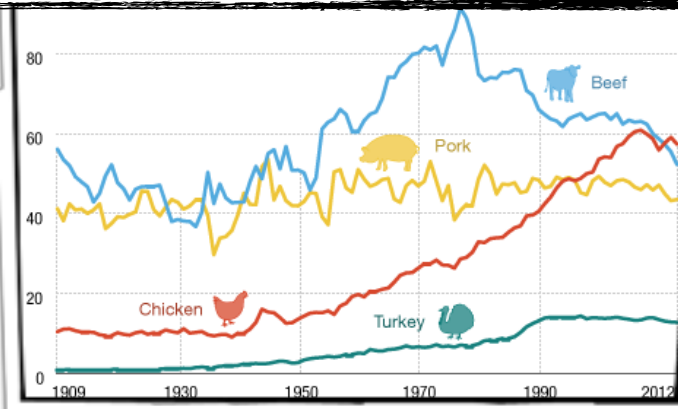
Before the 1950s, barely anyone ate chicken. Then, with industrial farming, there were repeated disease outbreak with pork and beef, leading people to look for an alternative. Chicken was viewed as the "safer" meat. Plus, chemicals were developed to accelerate the speed and size at which chicken breast - the most popular chicken meat - grows on the chicken. As perception changed, the demand for Chicken soared. Chicken began to appear on restaurant menus. Chicken fast food chains began, like Chick-Fil-A and Bojangles. By the year 2000, chicken became the staple meat of the Western diet.

To keep up with the demand, companies needed farmers to grow more chickens. In the 1980s, tobacco farmers were starting to struggle in the Southeast USA because of the correlation of tobacco with cancer and other lung diseases. These tobacco communities were on the brink of poverty and bankruptcy. Chicken companies, like Tyson and Perdue, persuaded these tobacco farmers to switch to raising chickens. These farms began to use the same commercial meat processing techniques as cattle or hogs: inputs of growth hormones to achieve larger chicken breasts, massive chicken warehouse, antibiotics, beak-clipping to avoid self mutilation, etc. These chicken processing factories were placed in economically depressed areas, along major transportation networks. This gives the poultry factories access to low wage workers - often migrants willing to work long, hard hours for little pay - in isolated areas, so they could treat the workers however they wish. This includes long hours, dangerous exposure to chemicals and sharp blades, etc. The location along the highways and railways allows the companies to put their meat into refrigerated containers, transporting the final product to anywhere in the world.

The change in consumer demand transformed the entire food culture of a nation and the economic structure of the Southeast USA.

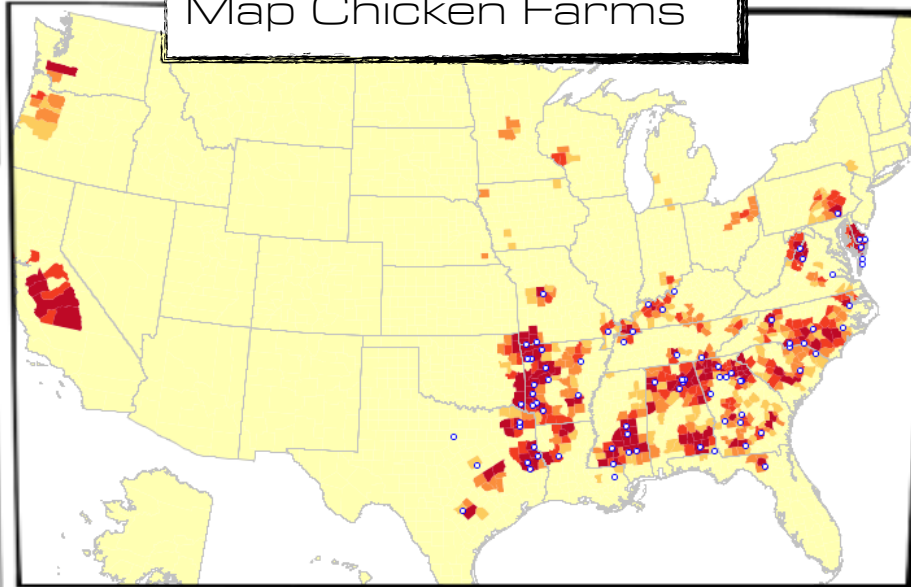


Amount Meat Consumed



Application #4: How did American meat culture change between 1910-2010 regarding the (a) type of meat people were eating and (b) the amount of meat people were eating? Do you think these changes are sustainable in a 10 Billion person world?

Map Chicken Farms



Fair Trade. What impact does a global supply chain agricultural system have upon the workers who harvest the raw materials? For a high mass consumption (Stage 5 society) to have low cost goods to consume in the store requires that the raw materials be sold for literal pennies per pound. Many highly consumed goods begin as raw materials grown in periphery states (or the peripheral regions of states). These relatively isolated communities rely on business contracts for their income, but are often unaware of the market value of their harvest and feel powerless to negotiate. The result is a world with 2.6 billion people living on less than \$2 per day, working in the primary sector. For example, the Ivory Coast of Africa is home to a multibillion dollar cocoa industry - growing the cocoa beans that get exported to Europe and America to be transformed into chocolate. The average pay for cocoa harvest laborers is \$.50 per 12-14 hour work day. Many farms employ child labor and human trafficked slave labor to keep their costs low, to try to make a profit.

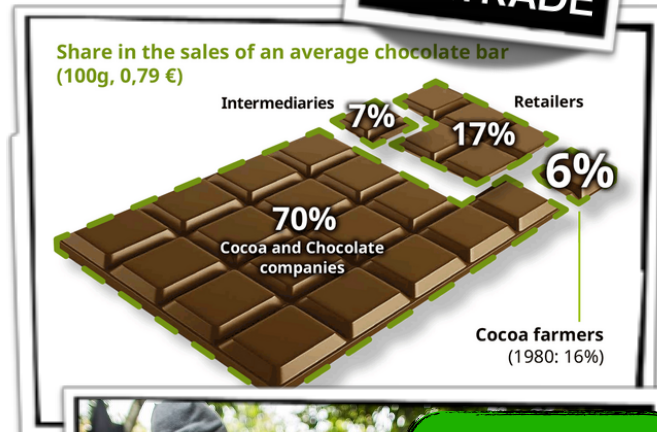
In the 1960s, fair trade organizations began to form, transforming how the farm workers are treated in the supply chain. The farms collectively organize together, demanding collective negotiating rights with the companies. By working together, farmers have more negotiating power and are able to demand: higher prices for their product, better working conditions, etc. In 1997, Fair Trade International formed a certification that goes onto products that meet certain fair trade standards:

- Fair working wages for farmers and laborers
- No child labor or slave labor
- Funding/Investment for environmentally sustainable practices and regional development projects like hospitals and schools.

International NGOs monitor business practices to make sure that products that have the Fair Trade label follow the Fair Trade ethical standards.

Demand for Fair Trade has increased, causing change in the production process of large corporations. In 2014, the Europe Union promoted support for Fair Trade, encouraging multinational companies like Nestles to change some of their trade practices to align with the Fair Trade. With Fair Trade, people have voted with their dollars for the production systems they most support, effecting change around the world.

Local Food Movements. Since the early 2000s, there has been an increasing push to bring food production back to local communities. People have become concerned about where their food comes from. For example, the average coffee bean travels 30,000 miles. The average banana and tomato travels 1,500 miles from farm to plate. They must be picked before they are ripe and then sprayed with ethylene gas to control the ripening process while they travel in refrigerated containers on fossil fuel consuming cargo ships. There is more air pollution created from 15 Cargo ships than ALL the cars in the world combined. People have become concerned with how their food is produced. They are concerned about the health and environmental effects of GMOs, pesticides and herbicides. People have become concerned about what is being produced. 90% of commodity crops grown on the monocropping mega farms in the USA go to feed animals or to processed foods. Farm land and corporations have become focused on quantity of calorie production, not quality of nutrients for consumption. People have become concerned about who gets access to the food. As discussed above, there are massive disparities in who has access to quality food, with 49 million food insecure people, and 24 million people living in food deserts. This is disconcerting, especially when 25-30% of all food produced in the USA goes to waste and ends up in landfills. People are concerned about the loss of farm land to urban growth and how humanity will feed 9-10 Billion people.





The solution: bring farming back to local communities. There are two major strategies being used to promote local-food movements:

- **Community Supported Agriculture (CSA).** CSA's work to support family farms while reconnecting farmers to their local communities. Local residents purchase a "share" of the farmer's crop before the season, similarly to how people buy stocks in a company on Wall Street. Ideally, all of the farmer's harvest has been purchased and paid for BEFORE the harvest season. This gives the farmer the money needed to run the farm, buy equipment, make upgrades, etc. In return, the people get box(es) of food each week from the farmer's harvest. The farmers produce the fresh foods that people want, with the people having a say in the varieties the farmer produces. Some farms produce as many as 40 different fruits and vegetables.

CSAs are intended to transform communities. Local family farmers are supported directly by their community. They answer directly to their local residents, not to multinational corporations or investors. This protects communities from the rising and falling prices on the global food markets, as the supply and demand is locally controlled. The residents get food that is more nutritious with a better taste. The food is allowed to properly ripen and does not get sprayed with preservative or ripening chemicals. People get to eat from the crops that are in season, getting greater nutrient diversity in their diets. The environment is better supported because a greater variety of plants are grown, promoting biodiversity. With the shorter travel distances, less fossil fuels are used, which reduces air pollution. Finally, CSAs change a community's culture and their relationship with food. Farming becomes a part of the cultural landscape, giving the community a sense of place. People can go and see their food growing and build relationships with the people who are growing it. The goal is to build a healthier, more balanced community.

What is CSA?

Community - Supported - Agriculture



You want an easy way to feed your family



food that is fresh and tastes great.



Your local CSA farmer grows a variety of fruits and vegetables



The food is harvested fresh from the field



You purchase a share at the start of the season.



Contact the farm to sign up for a CSA program



and packed into once a week farm shares



that are delivered to your door.



You eat well, support local agriculture, and foster a healthy lifestyle

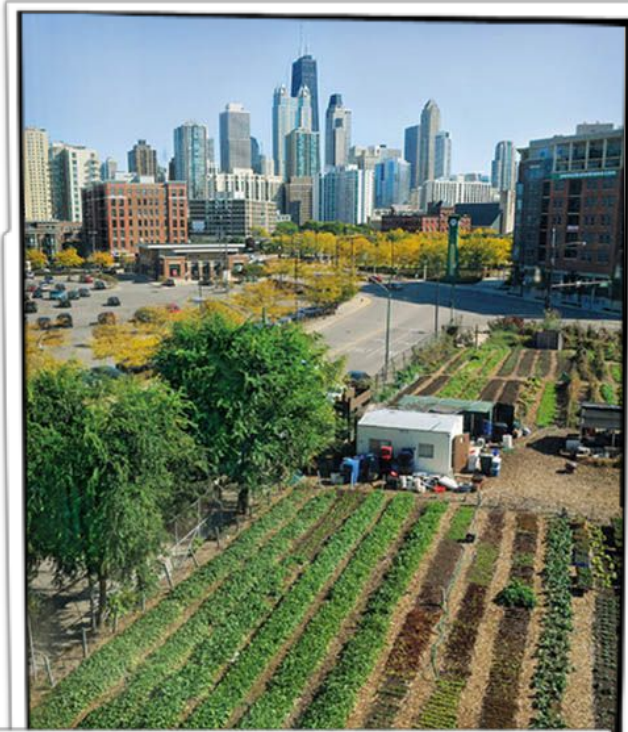
you by :

- **Urban Farming.** A key problem with local food movements is that over 85% of Core States live in Urban areas. These concrete jungles are known for their high rises, parking lots, and transportation networks... not their farm land. However, as cities enter the 21st century, forces of change are opening opportunities for farming to become a part of the city. The growing development of suburbs has encouraged people (with cars and money) to move out of the “downtown” inner-city. While this is causing massive sprawling urban landscapes - and the loss of farmland on the outskirts of the city - it is also creating vacant lots in the inner-city. Similarly, as the USA went through economic restructuring in the 1990s, factories and warehouses have shut down or moved to lower cost areas (in the USA’s sunbelt or overseas). As a result, they have left large vacant lots in the heart of urban areas. In total, Chicago says there are 1,200 acres of vacant, abandoned lots. In Detroit, there are 1,400 acres. Much of this land exists in the lowest income neighborhoods, with the highest crime rates and unemployment rates (not to mention food insecurity/food deserts). This is land that developers and commercial businesses have been scared away from investing into redevelopment.

The lots have created opportunity to bring agriculture back into the city. Nonprofit groups have organized to work with the city to identify vacant lots that can rezoned for mixed use or agricultural use. In Kansas City, groups have been able to purchase vacant land from the banks for under \$100. Groups then organize local residents to clear the land and prepare it for farming. This has included reaching out to local corporations to collect food waste from restaurants, grocery stores, and convention centers. This food waste is composted to create fertilizer that brings nutrition and fertility back to the soil. Then, the land is farmed with nutritious food that is sold (or donated) directly to the local residents. Some urban farms use a CSA model, where one or two families controls the farming and delivers the food to residents. Others use community models where the residents who provide manual labor get access to the harvest. After a couple years, these urban farms become profitable and sustainable in the community, creating jobs for local residents. Jobs consist of working the land, business management, marketing, sales at the local market, and community outreach.

With innovative technologies and the idea of possibilism, urban agriculture is also being considered being implemented in unique ways:

- **Roof Top Gardens.** Urban spaces suffer from the heat island effect - heat being absorbed by the black top on roads, parking lots, and roof tops, causing the temperature of the entire city to increase by a couple degrees. For example: In June, the temperature in Rural Florida is 98*, the temperature in suburban Orlando is 100*, while the temperature in downtown Orlando is 103*. Rooftops on vertical architecture are being used for growing fruits and vegetables. The rooftops have plenty of access to sunlight and water, and are flat - allowing larger gardens to be used. This will not only increase the amount of land space being utilized for farming, but will also improve the quality of life in the city. The green of the plants dissipates the heat from the sun, having a cooling effect on the city. The green plants also helps clean the city air.



Can I find
a root
with a
view?



- **Vertical Farming.** Technology and robotics is revolutionizing the possibilities of modern market gardening. Multi-story buildings are being converted into robotic-controlled farms. The computer monitors and controls the temperature of each of the rooms, to be the ideal temperature for growing all day long. Grow lights are strategically placed over each plant, allowing optimal lighting. Sensors monitor plant nutrition and water levels - applying optimal amounts of water only when that plant needs it. No soil is needed and 95% less water is used than on traditional farms. No pesticides, herbicides, or other chemicals are used on the plants. This method cuts the time to grow the plants in half, rapidly improving the amount of food that can be grown. Because the farm is indoors, the food can be grown all year round AND these factories can be installed in any indoor facility, anywhere in the world. Many cities are converting abandoned factories and warehouses into vertical gardens, revitalizing building infrastructure already in place.

Urban agriculture has its critics. Critics first point to the price of land. Land near the CBD is the most expensive because it is in the highest demand (theoretically). If more urban land is being zoned and repurposed for agriculture, that is less land available for business development or high density apartments/condos. The reduction in supply of land creates a natural increase in the demand (more people wanting the same land). In theory, this creates an increase in land prices, housing/rent costs. Critics also argue that less land availability in the city will encourage developers to continue to purchase land outside of the city - expanding the urban sprawl.

The growing impact of Urban agriculture is substantial. Urban agriculture can increase the global food production by 180 metric tons a year - including a 10% increase of vegetables. It has shown benefits of reducing the temperatures in cities - created by heat reflecting off of pavements, parking lots and dark roofs. Air quality has improved in cities. There has been a social benefit, as urban agriculture has thrived in areas with low income and food deserts. Communities that have embraced local gardens have seen an increase in access to affordable, nutritious food. This has led to a decrease in food deserts, food insecurity, and diseases directly related to poor nutrition.

Conclusion.

The number one human question is: where does my next meal come from? Food is the foundation of human life, culture, politics, and production. As the human population rapidly expands and as climates change, we are faced with tough challenges of how to make sure everyone is fed. Will humanity buckle under the weight of this enormous challenge or will human ingenuity show that with technology anything truly is possible?



Ch 11 Standards

	Objective	Knowledge
	Availability of resources and cultural practices influence agricultural practices and land-use patterns.	
5.1 Introduction to Agriculture Ch 11a & 11c	Explain the connection between physical geography and agricultural practices.	Agricultural practices are influenced by the physical environment and climatic conditions, such as the Mediterranean climate and tropical climates.
		Intensive farming practices include market gardening, plantation agriculture, and mixed croplivestock systems.
		Extensive farming practices include shifting cultivation, nomadic herding, and ranching.
5.2 Settlement Patterns and Survey Methods Ch 11b & 11c	Identify different rural settlement patterns and methods of surveying rural settlements.	Specific agricultural practices shape different rural land-use patterns.
		Rural settlement patterns are classified as clustered, dispersed, or linear.
		Rural survey methods include metes and bounds, township and range, and long lot.
	Agriculture has changed over time because of cultural diffusion and advances in technology.	
5.3 Agricultural Origins and Diffusions Ch 11b	Identify major centers of domestication of plants and animals.	Early hearths of domestication of plants and animals arose in the Fertile Crescent and several other regions of the world, including the Indus River Valley, Southeast Asia, and Central America.
	Explain how plants and animals diffused globally.	Patterns of diffusion, such as the Columbian Exchange and the agricultural revolutions, resulted in the global spread of various plants and animals.
5.4 The Second Agricultural Revolution Ch 11d	Explain the advances and impacts of the second agricultural revolution.	New technology and increased food production in the second agricultural revolution led to better diets, longer life expectancies, and more people available for work in factories.
5.5 The Green Revolution Ch 11d & 11e	Explain the consequences of the Green Revolution on food supply and the environment in the developing world.	The Green Revolution was characterized in agriculture by the use of high-yield seeds, increased use of chemicals, and mechanized farming.
		The Green Revolution had positive and negative consequences for both human populations and the environment.

	Objective	Knowledge
	Availability of resources and cultural practices influence agricultural practices and land-use patterns.	
5.6 Agricultural Production Regions Ch 11b & 11c	Explain how economic forces influence agricultural practices.	Agricultural production regions are defined by the extent to which they reflect subsistence or commercial practices (monocropping or monoculture).
		Intensive and extensive farming practices are determined in part by land costs (bid-rent theory).
5.7 Spatial Organization of Agriculture Ch 11d	Explain how economic forces influence agricultural practices.	Large-scale commercial agricultural operations are replacing small family farms.
		Complex commodity chains link production and consumption of agricultural products.
		Technology has increased economies of scale in the agricultural sector and the carrying capacity of the land.
5.8 Von Thünen Model Ch 11b	Describe how the von Thunen model is used to explain patterns of agricultural production at various scales.	Von Thunens model helps to explain rural land use by emphasizing the importance of transportation costs associated with distance from the market; however, regions of specialty farming do not always conform to von Thunens concentric rings.
5.9 The Global System of Agriculture Ch 11d & 11e	Explain the interdependence among regions of agricultural production and consumption.	Food and other agricultural products are part of a global supply chain.
		Some countries have become highly dependent on one or more export commodities.
		The main elements of global food distribution networks are affected by political relationships, infrastructure, and patterns of world trade.
	Agricultural production and consumption patterns vary in different locations, presenting different environmental, social, economic, and cultural opportunities and challenges.	
5.10 Consequences of Agricultural Practices Ch 11d & 11e	Explain how agricultural practices have environmental and societal consequences.	Environmental effects of agricultural land use include pollution, land cover change, desertification, soil salinization, and conservation efforts.
		Agricultural practices—including slash and burn, terraces, irrigation, deforestation, draining wetlands, shifting cultivation, and pastoral nomadism—alter the landscape.
		Societal effects of agricultural practices include changing diets, role of women in agricultural production, and economic purpose.

	Objective	Knowledge
5.11 Challenges of Contemporary Agriculture Ch 11d & 11e	Explain challenges and debates related to the changing nature of contemporary agriculture and food-production practices.	Agricultural innovations such as biotechnology, genetically modified organisms, and aquaculture have been accompanied by debates over sustainability, soil and water usage, reductions in biodiversity, and extensive fertilizer and pesticide use.
		Patterns of food production and consumption are influenced by movements relating to individual food choice, such as urban farming, community-supported agriculture (CSA), organic farming, value-added specialty crops, fair trade, local-food movements, and dietary shifts.
		Challenges of feeding a global population include lack of food access, as in cases of food insecurity and food deserts; problems with distribution systems; adverse weather; and land use lost to suburbanization.
		The location of food-processing facilities and markets, economies of scale, distribution systems, and government policies all have economic effects on food-production practices.
5.12 Women in Agriculture Ch 11c & 11d	Explain geographic variations in female roles in food production and consumption.	The role of females in food production, distribution, and consumption varies in many places depending on the type of production involved.