

URBAN[e] Agriculture
Developing an Architecture That Supports Hyper-Localized
Agriculture in the Urban Context

A Thesis Presented for the
Master of Architecture
Degree
The University of Tennessee, Knoxville

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Dedication

This document is dedicated to my beautiful and supportive wife, Ellen, without whom I would have never survived graduate school, much less excelled. Her constant encouragement and support provided the little pushes (occasionally shoves, and sometimes simply dragging me while I kicked and screamed) that I needed to stay focused. I thank you for sharing in this journey with me.

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To all of my classmates, friends, family and faculty who have slogged through this with me, I thank you.

Abstract

This thesis contains both the outline of the modern day problem of food deserts and nutritional injustice in urban areas, as well as my proposed solution for combatting both of those issues. Through research, investigation, experimentation and synthesis of design, I have put forth my thoughts and ideas on how we as a community can work together to shape our own nutritional destiny in the urban environment.

Preface

Issues of food access and food security plague the modern urban landscape. Simply examining the disparity in numbers of people that call themselves farmers exposes the loss of connection that we have to the land and to that which it supplies us with. With the number of farmers being reduced by 96% over the last fifty years, yet the general population level increasing, it becomes alarmingly obvious that we, as a society, are putting too many of our proverbial eggs into a single basket. How did we get to such a state, in a nation of plenty, where parents cannot buy fresh or nutritious real foods due to simple lack of availability? There are claims that a free-market economy should drive how people live and work, and which businesses live and die, but those positions make no allowance for those that lack the means to access that economy. Those of limited economic means find it difficult, if not downright impossible to navigate a shifting nutritional landscape that all too often demands a personal automobile.

Architecture forms the physical framework that supports a re-connection to the time honored process of growing food in an urban environment. The architecture will establish an energetic community locus that generates adjacent redevelopment of under-utilized and abandoned industrial buildings into a desirable mixed income community, supported primarily by the efforts of the existing community, through the development of a system of citizen operated hyper-local agriculture. This new system of agriculture is a distributed network of urban farms that re-appropriate blighted properties, converting them

from negative tax revenues into productive economic opportunities for neighborhoods. Sited on first creek, the architecture fulfills its third task by becoming a hub of activity and education through connection to green ways and the public transit system. The architecture encourages improved nutrition and self-reliance through education, better physical health and welfare through activity and enhanced nutrition, and forms a community through the myriad opportunity that it presents.

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Autumn

"The crickets felt it was their duty to warn everybody that summertime cannot last for ever. Even on the most beautiful days in the whole year - the days when summer is changing into autumn - the crickets spread the rumour of sadness and change."

-E. B. White, *Charlotte's Web*

Section 1: Old vs. New

The current system of industrialized food production in the United States is un-sustainable both from a viewpoint of environmental stewardship as well as from the standpoint of human health. The situation as it stands is the product of a multitude of events and conditions. It is not the effect of one, or of even a few factors, but a combination of many conditions that are a result of what we consider to be modern progress. One of the first contributing factors of the devolution of modern agriculture was developed in the crucible of war.

We call a great many things food, from raw vegetables and fungi, to animal based protein, but they all depend, at some point, on the nutrients that are present in varying levels in the soil. This connection is obvious for the plants and fungi as they grow directly in the soil, but most animals depend almost directly on plants as well. In a sense, when we begin to examine agricultural systems, everything traces back to the plants, and thereby to the nutrients in the soil.

Traditionally, agricultural plantings fall into one of four categories, Heavy Feeders, Light Feeders, Nitrogen Fixers, and Cover Crops.

- Heavy Feeders: Plants that fall into this category are those which we typically consume the portion of the plant that grows above ground. Most fruiting plants (okra, tomatoes, peppers, gourds, etc), as well as leafy plants (spinach, lettuce, chard, etc) fall into this category. They require the highest amounts of nutrients from soil.

- Light Feeders: Plants in this category are typically what we consider to be root vegetables (potatoes, turnips, beets, etc) as well as plants in the onion family (including garlic and shallots). These plants still remove nutrients from the soil, but not in quantities such as the heavy feeders.

- Fixers: Plants in this category are legumes such as peas, beans, and peanuts. They are called “fixers” because they actually work to replace nitrogen in the soil as they grow rather than deplete it.

- Covers: A cover crop typically consists of a mix of grasses and inedible legumes that are not harvested for consumption. The cover crop prevents soil from washing or blowing away, and is eventually either grazed or mowed down and cultivated into the soil prior to the planting of a heavy or light feeder crop. This helps to replenish the mineral levels in the soil and allows the naturally present microbes in the soil to work and rebalance the mineral content, reducing the amount of fertilization and intervention required. (Carpenter, 2011)

Another purpose for rotating these crops in fields was to prevent diseases and pests from wiping out large quantities of crops. Pests and diseases typically affect a particular species of plant. When crops are rotated and mixed together, the food source for pests and diseases is distributed in a more diffuse manner over a larger area, making it difficult for crop ruining conditions to exist, or if they do occur, to mitigate the damage to smaller areas. (Pollan, 2008)



Figure 001
A 4-planting crop rotation that includes all three edible groups, plus a restoration group. This rotation is easy to follow, and helps to maintain soil vitality.

In a mono-cultural crop system, pests and diseases have unfettered access to their preferred food supply, are likely to run rampant. The only way to combat them is through the application of toxic chemicals such as pesticides, herbicides, and fungicides. Until the 1930's, we lacked a supply of nitrogen sufficient to forgo the time tested techniques of crop rotation, as most of the nitrogen available came from livestock manure. The industrial supply of nitrogen changed that, and the mono-culture agricultural revolution was born. (Ganzel, n.p.)

These primary nutrients are nitrogen, potassium, and phosphorus, known by their elemental symbols of N, K, and P respectively. Potassium and phosphorus were both readily available through existing industrial processes and mining. Nitrogen, however, was far more difficult to obtain.

The Haber-Bosch Process is a complex series of chemical reactions that combine airborne nitrogen with hydrogen to form ammonia. At the beginning of World War II, the United States built ten manufacturing plants near hydro-electric power stations to produce nitrogen. The nitrogen manufactured in this manner was not originally used as agricultural fertilizer, however. The nitrogen was a crucial ingredient in TNT, used in bombs and explosives throughout the war. (Ganzel, n.p)



Figure 002
A farmer loads bags
fertilizer onto his
truck.

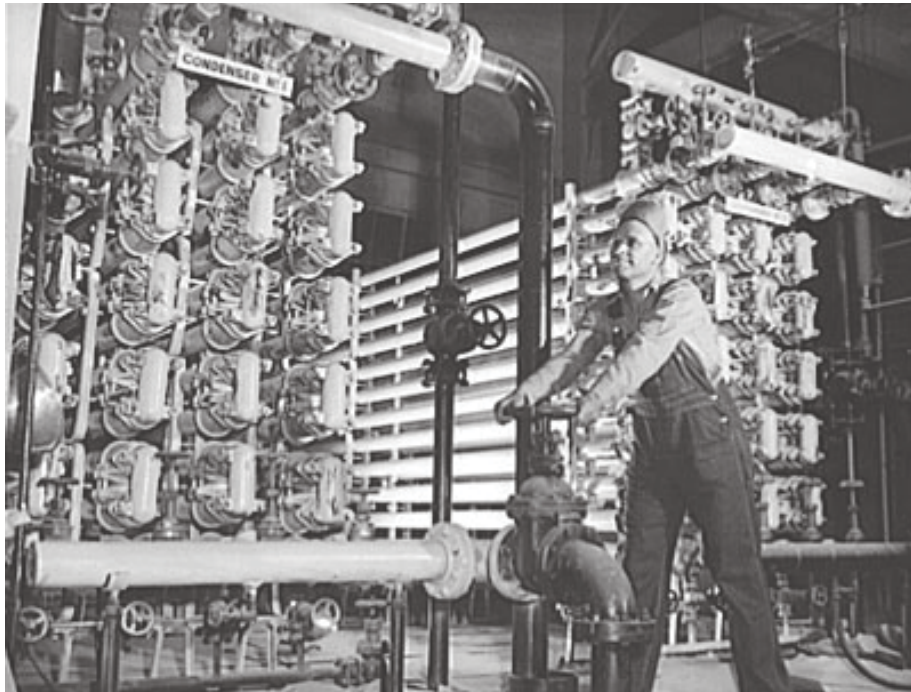


Figure 003
A worker turns a valve at TVA's Muscle Shoals Nitrogen Production Facility.

Once the war was over, the massive production capacity of these ammonia factories was shifted from munitions grade ammonia to nitrogen for fertilizer. The availability of this industrially produced fertilizer changed how crops were planted and rotated, or more precisely, seemed to eliminate the need for standard methods of crop rotation.



Figure 004

Aerial view of industrial agriculture, designed and optimized for automation and heavy machinery.



Figure 005

A mechanical harvester is used to take in a corn crop. Working in scales of industrial agriculture demands machines with a single purpose, which limits the flexibility of the operation.

Section 2: New Forms of Movement

The second factor in the decimation of sustainable agriculture came in the 1950's with the advent of the Interstate Highway System. The post-war surge in availability of personal automobiles, combined with vast expanses of verdant and open landscapes led to the development of a highway system that spanned the entire United States. While the general purpose of the interstate was to ensure efficient movement of people and goods, especially for use by the military if necessary, there were several drawbacks that the designers paid little attention to at the time.

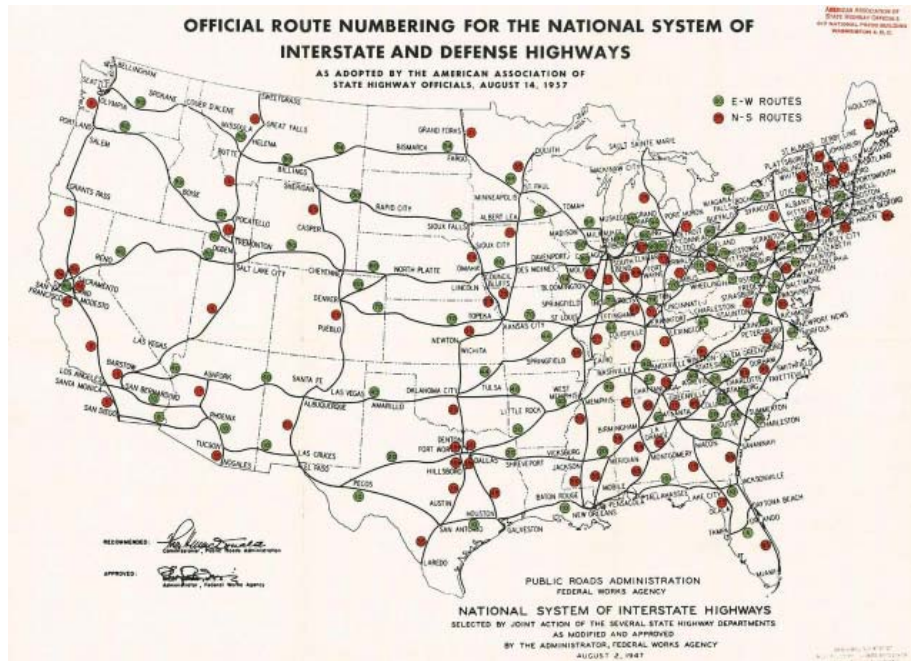


Figure 006
Original numbering system for the Interstate and Defense Highway System.

The interstates ended up cutting through cities, dividing or obliterating entire neighborhoods. They also provided fast access to previously undeveloped areas of land, much of which was agricultural. Previously, development followed infrastructure, or at least kept pace with it.

The end of WWII saw the return of thousands of soldiers into urban centers that were ill-prepared to deal with the growth in population. Couple this desire to leave the cities that were not prepared to accept them comfortably with the newly accessible developing sub-urban areas and sprawl was born. Urban growth stagnated as formerly pristine agricultural land was developed into a sea of single family homes and exclusive communities. Knoxville was no exception to this rule.

Table 001

Selections from the US Census data detailing population trends in Knox County and the City of Knoxville from 1910 - 2010. Notable is the near complete lack of growth inside the city from 1970 through 2010 (only 2.5% over 40 years) while the county grew by 249% in that same time period.

Area	2010	1970	1950	1920	1910
Total Knox County Population	432,226	276,293	223,007	112,926	94,187
Inside City Limits	178,874	174,587	124,769	77,818	36,346
Outside City Limits	253,352	101,706	98,238	35,108	57,841
% in City	41%	63%	56%	69%	39%
City Growth from Previous	4,287	49,818	46,951	41,472	-
County (non-city) Growth from Previous	151,646	3,468	63,130	-22,733	-

With the populations shifting from urban centers to sub-urban developments, sudden new economic markets sprang up, and commerce needed to follow. With a population spread out over a much wider area now, grocery chains began to develop. Public exchange markets used to be where farmers would come to sell their goods to grocers and vendors. With the advent of the interstates and newly relocated populations, grocery chains expanded and set up their own private networks of exchange markets. With this, some farmers began selling their goods directly to these private markets. This, in turn, began to eliminate much of the variety available in the public exchanges, as well as the customer base. With fewer producers and customers, the public markets began shutting down. Knoxville's own Market Hall on Market Square was no exception. (Wheeler, 2005)



Figure 007
View of the Market Hall roof, facing south.

Many cities other than Knoxville had varying levels of success when it came to preserving their public markets. Though some have dwindled in spirit from their former use, such as the French Market in New Orleans, LA, others like the Pike Place Market in Seattle, WA, have continued to see long lasting success. Knoxville, however, faced a legal anomaly when it came to preserving the Market Hall on Market Square.

The conditions under which the land was given to the city for the Market Hall essentially prevented adaptive reuse. The city began a movement against preservationists in 1950 to tear down the hall in an attempt to “modernize” the downtown. This fight lasted nine years, when the city finally voted to demolish it. The building’s fate was further sealed by a fire that damaged it heavily in 1960. Though most thought it was repairable, it was torn down anyway. (Wheeler)



Figure 008
View of the former Market Hall in Knoxville from the South End.



Figure 009

The Pike Place Market in Seattle, WA is an active, vibrant community unto itself. It has its own identity and energy, attracting people from all corners of the city, as well as tourists from other cities.



Figure 010

Image of a vendor inside the Pike Place market. Availability of produce is clearly not an issue here.



Figure 011

The Reading Terminal Market in Philadelphia, PA. The Market is housed inside of a repurposed railway terminal.



Figure 012

Interior view of the Reading Terminal Market. The Market serves as both a focus of activity as well as a source of food and value added goods.



Figure 013
The French Market, circa 1915, New Orleans, LA.



Figure 014
Interior of the promenade in the French Market, 2013.



Figure 015

Exterior photograph of the Market Square Market Hall after the fire and demolition.



Figure 016

Workers evaluate the Market Hall after the fire, but before demolition. Many thought that the Market Hall could be salvaged and repaired, but demolition continued contrary to public outcry.



Figure 017

Market Square Farmer's Market as it stands today.

Following the loss of availability of farm fresh goods, many urban grocers either gave up, or shifted their stocks towards items that could make the most money with the least waste. Alcohol and tobacco are chief among these goods, and modern foods that were heavily processed so as to be shelf stable became staple offerings in what used to be neighborhood grocery stores. The modern convenience store has been invented. All too often, we see "Food Mart" or "Market" as part of a name of a convenience store, only to find the shelves filled with processed foods, loaded with chemicals and subsidized industrial agriculture products cleverly hidden behind a façade of marketing. By the end of the 1950's, many urban centers are now bereft of any kind of market where fresh foods are available. To make matters worse, many people did not own automobiles, so getting to a market became nearly impossible. Though it didn't get its name until 1995 from a study in the United Kingdom (Beaumont, 1995), the food desert was born.

Winter

*"If we had no winter, the spring would not be so pleasant:
if we did not sometimes taste of adversity, prosperity would
not be so welcome."*

[Meditations Divine and Moral]

-Anne Bradstreet, The Works of Anne Bradstreet

Section 3:

A Season of Empty in a Nation of Plenty

A food desert is defined by the United States Department of Agriculture as “urban neighborhoods or rural towns without ready access to fresh, healthy, and affordable food. Instead of supermarkets and grocery stores, these communities may have no food access or are served only by fast food restaurants and convenience stores that offer few healthy, affordable food options.” (USDA)

For a rural population, where personally owned vehicles are more prevalent, the radius is set at 10 miles. Urban areas tend to have more people that are dependent on public transportation or pedestrian transit (bicycles and tennis shoes), so the radius is set at one mile. Recent statistics show that:

- Approximately 23.5 million people live in food deserts in the US.
- 13.5 million of those people are low income
- 90% of the people that live in food deserts are in Urban areas

Knoxville has, unfortunately, far too many people living in food deserts. On average, cities have approximately 5% of their population living in a food desert. Knoxville shatters this statistic with an alarming 33% of the population (59887/178874) living in food deserts. (Gervin, 2011) While not all of these people are low income, it does serve to illustrate how limited our food procurement options have become.

It is worth noting, at this point, that many scholars and activists have issues with the term “food desert”, as it implies that there is no food available at all. When people then see, stores where processed and packaged foods, such as heavily processed cold cuts, artificially preserved breads, cakes, candies, and chips, they assume that this helps solve the food desert issue. The truth, in fact, is that these sources of “food” actually work to promote food deserts rather than to help eliminate them. When new stores can be opened or accessed on the periphery of food deserts, they often are not frequented, as people have become used to shopping at these closer establishments, even though the products offered meet almost none of their actual dietary needs.



Figure 018

USDA map of the Knoxville area food desert, based on low income status alone.

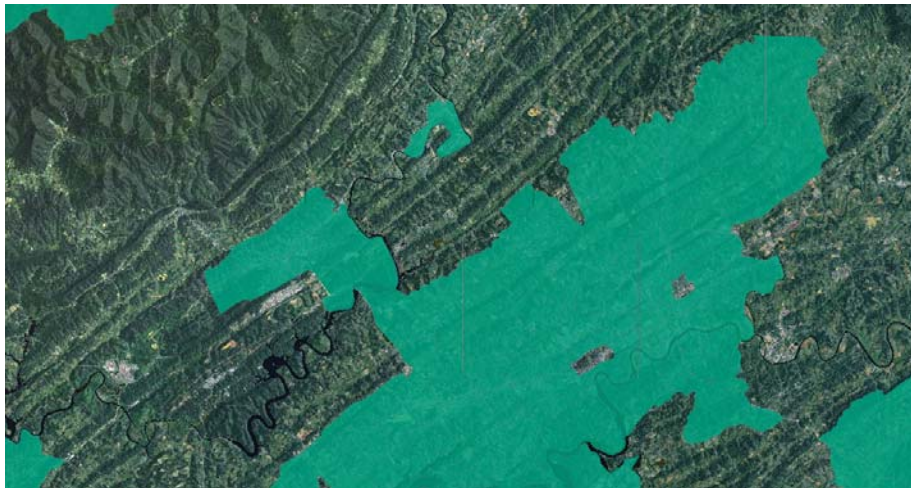


Figure 019

USDA map of the Knoxville area food desert, based on limited access statistics. Areas shaded indicate that there is no source of fresh or nutritious food at reasonable prices within 1/2 mile of the majority of residents in urban areas.

This elimination of the availability of fresh and nutritious food in favor of manufactured food products has taken a toll on both the physical health of Americans, as well as on the condition of our general knowledge of food; where it comes from, what it should resemble, and how to deal with it.



Figure 020

A modernized convenience store. Even though the fixtures and lighting have been improved, the nutritional quality of products offered remains low. Candy, sweetened beverages, and fried chips make up the bulk of the offerings, supplemented only by tobacco and alcohol.

Section 4:

The Changing Food Landscape: Health and Economics

Looking at health statistics alone should be frightening enough to get us to enact real change, quickly, yet we seem determined to continue down the road we are already on. It is estimated that 50% of children born in the U.S. in 2010 will be dependent on some form of taxpayer subsidized food assistance program, such as “Women-Infants-Children (WIC), the Supplemental Nutritional Assistance Program (SNAP, formerly referred to as ‘food stamps’), subsidized school lunch programs, and the like. Approximately one third of the population born in 2012 will develop Type-2 diabetes. This self-inflicted disease was formerly called “adult-onset diabetes”, but the nomenclature was changed when children started developing it at an alarming rate due to poor dietary conditions. (Silverbush, 2012)

If the physical effects of the combination of restricted access to healthy food with an oversupply of heavily processed, calorie dense but nutritionally sterile food isn't convincing enough on its own, then we should also examine the financial burden that we share as a nation. From an employment standpoint, industrialized farming represents one of the largest shifts in the fiscal landscape.

According to 1910 U.S. Census records, a total of 32% of the U.S. population, self-reported their primary occupation to be either a farmer (15%) or a farm laborer (17%). Fast forward to 2010, and the occupation of "farmer" is no longer an option on the census form. It now falls under the "other" category, as less than 1% of the U.S. population is considered to be a farmer. This shift represents a loss of 96% of the jobs, per capita, that used to be based in agriculture. We have replaced these paying jobs with machines and factory processes.

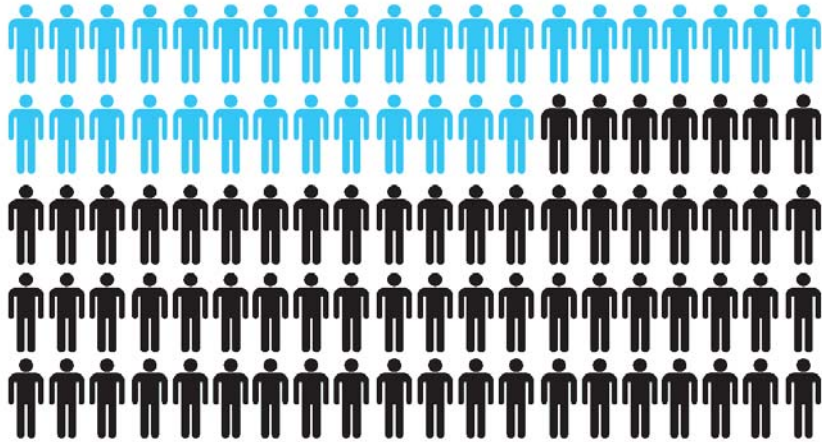


Figure 021
Percentage of Americans, per capita, that were farmers or farm workers in 1910 (32%).

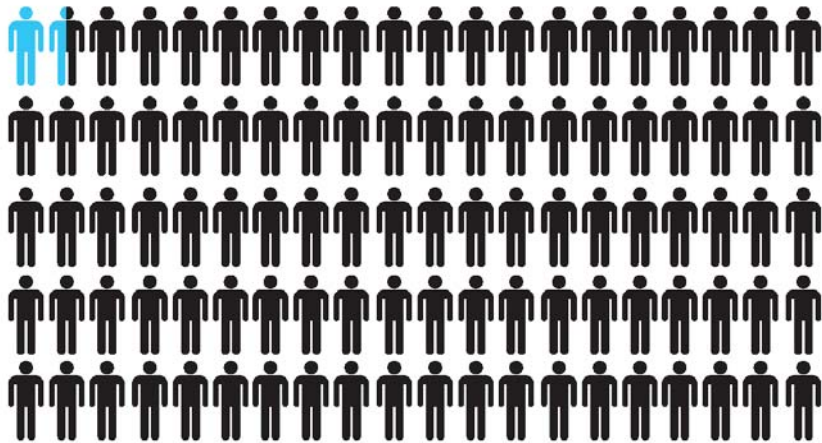


Figure 022
Percentage of Americans, per capita, that were farmers or farm workers in 2010 (1.2%).

Publicly funded farm and crop subsidies also represent a significant annual cost of our industrialized agriculture process. According to the EWG Farm Subsidy Database, in the 18 years from 1995 to 2012, the U.S. tax payers have paid nearly \$283 billion in farm subsidies. While one might think that all farmers are sharing in these payments, the truth could not be any different.

Subsidies were collected by only 38% of the farms in the U.S. during this time period, according to the USDA. Of those farms, 10% collected 75% of all the subsidies awarded. This means that less than 4% of the farms in the U.S. collected almost \$180 billion in subsidy payments. If one were to imagine this as individual piles of money, each of the top 10% would receive over \$32,000 annually, while the bottom 80% would receive an average of \$600. As if this were not complex enough, if one breaks down what subsidy payments went to, corn alone accounts for almost \$85 billion of all subsidy payments from 1995-2012. That is almost 50% of all commodity subsidies paid. (EWG, 2012)

We can see, quite clearly at this point, that agriculture that was formerly a hands-on operation a century ago is now a low man-hour input operation. Careful crop rotation, natural defense systems such as beneficial planting patterns, and soil cultivation has been replaced by chemical and mechanical inputs. Unfortunately, these are not flexible inputs, and as such, the food being grown today often resembles that which was grown previously in name only.

Section 5:

The Changing Food Landscape: Unnatural Selection

Crops grown today are most often selected for their capacity to ripen uniformly, produce as much weight per plant as possible, and to produce a product that is easy to pack and ship. (Joanes, 2009) As the number of farms has declined rapidly, this indicates that the farms that do continue to exist are large, and are not typically located in urban areas. As such, the food that is not grown where people are has to be moved to where people are. This usually means a longer-life product, but it also means that the food that you do buy has spent a significant amount of its life in a truck, on a train or on a boat, or in the hold of a cargo plane.

Crops are now grown with this transit requirement in mind, but it comes at a cost. Our current food supply is nutritionally deficient in nearly every way to food produced just 50 years ago. Levels of nearly every measurable vitamin and mineral in food have declined significantly, and this is thought to be due, in large part, to the selection of strains of food that grow to "harvest size" quickly, and that are stress and pest tolerant. This reduced growth time equates to a reduced time allowed for nutrients to be taken from soils and converted in the vegetables, and thus, the inferior vegetable. A study from the Kushi Institute found that levels of calcium in some foods dropped nearly 27%, iron declined by 37%, and vitamin C by 30% from 1975 to 2012. (Scheer, 2011)

The last phenomenon in the selective landscape is the travel component. There are several different metrics available, but using the most conservative available, on average, food travels over 1500 miles from the farm where it is grown, until it is available for consumption by the consumer. (Johnson, 2010)

The local movement is beginning to take hold, with conscientious consumers opting to select locally grown food over food grown at other points of origin. Though there is no official designation as to what local consists of, it is typically accepted that anywhere within approximately 100 miles of the point of consumption is considered local. To put this into a scale that maps well, using Knoxville as a point of consumption, average travel distances would be from Knoxville, TN to Albuquerque, NM or from Knoxville, TN to Halifax, Nova Scotia.

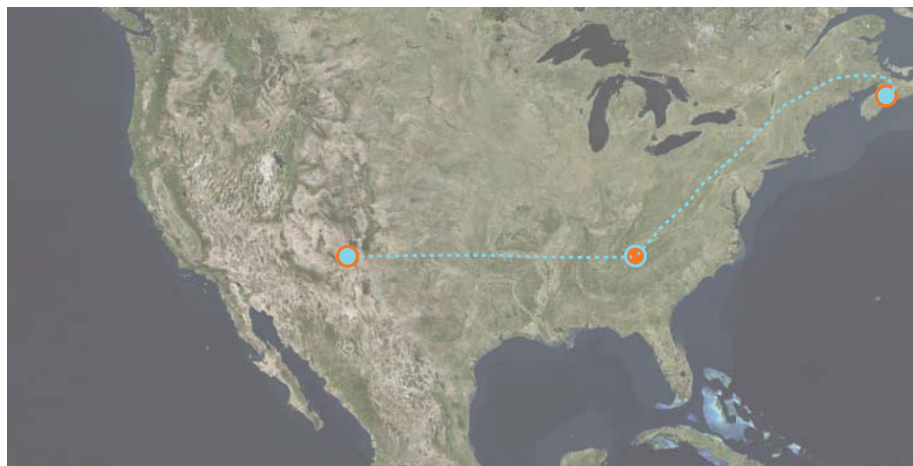


Figure 023
Satellite imagery showing relative positions of Albuquerque and Hallifax to Knoxville.

Bearing in mind that this is an average, one must remember that for every truckload of food that is produced locally, one comes from nearly 2900 miles away. Further complicating this issue is the industrial food complex. When food isn't in the form of simple, traceable ingredients, the equation becomes nearly impossible to decipher. A batch of high fructose corn syrup might be made and blended from corn crops from all over the US, then combined with tomatoes grown in Peru with spices and other vegetables grown in Mexico. How then, do we track how far the jar of spaghetti sauce that contains those ingredients has traveled before it reaches our pantry?

Agriculture consumes over 40% of the fossil fuels used in the United States every year. According to a study performed by Oregon State University, for example, between 1910 and 1983, the amount of corn produced in the U.S. increased by 346% , while the energy inputs to make those leaps in production increased by 810%. In order to become more "efficient" in producing food, we have become far less efficient. We may be utilizing far fewer people to produce food, but we are using far more energy. (Muir, 2014)

Food is now more expensive in hidden costs (subsidies and the health crisis), benefits us less by way of satisfying nutritional needs, and travels further than ever before, consuming more natural resources and fossil fuels. The need for change should be glaringly clear at this point.

1965: 787,000 combination trucks in service



consuming 6.7 billion gallons of fuel

2008: 1,790,000 combination trucks in service



consuming 20.3 billion gallons of fuel

2.27x the number of trucks consuming 3.05x the fuel

Figure 024

Diagram showing the number of combination trucks (also known as 'long haul trucks') in 1965 vs in 2008. The consumption of fuel indicates that trucks are traveling much further per vehicle, especially given the increase in fuel efficiency of modern vehicles.

Spring

*“April is the cruelest month, breeding
lilacs out of the dead land, mixing
memory and desire, stirring
dull roots with spring rain.”*

-T.S. Elliot, *The Waste Land*

Section 6 - Precedent

Fortunately, movements are already under way in cities all across the U.S. to take back control of our food supply from giant agri-businesses. There is a resurgent movement in farmer's markets across the nation (Bates, 2009), as well as in community gardening efforts. Ironically, these moves towards sustainable futures borrow technology and precedent from centuries ago. Sometimes less really is more.

When looking at systems of supplying food that can be developed in existing urban areas, we have several precedents to examine. As Jennifer Cockrill-King's book *Food in the City* explains, 19th century Paris is a stellar example of how agriculture can be integrated into the urban fabric. (Cockrill-King, 2012).

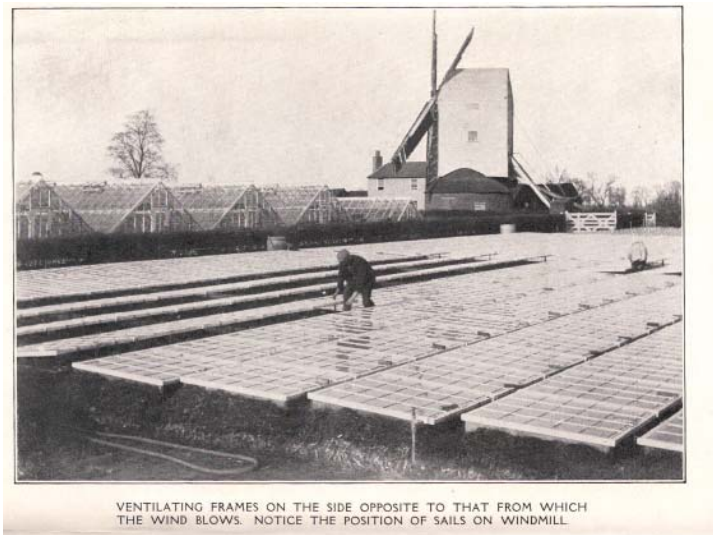


Figure 025

Rows of vegetables under glass frames helped protect them from frost and freeze, while allowing cross ventilation as needed.

Paris' urban agriculture supplied not only all of what was needed to sell to residents and chefs alike, but also excess to export to England. Some estimates place the amount of land inside the city limits of Paris at 16%, or nearly 1/6th of the available land. This system was an integral part of the city's waste management stream as well. Copious amounts of horse manure was composted, providing both nutrient rich soil, as well as providing the heat needed to extend the growing season through winter. (Chelsea, 2012)



Figure 026

Produce growing under glass cloches. These simple devices used solar radiation to increase heat, as well as to keep moisture where it was needed.

During World War I, the United States encouraged its citizens to grow their own gardens out of an interest in securing the national food supply. As industrialized agriculture was in its infancy in the U.S., it was unknown if the country could produce enough food necessary for an overseas war effort. Citizens then did their civic duty by growing as much food as possible so that farm efforts could be applied to establishing a national food supply. These home gardens were called "Liberty Gardens".

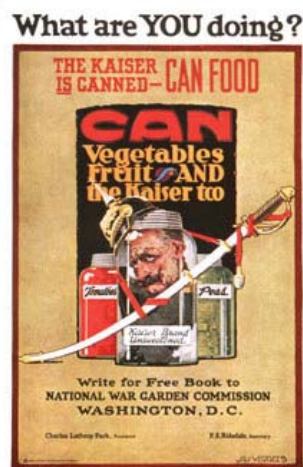


Figure 027
WWI poster promoting urban gardening and Liberty Gardens.



Figure 028
Chicago lot converted into a garden to produce food.

When Pearl Harbor was bombed in 1941, it only took 10 days for the U.S. Government to begin rolling out the “Victory Garden” program. Rather than secure the food supply, however, the purpose of the victory gardens was to reduce food miles. This served to conserve tin (from canned goods), gasoline and rubber from being consumed, and helped shift cargo trucks from moving food about the country to moving munitions and troops around. The mission may have changed, but the execution was similar, as was the outcome. (Lamp’l, 2012) During 1944, over 40% of the produce consumed in urban areas was grown inside of urban areas, thanks mostly to the Liberty Garden movement. By 2009, that figure had dropped below 15%.



Figure 029
WWII poster promoting urban gardening and Victory Gardens.

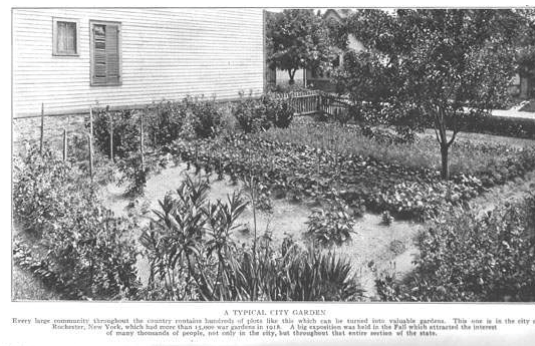


Figure 030
Typical yard in an urban area converted into a Victory Garden.

We see from the basis of these two similar efforts, the difference in the driving force behind the movements. The first was to secure a food supply, but the second was to disassemble the infrastructure necessary to maintain the food supply that was created to be re-purposed.

It is worth noting, at this point, that we are losing existing agricultural land to sprawl and development at the rate of approximately two acres per minute. (AFT, 2014) From 1982-2007, that represents over 23 million acres of farmland lost to development, or nearly 1 million acres per year. Almost 40% of that land was considered prime, or of a soil fertility ideal for growing food crops. There are some that would argue that, once gone, you can't get farmland back. I would argue that you can, just not all at once, and not in the same form that it might have previously existed. This new attitude is not mine alone. Citizens of cities all across the nation are participating in efforts attempting to do just that, and they are succeeding. Now, instead of the two previous choices of food distances (1500 miles vs 100 miles), we've added a third option.

Hyper-local agriculture takes place directly in urban areas, where people live, and where they consume the food. The hyper-local moniker is similar to the local in that there is no firmly established distance, but for illustrative purposes, I will be utilizing 5 miles. This is an area that is readily accessible by an electric vehicle, public transit, or a bicycle.

While large parcels of permanent agricultural land are unavailable in urban areas, we can learn from Paris' example and begin to distribute agricultural efforts across the cityscape in vacant lots and underused spaces. We then begin to chip away at not only food access issues, but also the issue of urban blight and decay. Additionally, evidence exists that indicating that people who grow vegetables are more likely to eat vegetables, and that activating blighted urban spaces helps to reduce associated crimes such as drug use and prostitution in those areas. (Johnson, 2010)

The City of Knoxville alone spent \$117,000 in 2012 keeping blighted property cleared. (COK, 2012) Shifting those resources to encourage and promote hyper-local urban agriculture begins to not only make better use of resources and land, but also provides jobs and creates a sense of community where before there was nothing.



Figure 031

Google Earth image of a vacant lot in North East Knoxville. The original structure has been removed, and the lot has been cleared, but is maintained by the city at taxpayer expense. There are dozens on dozens of similar lots in the city.

Section 7 :

Re-establishing Access to Food and Community

One of the critical milestones in reconnecting people with healthy food is availability. As a lack of availability of food was one of the causes of the current conditions, it should be addressed as a central focal point of the solution. However, we must remember that it is one of several contributing factors, and correcting one factor does not fix the others. A recent study at Penn State has revealed that simply creating a supply opportunity isn't enough to change established habits. As a matter of fact, fruit and vegetable consumption in a studied Philadelphia neighborhood was largely unchanged 6 months after a new market was opened in a food desert. The study found that less than 25% of the residents surveyed used the new market, and most of those that did used it because it was the closest available. (Neighmond, 2014)

There are two components that a market alone cannot satisfy: the replacement of a lost knowledge of food, as well as a civic energy that transforms a chore into a welcome facet of daily life.

Over fifty years, a lack of active knowledge in how to prepare foods has left entire generations of Americans adrift. Due to the ready availability of processed foods, people haven't participated in the process of preparing foods. As such, tasks that were simple to execute years ago now seem foreign and complex. Education must be provided alongside the access, so that people that have not previously had access to fresh foods can be made aware of how to easily select and prepare the food. Creating demand for the newly accessible foods is critical.

Finally, a sense of civic connection and place is required. Part of the success in the resurgence of both permanent markets as well as temporary farmer's markets is the civic sense of place that we get when shopping there. When at one of these markets, shopping becomes less of a chore and more of an activity of leisure, mostly due to the myriad activities and sensory stimuli available. From buskers at the French Market in New Orleans, LA and Pike Place Market in Seattle, WA, to the integrated café and butcher in the Reading Terminal Market in Philadelphia, PA, the trip to market becomes an activity that is shared across a community.

Making markets more entertaining (as well as more consistently available), smaller, more frequent trips become normative. An additional advantage that this provides is in helping to reduce food waste from post-consumer spoilage, which is responsible for over two-thirds of the food wasted annually. In 2010, over 133 billion pounds of food was wasted. Using retail pricing, this represents approximately \$162 billion dollars that went into trash cans and landfills across the U.S. (FWN, 2014)

Summer

“And so with the sunshine and the great bursts of leaves growing on the trees, just as things grow in fast movies, I had that familiar conviction that life was beginning over again with the summer.”

— F. Scott Fitzgerald, *The Great Gatsby*

Section 8 :

A Call to Action

In order to fully realize the potential of hyper-localized agriculture, three critical fractures in the food supply system will have to be re-evaluated and reconstructed.

- Food access must be restored through a market offering sustainably sourced foods and other consumer products. The market should be large enough to support the sale of all of the secondary and tertiary goods that are needed to prepare healthy and tasty meals without resorting to trips to multiple stores.
- Education must be available to bridge the gap in knowledge left from generations of food access issues. This includes teaching how to prepare food, as well as how to produce and preserve it.
- A sense of place must be created that encourages use of the site outside of the market itself. Locating the market on the edge of an area marked for urban redevelopment suggests that space should also be made to help establish the immediate community. Green spaces that can be occupied and open space that can transition from use to use as needs dictate should be created to encourage active occupancy during most hours of the day.

Supporting all three of these links will be the system of hyper-local urban agriculture that takes place on vacant urban lots across the city. Garden support pods, built from restructured used shipping containers create an affordable and attractive, as well as secure remote base of operations from which the newly trained citizen farmers can develop vacant blighted property into productive agricultural land. The deployed pods also act as a signifier that the lot is a productive place, helping to make the greater community a better place. When a person sees a garden with a cypress clad pod on site, they know that people are working to make lives better.



Figure 032

Photo montage of a Garden Pod and productive agriculture on a vacant lot.



Figure 033

Concept sketch of a Garden Pod.

The hyper-local process is diagrammed through a series of 4 steps:

1) The Market Hall is the beginning and end of the cycle. Here, interested residents take special classes to learn the regulations and methods used to grow food in the urban context. That knowledge goes with them, along with the Garden Pod, provided by the Hub, into the community.

2) Vacant lots are converted into productive intensive farms. The lots are split between production for the farmer, and production for the Hub. The Hub's production requirements are provided to the farmer, so that the farmer does not have to market what is being grown, and the Hub can plan on what the urban farms should be producing. The other portion of the farmed lots is at the farmer's discretion. They might grow food for their own families, or for local food banks, or even for their own marketing.

3) The food is collected at the Garden Pods by a representative of the Hub in an electric vehicle. This representative can also answer questions the farmer might have, and can inspect the urban farms to make sure that regulations are followed.

4) Food is returned to the hub, cleaned, processed, and put out for sale.

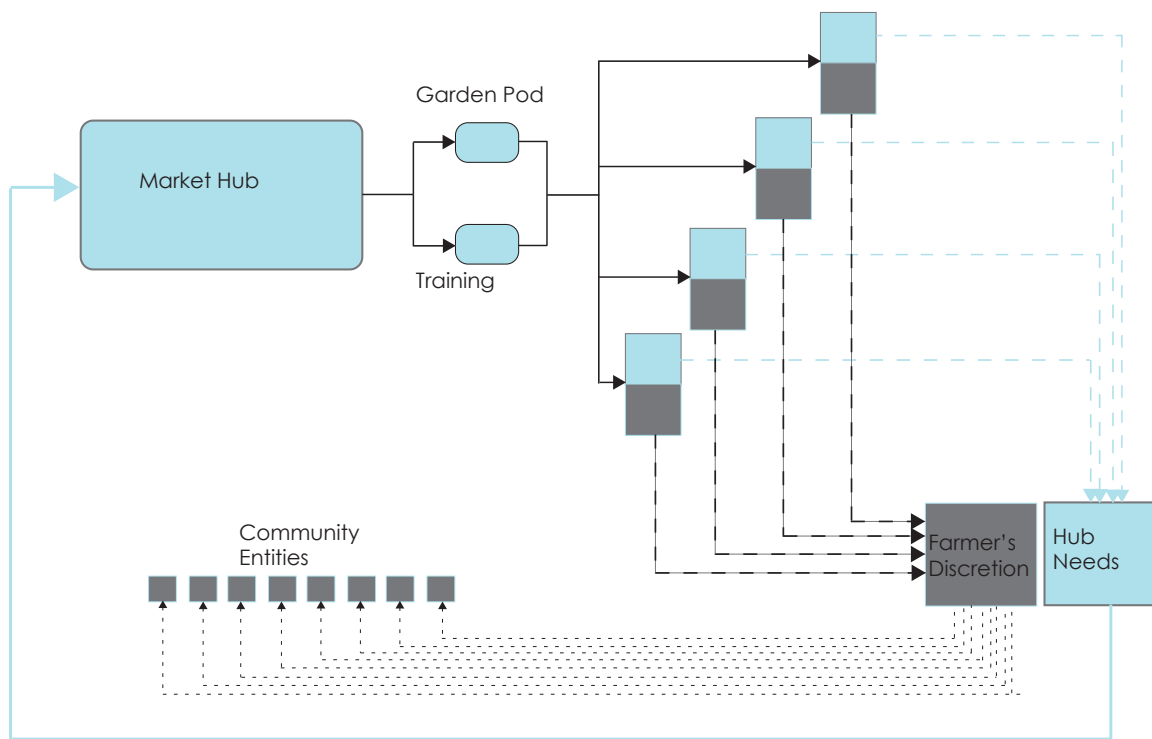


Figure 034
Diagram of the controlled hyper-local food system.

Section 9 : Siting the Market Hall

The site for the program exists in the Magnolia Warehouse District, adjacent to the Central Business Improvement District and the Magnolia Corridor Improvement Zone. The site was selected from several contenders due to its proximity to several existing bus lines, adjacency to the CBID, and the James White Parkway, which has potential to host a greenway connecting North and South Knoxville. The Magnolia Warehouse District is largely made up of dilapidated industrial buildings, with many of them vacant and hazardous. Through what can only be described as serendipity, I discovered that one of the buildings on the site was also home to the Farmer's Co-Op in 1980's. (KGIS.org)

PROPERTY ASSESSOR'S OFFICE - KNOX COUNTY, TENNESSEE										Source: KGIS
MAP DEPARTMENT - OWNERSHIP CARD										10/30/2013
ACTIVE	NORMAL									
District	Map	Insert	Group	Parcel	Ward	Property Location				
	95	H	C	18	06	816 WILLOW AVE				
Subdivision				Block	Lot	Plat	Dimensions (shown in ft.)		Acreage	
KHA INCS ADD PROPERTY				-	1-2	25-155	372.44 X 213.63 X IRR		1.79 - A.C. Deeded	
									0.00 - A.C. Calculated	
Owner				Sale Date	Book	Page	Sale Price	Mailing Address		
KNOX FARMERS CO-OPERATIVE				8/27/1987	1926	43	\$ 155,000	816 WILLOW AVE KNOXVILLE, TN 37915		

Figure 035
Public record of the former Farmer's Co-Op.



Figure 036
Photo-montage of the current site.

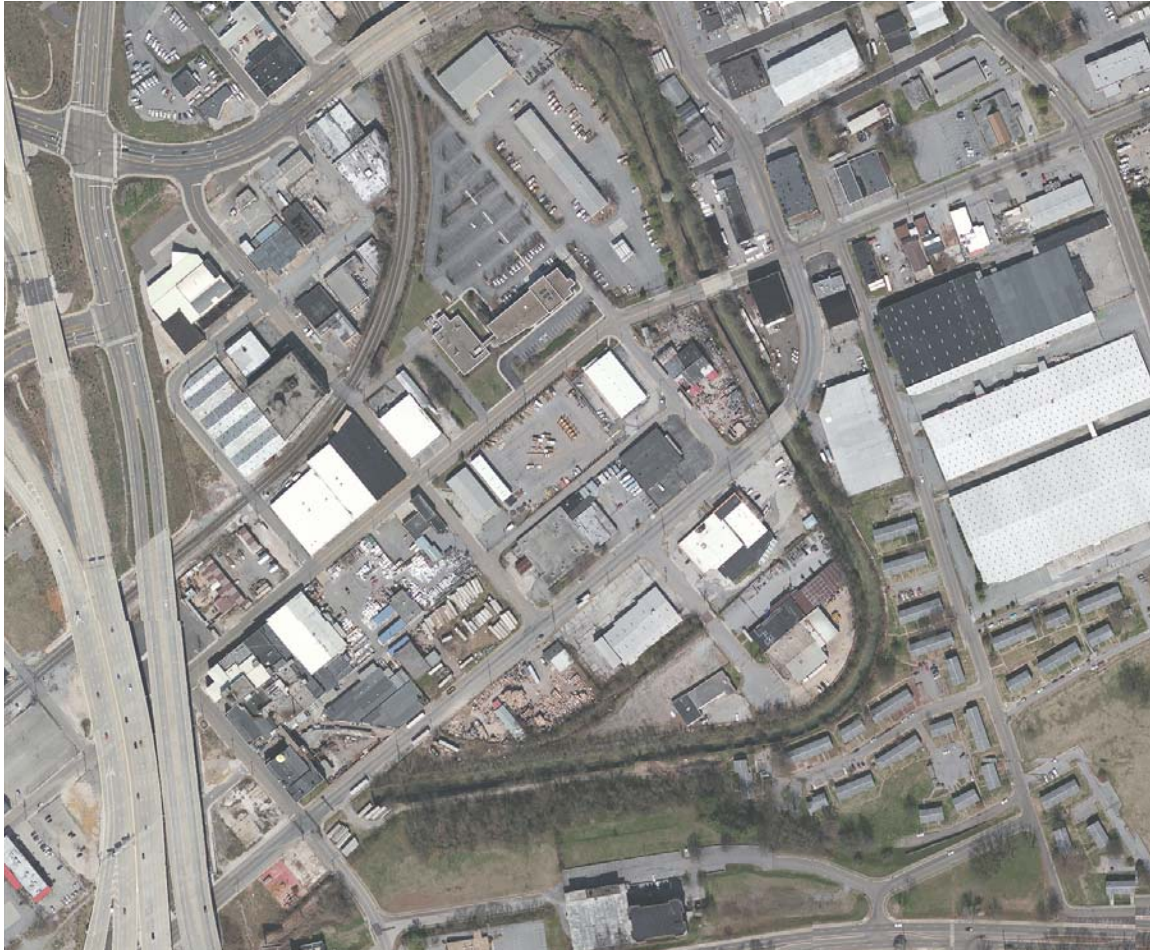


Figure 037
Satellite image of the site as it currently exists.



Figure 038
Satellite image of the site with the proposed project superimposed.

Section 10 : Defining the Program(s)

Program:

Market Hub

- Market Space: 15000 square feet of climate controlled retail
- Food Receiving: 6000 square feet of access limited, climate controlled produce intake, processing, and storage. Includes space for walk-ins for vendors, as well as Retail Market administration and support space.



Figure 039
Rendering of the proposed market space.



Figure 040
Ground Floor Plan
Market Hall

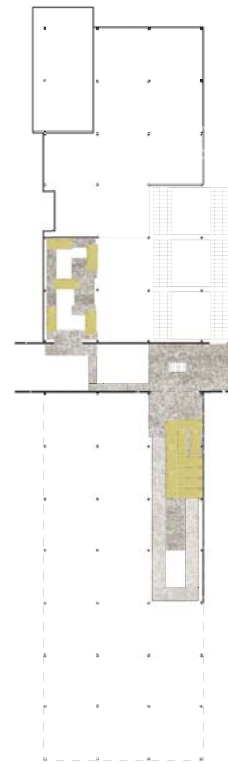


Figure 041
Mezzanine Floor Plan
Market Hall

- Vendor Village: re-purposed shipping containers form an intimate village of vendors selling anything from coffee and pastries to pizza, sandwiches, and specialty cheeses. 3200 square feet of floor space
- Green Houses: 4500 square feet of greenhouse space is distributed across 3 identical units, allowing for different temperature and humidity levels to be controlled, depending on what is being grown.



Figure 042
Rendering of the proposed Vendor Village from the ground floor.

- Teaching Kitchen: a 500 square foot, climate controlled kitchen is created using re-purposed shipping containers. The unit includes seating for up to 20, as well as a working kitchen equipped with the same sort of equipment that would be found in a typical home kitchen. The teaching kitchen also doubles as a seminar classroom and community meeting space as needed.

- Community Kitchen: a 500 square foot, climate controlled kitchen is equipped with commercial quality preparation appliances and fixtures. The Community Kitchen is rentable to small businesses and groups as a means to start businesses without having to invest in a commercial preparation space.



Figure 043

Rendering of the proposed Offices on the Mezzanine, with the kitchens and classrooms below.

- Administrative Space: to support the education and production mission of the Market Hall, and administrative space, separate from the Retail Market space will be created. 1600 square feet of space created from modified climate controlled shipping containers on a mezzanine overlooking the event space house the administration and staff.

- Event and Open Grounds: a combination of open air and covered space makes up approximately 20,000 square feet of flexible use space. Weekend markets, cultural festivals, and other events can take place here, helping to activate the space.



Figure 044
Rendering of the open esplanade.

•Artificial Wetland: Sited on Knoxville's First Creek, an impaired, channelized waterway that feeds directly into Ft. Loudon Lake, much of the site will be dedicated to repairing the environmental damage done by encasing the creek in concrete. Gabions will be used to create a series of islands in a widened waterway. The wider water area and the inclusion of gabion islands will slow the flow of water. The gabions give native plants and grasses a surface on which to attach and grow. The gabions will be constructed from both natural material and rubble salvaged from the demolition of industrial structures located on the existing site. What cannot be recycled will be re-used.



Figure 045

Rendering of the Market Hall South Facade and grounds from one of the creek islands constructed from gabions in the newly widened First Creek.

- Orchards and Kitchen Gardens: productive orchards and a kitchen garden support the educational mission of the Market Hub.

- Cistern: To assist in the remediation of First Creek, the foundation of the Market Hall will be a cistern capable of holding runoff from captured from the building surface. Once full, the cistern can be emptied slowly to help irrigate the wetland, and to better distribute the volume of water flow.

- Greenway Connector: Located on First Creek allows an opportunity to create a hub connecting several separate bike and pedestrian corridors. Connections can be made to the south and the Ned McWherter greenway, to the Magnolia and Central Avenue bike corridors to the east and north, respectively.



Figure 046

Rendering of the Market Hall, NorthEast Corner on Willow Avenue.

Garden Support Pod

Re-purposing shipping containers as garden pods connects the agriculture effort to the Market Hub through use of size and proportion. The same 20' long "tall containers" that are used to create program and fixture in the Market Hub are used to create secure storage and support units to be distributed through the city. Once a group of citizens are properly trained in all aspects of agriculture and food safety relevant to local operations, a pod is delivered to their site, where they begin the work of redeveloping the land for agriculture. Each site will be programmed differently, per direction of the Market Hub's needs and projections. Site size determines the number of participants involved in each effort, with approximately 50% of the productive area being dedicated to the Market Hub's localized food efforts, and the other half being grown at the farmer's discretion for personal sustenance, additional income, or charitable donation. The Market Hall portion of the program pays a stipend to the farmers based on share values for the month and productive areas, regardless of what specific crop is being grown (a cooperative method).

- Pods are clad in cypress, the same wood used on the Market Hub timbers and exposed cladding. Cypress is readily available in the South Eastern United States, and offers superior resistance to rot and pests in exterior applications.

- Pods are fitted with photo-voltaic panels, to help run a small cold-room to extend storage and minimize trips between harvests. The pods are hooked into the local power grid, drawing power as needed, but also adding power to the grid when possible.
- The pods contain caged cisterns for storing water that would normally run off of the surface of the unit. This water can then be used to irrigate the crops as necessary during the growing season.
- Secure storage for tools and supplies is provided with a Garden Pod, as well as temporary refuge from sudden storms. A deep sink and counter provide space for cleaning up after working, as well as for washing tools and produce.

Section 11 : The Design

The Market Hub is, of course, more than the sum of its programmatic parts. It serves to create an edge for an area that will be developed in the near future and provides several highly sought after amenities, in addition to helping to alleviate some of the conditions that go into the creation of food deserts.

Its size alone marks the structure as civically significant. The linear nature of the building, broken only by the gateway transept, echoes the rhythm of the adjacent city blocks. The height of the transept makes it visible from any direction, and the open nature of the passage invites people through in an implication of public space. The communal nature of the space encourages people to go on about their daily lives in the open, acting as part of a new community. The open and covered esplanade puts public festival and activity on display, helping to activate the space.

The building's overall form is derived from that of a barn. While silos make for interesting focal points, their mission is to store as much of a commodity as possible on a smaller footprint. The mission of the Market Hub is in opposition to this form. Barns are used not only as shelters, with storage of grasses for appropriate winter animal feed, but also hosted civic events such as town meetings, dances, and socials.

The food store-room and support area is separated from the linear form

by offsetting it slightly to the North and East. It has roughly the same rectilinear form as the Garden Pods, and is clad in the same cypress wood. This serves to associate the Garden Pod with the Market Hub visually. The interior of the enclosed spaces are also clad in this material, as is the grand transept.

The heavy timbers that form the structure of the Market Hall are also cypress. Cypress is considered to be one of a few varieties of wood to be ideal for use in exposed situations, as it is highly resistant to rot and pests find it unpalatable. The rhythm of the timber structure carries beyond the building to the West in the orchard, which is laid out on the same grid as the structure. Occasionally, a tree is replaced with a timber post to reinforce that the timbers at one point came from trees, and that they should both be respected.

Standing seam steel cladding is used on the gabled roof, and is wrapped to the vertical walls. Where the walls are recessed for entry, the steel is removed and cypress cladding shows. This highlights the entry in a warm natural material, making it more inviting, while also making the entry more obvious to passers by.

Building on the theme of a barn as a building for shelter and storage, and also on the reduction of food miles, used shipping containers are re-purposed into internal program elements. This signifies the building as a container for containers, and also plays to the subversive element that

once we reduce the miles that food travels, new uses for the existing containers must be found. This also helps tie the theme of the Market Hall together with the Garden Pods.

The offices are located on the Mezzanine above the teaching and community kitchens, where people learn about food preparation and can participate in community food preparation activities. The community kitchen can be rented by the hour so that startup businesses can prepare their foods without incurring the expense of having to build a commercially graded kitchen. A long, gently sloped ramp runs around this container area, helping to encourage exploration and providing new views of the activities below. The mezzanine also features an observation platform in the grand transept looking south over the new artificial wetland and public grounds. This same mezzanine also connects to an area above the vendor village on the east side of the building.

The Vendor Village is a collection of re-purposed shipping containers that serve as small service cafes and eateries. They are arranged so that they form their own area, and create a surface above them that can be navigated and occupied, again offering a different viewpoint of activity than one might normally experience in a public structure. People can purchase food and drink at one of these eateries, and take it elsewhere in the building or on the grounds to for relaxation and recreation.

Section 12 :

Finale

Real change never comes easily. Meaningful change comes through hard work and perseverance. Correcting issues of food access and food travel distance cannot happen over night. Rather, it will depend on communities rising up and reclaiming control of their nutritional destinies, one garden at a time. By participating in the Market Hub program, everyone benefits. Rather than tax revenues going into cutting turf grass on vacant lots, those same revenues can go towards helping jump start the garden pods, supply tools and seeds, and pay for the education that goes along with growing and preparing fresh foods.

By moving agriculture back into the urban environment, people engage it daily, whether through participation and activity, or via passive engagement, such as seeing it on a morning commute, or cycling past it on a weekend bike ride. Moving food back into the city moves food back into our daily consciousness, and reminds us that we still have choices, and that we can take control of our food future.

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Appendix

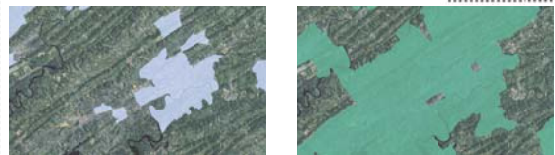
University of Tennessee | Master of Architecture
Jason Cole | 500 Spring 2024
Dr. Angel Jacobs | Professor Jennifer Atwood | Professor Ted Stutzman













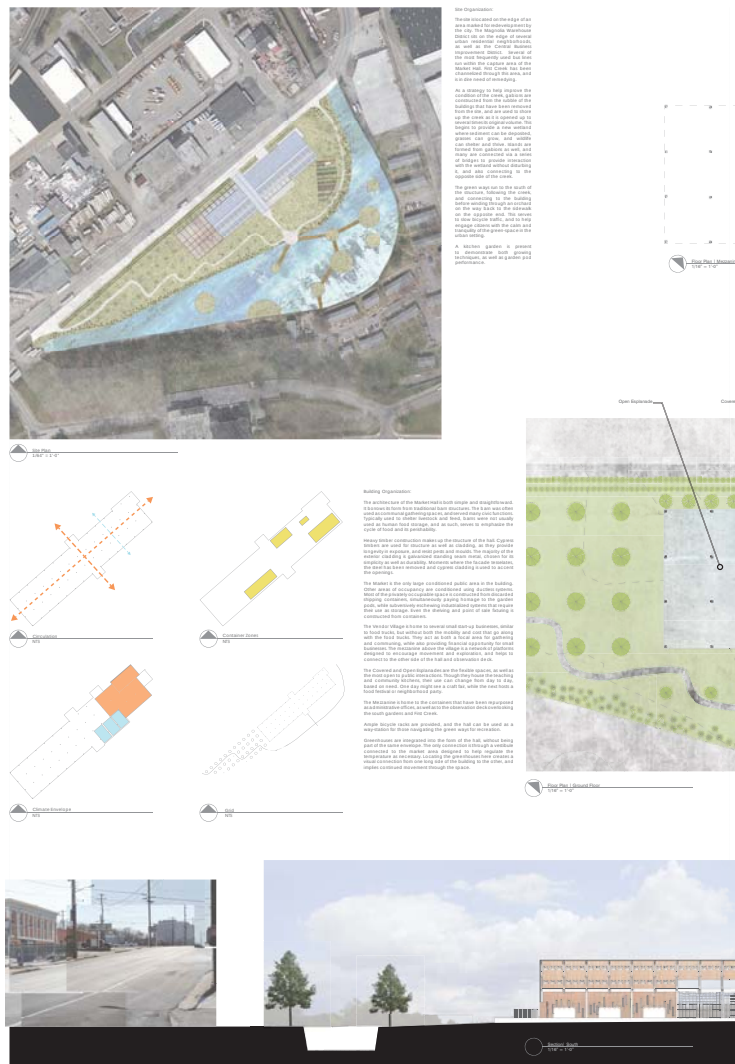


Figure 049
Presentation Board 3

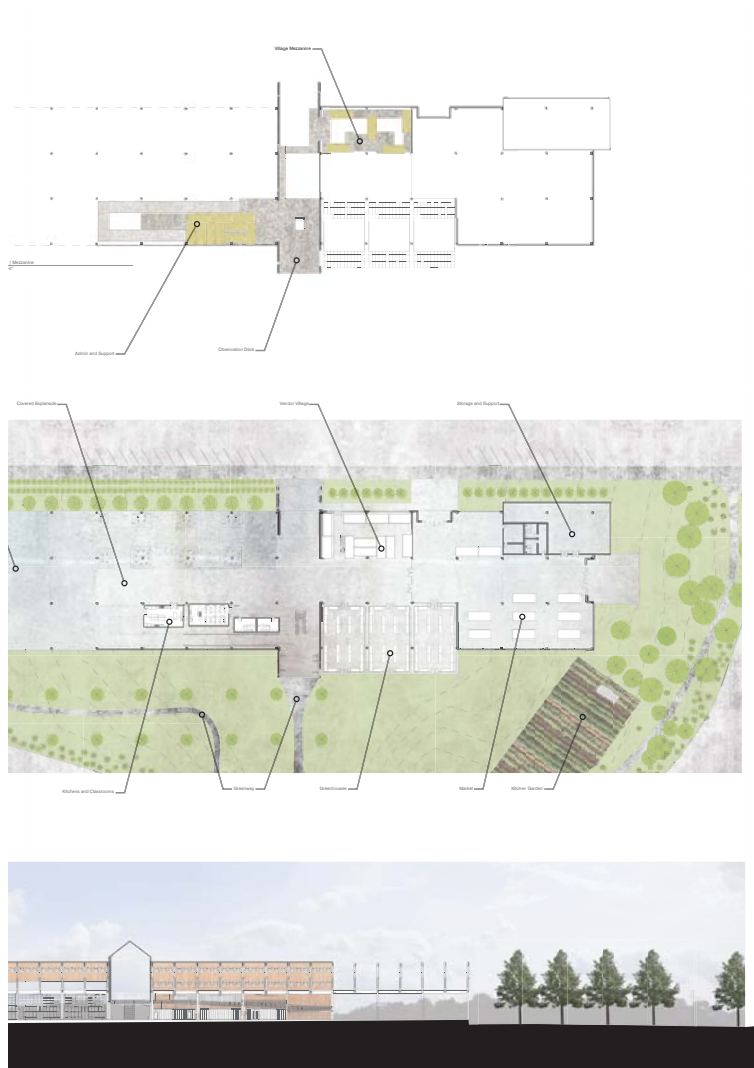


Figure 050
Presentation Board 4



Figure 051
Presentation Board 5



Figure 052
Presentation Board 6

Vita

Jason Cole is from Knoxville, Tennessee. Though he is fortunate to live in an urban area that is not a food desert, he regularly sees the effects of the conditions that occur within these areas, and is interested in finding a way to help correct them. He holds an A.A.S in Computer Aided Design and Drafting, and a B.S. in Industrial Engineering Technology. He is the recipient of the Alpha Rho Chi Bronze Medal for Leadership, Merit, and Service for 2014. This thesis represents the completion of his Master of Architecture degree.