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Fast/Fresh Food: Feed Syracuse Communities

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~~Fast~~/Fresh Food: Feeding Syracuse Communities

A Capstone Project Submitted in Partial Fulfillment of the Requirements of the Renée Crown University Honors Program at Syracuse University

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~~FAST~~ FRESH | FOOD | Feeding Downtown Syracuse

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glossary

a system is an assemblage of parts and relationships that form a unified whole.	system
a closed loop system is a system that uses its outputs as inputs, it is self-suffcient and sustaining.	closed loop system
an open loop system is a sytem that requires constant inputs and produces constant outputs, it is not self-sufficient or sustaining.	open loop system
food access refers to the ability for an individual or community to obtain nutritious and affordable food.	food access
food security refers to the dependability and reliablility of food access.	food security
a food desert is any point where there is no physical access to healthy foods within a walkable (.5 mi) radius.	food desert
food miles refers to the distance food travels from farm to table.	food miles
local food is food that travles less than 50 miles from farm to table.	local food
fresh food is local food that has never been frozen, canned, cooked or processed in any way.	fresh food
organic food is food that is grown or raised without the use of artificial fertilizers, pesticides, antibiotics, or chemicals.	organic food
famine refers to the widespread unavailability of food.	famine
obesity is a medical condition that develops when and individual accumulates excess body fat to the point where it has adverse effects on health. The most powerful predictor of the ocurrence of obesity is socioeconomic class (Cristler 111).	obesity
poverty is the state of have little or no money, goods, or means of support.	poverty
poverty alleviation is mitigating the effects of poverty	poverty alleviation
environmental restoration is the refurbishment of both the natural and the constructed environment	environmental restoration
monoculture refers to the cultivation or growth of a single crop/organism in a described area for a period of time.	monoculture
polyculture refers to the cultivation or growth of multiple crops/organisms in a described area at the same time.	polyculture
permaculture is an approach to designing human settlements and agricultural systems that are modeled on the relationships found in natural ecologies.	permaculture
community development redeveloping and advancing relationships within historically disenfranchised communities and developing new communities across traditional community/neighborhood boundaries.	community development

introduction

Industrial agricultural practice coupled with urban planning and infrastructural development over the past century has placed an unfair ***environmental burden*** on low income urban communities across the United States of America. As Majora Carter explains in her 2006 TED talk titled “Greening the Ghetto,” race and class correlate directly with the availability of parks, space and quality of public programming, as well as proximity to undesirable things such as highways, dumps, power plants, distribution centers etc. Furthermore, the development of said highways, distribution centers and the like has precipitated the ***exodus of economic opportunity*** including healthy food programming from the accessible urban realm marginalizing the low income communities at their core because of these boundaries and barriers to success. “***Economic degradation*** begets ***environmental degradation*** which in turn begets ***social degradation***,” (Carter) so it should be no surprise that the result is a continually deteriorating low income urban realm that is poverty stricken and crime ridden, with little educational or economic investment. All of these environmental burdens together promote the unhealthy diet and lifestyle that characterizes many low income low income urban communities which also contributes to the ***tax and healthcare*** burdens experienced by the middle and upper socioeconomic echelon.

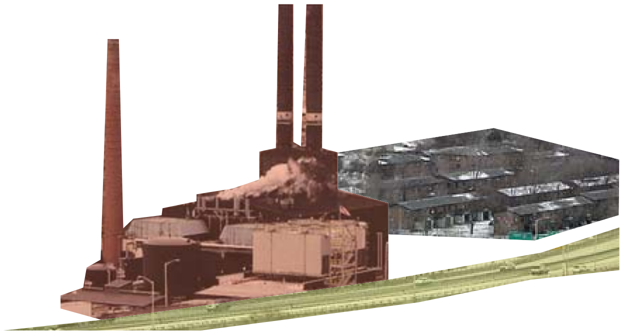


Figure 0.1

Figure 0.1_ *Pioneer Homes, a subsidized housing development in The City of Syracuse, is split in half by Interstate 81 and is bordered by the elevated railway and a paper factor to the south and another low income housing development to the east.*

Figure 0.2_ *The elevated highway splits the city and creates pronounced zoning separations throughout the city as well as class separations.*

Figure 0.2

Source: Syracuse Metropolitan Transportation Council

introduction

Obesity is defined as a medical condition that develops when an individual accumulates excess body fat to the point where it has adverse effects on health. Obesity rates have been on the rise since the 1960s to the point where 60% of Americans are now considered overweight (BMI 25.0-29.9) or obese (BMI +30.0). Even more frightening is the fact that the price tag for diabetes and health care tops out at approximately $100 billion annually. While diet and exercise are the determining factors on the occurrence of obesity, the most powerful predictor of obesity is socioeconomic class (Cristler 111). What this means first is that obesity is a systemic disease which arises because of exposure to low income environments described above over a period of time (Crooks) and secondly, it is costing tax payers an astonishing amount of money every year to ignore the declining environmental quality of low income environments. If a handful of the billions of dollars allotted to the diabetes industry were rerouted to support the environmental remediation and development of low income urban communities, it would increase the quality of life for the low income urban dweller and help to reduce taxes and cut obesity rates and consequently the cost of health care.

Figure 0.3_ *Body Mass Index in relation to Obesity*
a.) Normal weight (BMI 18.5-24.9)
b.) Overweight (BMI 25-25.9)
c.) Obese (BMI 30-34.9)
d.) Severe Obese (BMI 35-35.9)
e.) Mobidly Obese (BMI 40 +)

Figure 0.4_ Cover image for the movie *Waiting for Superman.*

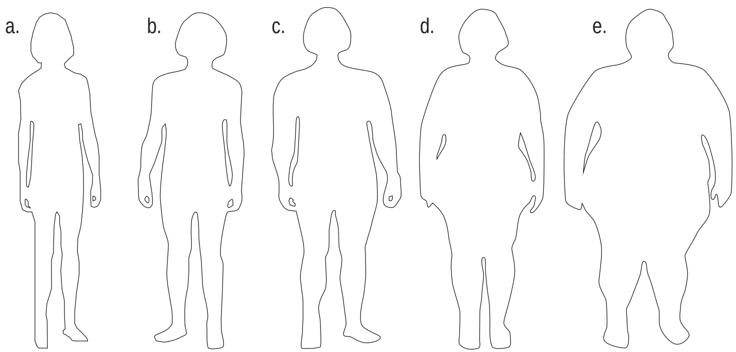


Figure 0.3

If the healthcare portion of this were not convincing enough, it should also be stated that low income communities generally feed into poorly resourced public schools that produce an astonishing amount of high school dropouts. According to the 2010 film, Waiting for Superman, which details educational inequity across The United States:

"These drop-outs are 8 times more likely to go to prison, 50% less likely to vote, more likely to need social welfare assistance, not eligible for 90% of jobs, are being paid 40 cents to the dollar of earned by a college graduate, and continuing the cycle of poverty."

The cost to incarcerate one individual annually is $33,000 while the cost of education per student in public school throughout the U.S. is just $9000. If more of tax payers money was put toward enhancing the educational environment in low income communities, it would keep more low income individuals out of jail and in the workforce, and help to give people the knowledge to make healthy dietary and lifestyle choices while minimizing the cost of the low income urban dweller to the tax system at the same time.

contention

Figure 0.5

"No community should be saddled w/ more environmental burdens and less environmental benefits than any other" (Carter), but before urban farming design can address issues surrounding the urban decay of low income neighborhoods, it needs to address the urban condition; that is the inherent competition for both light and space within the city, the scalar aspect of the city, and the regional characteristics of the city. Only when an urban farming design successfully addresses these issues can it function to alleviate poverty, increase food security, restore the environment, and develop communities in low income urban environments. Many contemporary urban farming projects aimed at the urban poor are unsuccessful because they are based on rural farming models that are inserted into the city rather than models that emerge as a result of the urban condition. Therefore, the design research driving this thesis project is centered on finding particular crop characteristics in combination urban production and transforming that into a universally applicable design strategy that will help improve the lives of the urban poor in cities throughout the world.

Figure 0.5_Monage depicting the dichotomy created by the elevated rail line that runs through downtown Syracuse which, at this juncture separates the thriving commercial district of Armory Square and the deteriorating residential Near Westside Neighborhood. The montage also represents the potential of urban agriculture to reinvent and reinvigorate the Near Westside Neighborhood.

I. *FOOD SECURITY*

"The relationship between food and cities is endlessly complex, but at one level is utterly simple. Without farmers and farming, cities would not exist."

-Carolyn Steel
Hungry City: How Food Shapes Our Lives

Food access is defined as the abililty to obtain healthy and quality food at reasonable prices. Adequate food access means an individual or community is food secure. Food access and the resultant lack of ***food security*** are the primary contributing factors influencing the ***obesity*** epidemic in the low income communities across the United States . To understand the they ways in which design interventions can positively impact food security, it is first necessary to understand the continually evovling relationship between food and the city. Only then will it be posible to identify benefitial strategies and points of intervention in the urban food supply system

Figure 1.1.1

1. Food Security in the Pre-Industrial City

While trade networks did exist in pre-industrial times, transportation was slow, preservation technology limited and the process was unreliable. As a result, the pre-industrial city operated as a self-sustained and maintained unit (Figure 1.3). For this reason, food programming was localized and dominated the pre-industrial city landscape blurring the boundaries between city and county. Food production occurred in the city and out, animals roamed the streets alongside their human counterparts, and markets infiltrated every nook and cranny of the urban fabric (Figure 1.1) . The streetscape became an impromptu trading ground and sales venue for food and other items; the public realm was alive and well with food as the cultural centerpiece (Figure 1.3).

Because knowledge sharing about food was abundant in the preindustrial city and food such and important part of tradition, it was almost impossible to experience a lack of informational access which would prevent healthy eating. There were also not many 'unhealthy foods' in the foodscape in pre-industrial cities to consume and nearly everyone was in proximity to a market so physical availability was also a non-issue. Therefore food access understood in the preindustrial city is extremely different that undertanding food access today.

Food access in the preindustrial city was only concerened with food availabiliy and affordability. Availability in this context is universal, and refers to local harvests and growing seasons. In the preindustrial city, a bad growing season would mean a widespread and universal lack of food access for everyone in the city. Famines were common in the preindustrial city because they were largely dependent on factors outside of human control such as weather, pests, and invasion from outside states. The other factor, affordability, is understood in a similar way as it is today, being that those who could not af-

Figure 1.1.1_ Copy of John Ogilb's map of London highlighting food supply routes and markets. Image Source: *Hungry City, How Food Shapes Our Lives.*

Figure 1.1.2_ The medieval market depicted as festival. Wealth and people spilling into the streets blur the lines between public and private, producer and consumer. Image Source: *http://teachmecon.com/the_medieval_and_early_modern_world.*

Figure 1.1.2

ford food were denied access to healthy food and therefore suffered from undernutrion. The difference is in the way in which ‘undernutrition ‘manifests itself: minimalism verses excess. Today, those who cannot afford healthy food simpley eat larger quantities of unhealthy foods in order to satisfy caloric needs, where as in the postindustrial era, those who could not afford food did not have the option of ’cheaper’ food and experience resulting in starvation. As Michael Pollan states in his book An Eater’s Manifesto, industrial agriculture ushered “...a new creature on the world state: the human being ho manages to be both overfed and undernourished.” (Pollan 122).

Figure 1.1.4 _Image of a xisteenth centry cookshop catering for a wedding feast. Note how the banquet table and the wedding party spills into the street and the cookshop is open to outside air. Image Source: *Hungry City, How Food Shapes Our Lives.*

Figure 1.1.5 _Smithfield Market, London circa 1830. Animals and humans in habit the same space within the market adn food is abutndent. Image Source: *Hungry City, How Food Shapes Our Lives.*

Figure 1.1.3_ The pre-industrial city functions as a self contained unit with resources expanding out from the city center in a conecentric or radial pattern.

2. Food Security in the Industrial City

The rapid urbanization that accompanied industrialization in the early to middle 1880s created a concentration of people in a limited amount of space. Many of these people were leaving the countryside and the farm for the city and displacing what was left of the farm within the city (figure 1.3). Such drastic population shifts over a short period of time, left the responsibility for the feeding of more and more people in the hands of fewer and fewer farmers. This placed unprecedented strains on existing local food systems and posed an immense threat to food security in growing cities in terms of food availability. Because industry depended on a concetration of available labor for efficiency, and this new industrial era was a boon for the economy it was apparent that cities were not going to get smaller and sourced locally was no longer sufficient to meets the needs a the growing city. Therefore, levels of production needed to scale up and a radical re-invention of agriculture practice was in order. As Plato states, "Necessity is the mother of invention," and because traditional agricultural practices could no longer provide food security for cities effectively, the seeds of a new agriculture for the industrial age were planted.

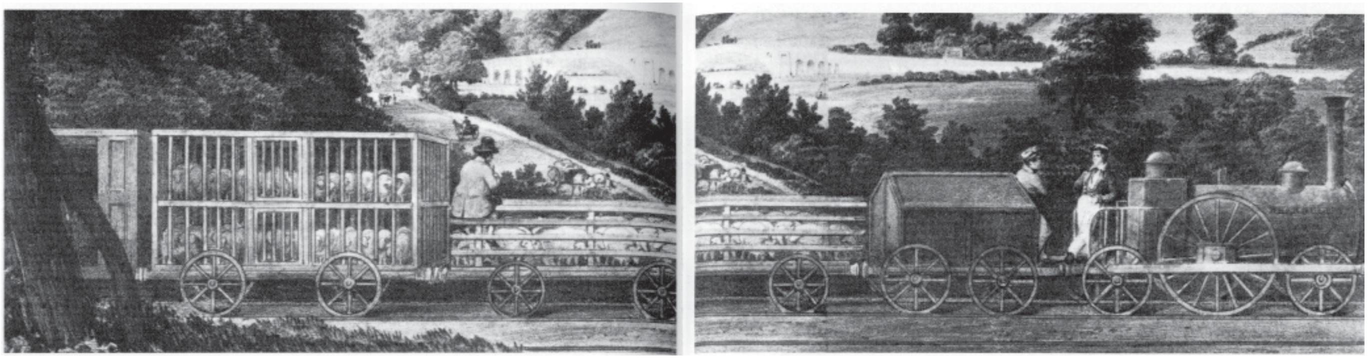


Figure 1.1.6

Over the next half of a century, the basic geographic and infrastructural relationships required for industrial agricultural systems developed around the principles of food security: dependability, affordability and availability. The development of trains and public transportation networks aided the consolidation of markets thereby providing the necessary distribution channels for farmers to sell their products efficiently at great distances from where they were produced. No longer impeded by the constraints of geography (Steel), the dependency on local conditions availability was diminished. Advances made in food processing, packaging and storage helped aid in the transpiration of goods across vast distances with minimal decay and waste. Lastly, technological and scientific advances in production boosted production yields so dramatically that agriculture could now feed animals and people while still maintaining a healthy surplus. Together, all of these advances in agricultural practice made food available for all, affordable for most, and dependable .

On the surface, this new industrial agricultural system is excellent; it has solved the woes of food security in the preindustrial city and appears fool proof. What is not readily apparent are the new food access issues in the making and the way in which food security will be transformed by future trends in devlopment. By moving food

Figure 1.1.6 _The Great Western Railway in 1840, carrying animals bound for the city blurring the lines between city and country in a transition period between the pre-industrial and industrial city. Image Source: *Hungry City, How Food Shapes Our Lives.*

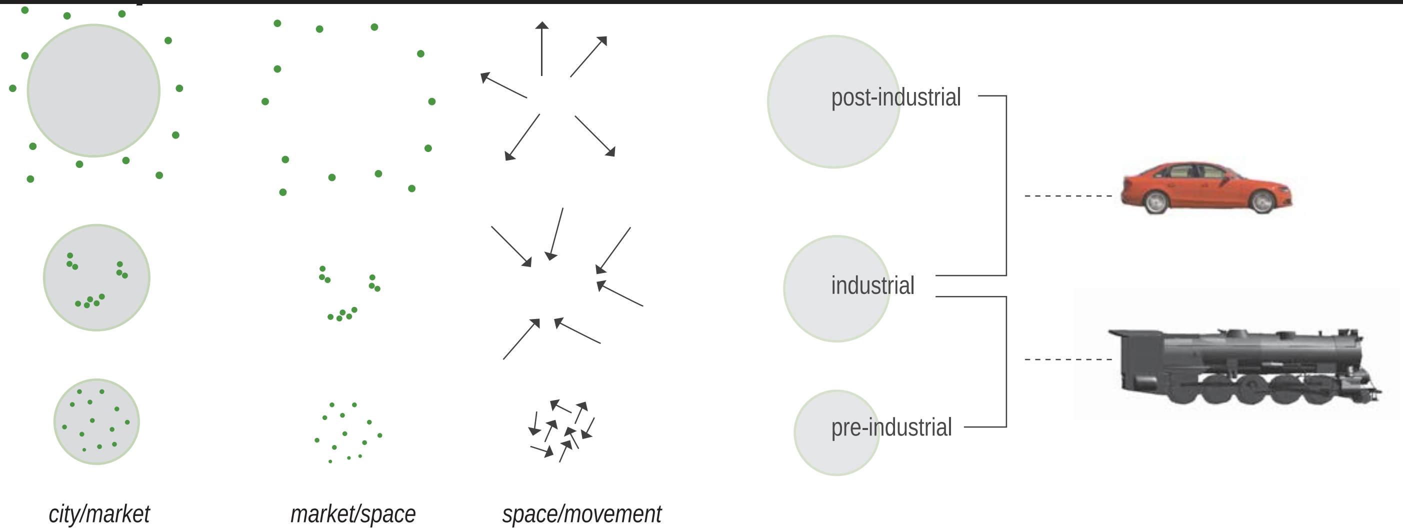


Figure 1.1.7

production completely out of the public eye and consolidating markets throughout the city, there is a shrinking presence of food in the city and a growing knowledge gap between the producer and consumer of food (Figure 1.4, 1.5). While the knowledge gap is not complete and physical accessibility is not yet an issue, the stage has been set for the food access issues that come with the post-industrial era of cities and food and the emergence of obesity as an epidemic.

3. Food Security in the Post-Industrial City

Just as the train had freed food production from the constraints of geography, the commercial availability of the car and Eisenhower's Interstate Highway system freed consumers from the constraints of geography catapulting the American City into a post industrial era. People bought cars and left the city for suburbia, a happy mix of city and country living. New food distribution networks and marketing strategies followed suite order to respond

Figure 1.1.7_Diagram showing market movement from pre-industrial times to present and its relationship to population flows around, in and out of the city.

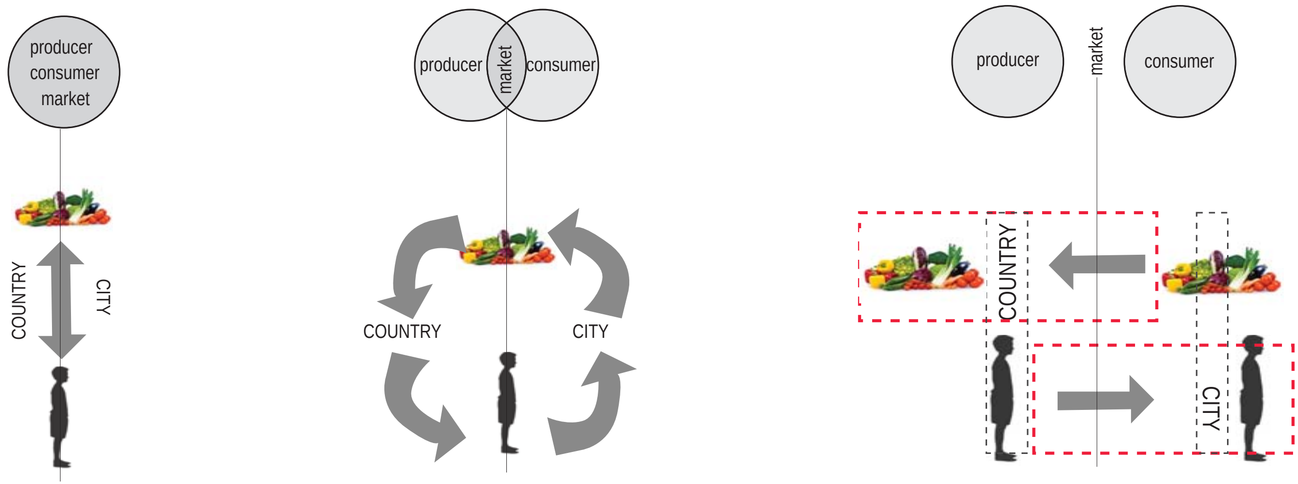


Figure 1.1.8

***Figure 1.1.8**_*Diagram showing the evolution of the growing knowledge gap between producers and consumers of food in relation to industrial development.

to the new mobility of the consumer. Markets consolidated once again, now bearing the title of SUPERmarket and moved to the urban periphery. As a result food distribution channels became endlessly complex in order to supply larger markets (Figure 1.4,1.5)). Now the disconnect between producers and consumers of food was complete and new dimensions to food security emerged.

In the preindustrial city and industrial city, information and knowledge about food was a given where as in the postindustrial city knowledge about food needs to be learned. The transition to a post industrial era was also a time of economic turmoil which saw government cuts in public school health programming. The coming of the post-industrial age coincided with the serious entry of women into the workface as well, meaning there traditional transmitter of food knowledge and values was largely out of the picture (Pollan). As a result, inadequate access to information about food becomes a serious inhibitor to healthy diet and lifestyle in the postindustrial city. Assuming that knowledge is not a barrier to food access, individuals and communities also need to have a physical/financial means of getting to the newly dubbed supermarket. In the preindustrial city food infiltrated the city and the street was the market and physical access was not an issue. In the industrial city the market consolidated but was still accessible to most communities and physical access was not an inhibitor to healthy living. In the postindustrial city the market is absent thereby leaving those without access to a car or other means of transportation without access to healthy food.

Lastly, assuming that an individual or community is armed with the knowledge and ability to get to the supermarket, they need to be able to afford healthy food. Affordability has been a constant factor for food accessibility, in all ages and eras of city development, but in the past affordability was a black and white issue and today it manifests itself in shades of gray. Government policy has developed to support the affordability of food for all and while the corresponding development of food science and manufacturing have made calories cheap. Unfortunatly, foods they have also been

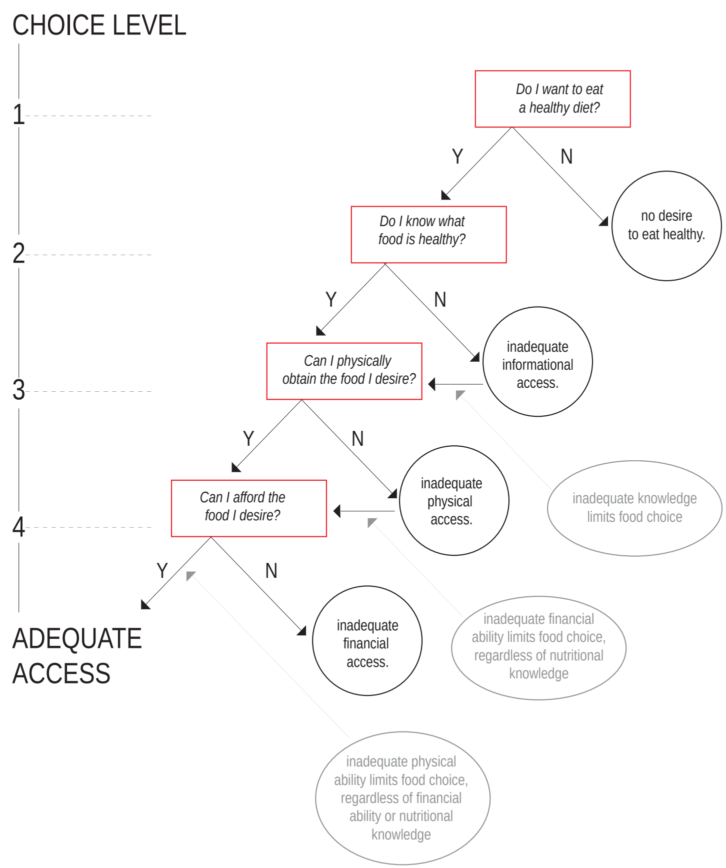


Figure 1.1.9

emptied of nutrient content in the process . As a result those who would have died of starvation in the preindustrial city are dying because of obesity and its related illnesses in the postindustrial city, not because they cannot afford food but because they cannot afford food that is good for their health.

4. The Role of Design

Barriers to healthy food access may begin with the individual desire to eat healthy, but the rest of the barriers are systemic in nature and have developed over time. Knowledge about healthy food choices, physical means to get to a venue and purchase healthy foods, and the financial ability to purchase healthy foods are all systemic barriers that have emerged since the industrial rev

*Figure 1.1.9*_Diagram Source: Jesse McEntee, (2009) "Highlighting food inadequacies: does the food desert metaphor help this cause?", British Food Journal, Vol. 111 Iss: 4, pp.349 - 363

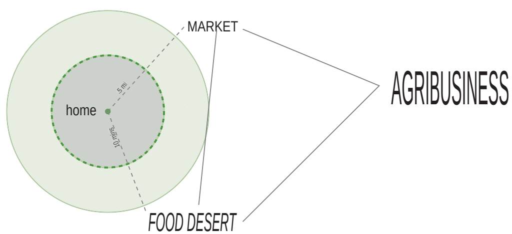


Figure 1.1.10

*Figure 1.1.10*_Diagram showing the relationship between food markets, food derserts and agribusiness.

olution that primarily effect lower income populations (Figure 1.6). For these reason, urban farming design will first focus on increasing informational access, physical acess and financial access to healthy foods in order to acheive food security in systemmically disadvantaged communites.

Urban farming design can begin to address issues of informational access and physical access by giving food a physical ***presence*** within communities in need. As in the preindustrial city, ***visibility*** can encourage tacit learning in the post-industrial city. Design can also encourage more active forms of learning through ***auxiliary public programming*** derived from the urban farming program. Public spaces such as parks, markets, demonstration areas, classrooms, etc can help to reestablish communication channels between the producers and consumers of food while further increasing foods presence. Lastly, the urban farming design needs to be ***economically feasible***; affordable to start up, affordable to maintain, and affordable for low income consumers. Only then can design truly help to ***shrink food deserts, increase food access,*** and deliver ***adequate food security*** to low income neighborhoods within the city.

II. *ENVIRONMENTAL RESTORATION*

Neighborhood security refers to the overall environmental quality of a neighborhood. Historically, factors that negatively impact perceived neighborhood security include physical characteristics such as urban decay, neglect, and proximity to undesirable programming as well as social characteristics such as crime rates, racial composition and quality of education. Not surprisingly, many low income urban neighborhoods suffer from a lack of neighborhood security. This contributes to the sedentary lifestyle which characterizes low income urban environments influencing the prevalence of ***obesity***. To understand the ways in which design interventions can positively impact neighborhood security in low income urban communities, it is first necessary to understand the causes of neighborhood deterioration. Only then will it be possible to identify beneficial strategies and points of intervention for appropriate ***environmental remediation***.

EARLY 1900s **TODAY**


Figure 1.2.1


Figure 1.2.2

Figure 1.2.3

Figure 1.2.1_Snowden apartments, located right next to I-81 in the Near Northside Neighborhood of The City of Syracuse. Pictured to the left in the early 1900s and then pictured today, notice the reduction in foliage and bare atmosphere of the streetscape as compared to 100 years ago. Image Source: *syracusethenandnow.org.*

Figure 1.2.2_A doctor's home pictured in the early 1900s and then today. Deterioration and neglect is aparent. Image Source: *syracusethenandnow.org.*

Figure 1.2.3_The old Otisco Brewery sits in disrepaired after being abandoned for more than 30 years.

1. Redlining, White Flight, & Urban Decay

Many of the issues surrounding low income environments that harbor obesity today come as a result of a piece of legislature developed during The Great Depression by the Teddy Roosevelt administration which created the Federal Housing Administration (FHA). The job of the FHA was first, to promote the building of new homes throughout the country as a way to provide new modes of employment for a struggling nation and second, to provide federally guaranteed mortgages to home buyers. Unfortunately, the government could not give loans to everyone, so the Home Owners Loan Corporation (HOLC) was created in 1936 to assess the 'residential security' of America's neighborhoods and provide lenders of federally guaranteed loans with guidelines about where loans could be safely made (syracusethenandnow.org).

Hundreds of maps were created for all of the cities and towns in the country including Syracuse grading neighborhoods from 'A to D' based on the overall environmental quality of the neighborhood (Figure X). Areas that were in good condition had no undesirable social characteristics were considered the safest areas to give out federally

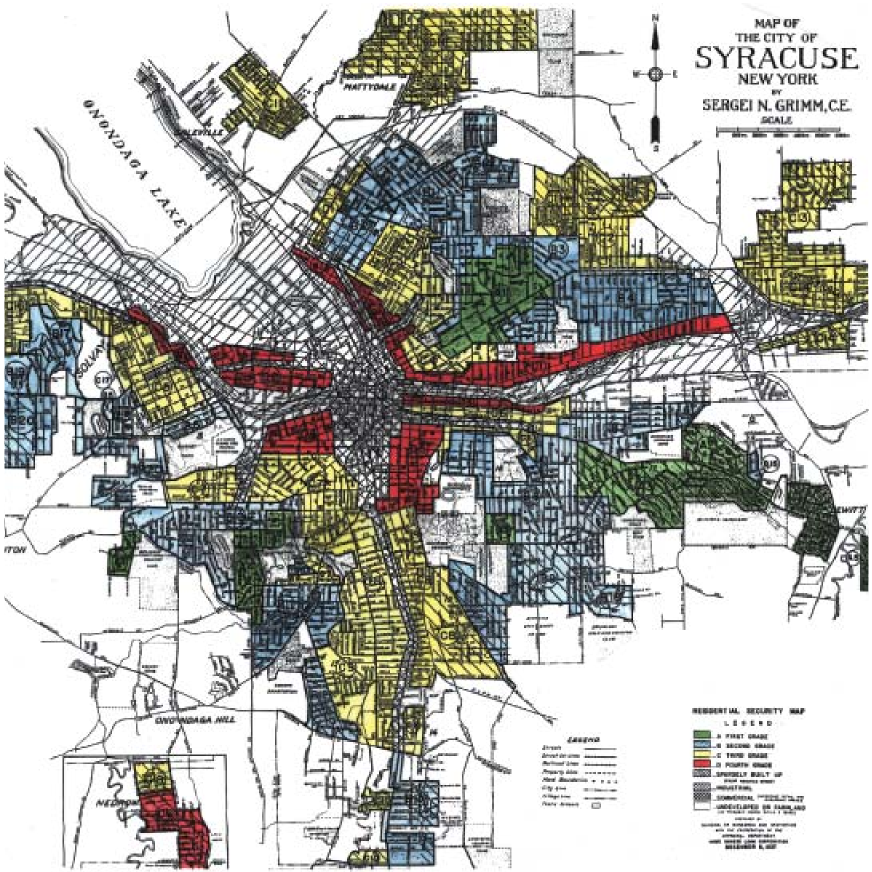


Figure 1.2.4

***Figure 1.2.4*_** Redline map of The City of Syracuse drawn by Sergei N. Grimm for the Homeowners Loan Corporation in 1937. Image Courtesy of Emanuel J. Carter, State University of New York, College of Environmental Science and Forestry accessed via learner.org.

***Figure 1.2.5*_** Diagram of the concentric nature of HOLC grading.

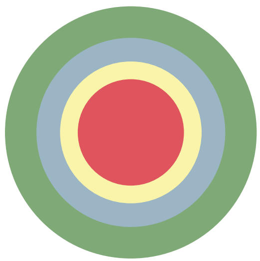
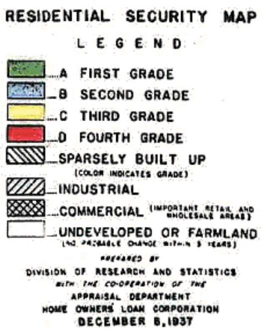


Figure 1.2.5



guaranteed mortgages thereby awarded the letter grade 'A' and coded green on the map. Areas graded 'B' were coded blue and considered the next safest area to give out federal loans. As areas graded 'C' were yellow and described areas where obtaining loans was extremely difficult; and areas graded 'D' were red and were considered areas where no loans would be given out.

The criteria for grading neighborhoods included physical and spatial characteristics such as urban decay and proximity to industrial and commercial zones, as well as social characteristics including race and ethnicity. The more a neighborhood experienced physical decay and the closer it was to a commercial and/or industrial center the lower its grade. Similaryly, the larger the non-White, non-Christian, and/or immigrant population the lower a neighborhood's grade. Green areas on the map had no infiltration of 'undesirable' races or ethnicities and were either in good physical condition or underdeveloped, while red areas on the map were primarily non-White, non-Christian, and/or immigrant neighborhoods that were densely built up yet experienced a considerable amount of physical decay.

Ironically, those neighborhoods closest to the cities commercial and industrial centers also had the highest concentration of 'undesirable' populations. The result is a concentric pattern of investment in American cities spurred by racist lending practices that strands poor and colored populations in deteriorating urban centers (Figure X). Following the creation of the HOLC maps, these areas experienced extreme disinvestment and the beginings of white flight out of cities, thereby accelerating the process of urban decay in low income and colored urban neighborhoods.

2. The Interstate Highway System, White Flight, & Urban Decay

Approximately twenty years after the creation of the HOLC maps, Eisenhower's Interstate Highway System would further decimate low income neighborhoods in cities across The United States. Majora Carter notes that more than 600,000 families were displaced during the construction of the Interstate Highway System. Frequently, the highways plowed through and divided low income urban neighborhoods and families property became worthless (Figure X). It also accelerated white

CASE STUDY: THE DESTRUCTION OF THE 15th WARD

During the 1960s, the construction of Interstate 81 split the city of Syracuse in two. Most notably it plowed through a neighborhood in Syracuse that was at one time known as the 15th ward. Historically, the 15th ward has always been home to immigrants; the Jews in the 1800s and the Blacks in the 1920s. It is also home to one of the first government funded housing projects entitled *Pioneer Homes*. As can seen in Figure X, a portion of the *Pioneer Homes* were demolished to make way for Interstate 81, which drives right through its center. Furthermore, residents living in 'The Ward' at the time had no voice regarding the constuction of the highway which is astonishing considering nearly 1,300 individuals were displaced during construction of the project (syracusethenandnow.org). Today much of the 15th ward is populated by largely vacant parking lots, abandoned builidngs, and delapidated structures and the local populations are still struggling with poverty as a result of the constuction of Interstate-81.

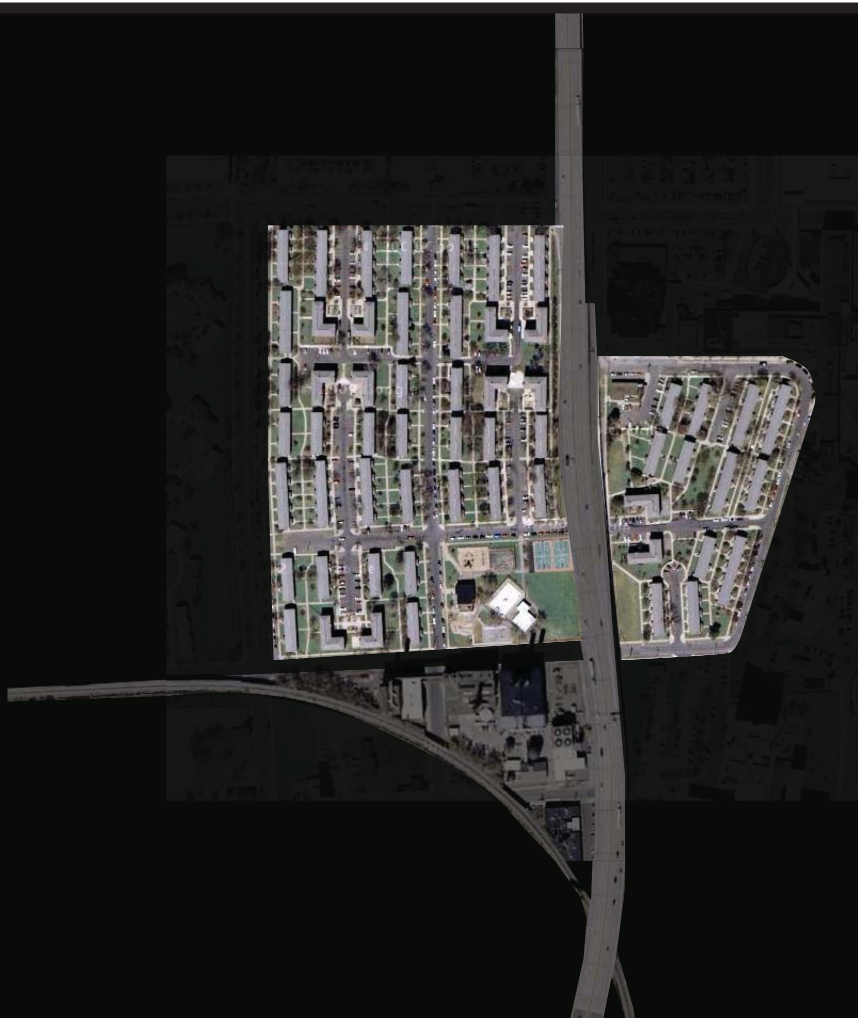


Figure 1.2.6_ 15th ward map before the construction of Interstate-81. Highlighted is the future location of the *Pioneer Homes* development. Image Source: *Jewish Heritage Center of CNY.*

Figure 1.2.7_ Construction of Interstate 81 along Almond Street, looking south from downtown Syracuse. Crouse Hospital's clock tower can be seen in the distance. The Clover Club, a jazz club, is the one-story building at top left. Image Source: *The Onondaga Historical Association accessed via syracuse.com.*

Figure 1.2.8_ A landmark of the old 15th Ward was Schor's market at 604 Harrison St. The site is now the southbound exit ramp of Interstate 81. Image Source: *The Onondaga Historical Association accessed via syracuse.com.*

flight out of city centers and the economic growth of suburbia, which depleted the city's tax base and continued the trend of urban decay in city centers and their surrounding neighborhoods.

3. The Role of Design

Historically, low income communities have been subject to disenfranchisement and decay as a result of racist and classist lending practices and infrastructural development. Urban decay manifests itself within the physical environment by means of visible deterioration, neglect, and/or vacacy of construction space as well as deterioration of nature (soils, water, light, and air quality). Socially, urban decay manifests itself through a deteriorating tax base that cannot support quality education and public programming, which results in high crime rates and high rates of unemployment. Therefore, in addition to environmental remediation of the physical and natural environments in low income communities, urban farming design needs to function as a tool for social restoration, poverty alleviation, and community development.

Image Source: artragegallery.org

I. *MUSHROOM PRODUCTION*

There are striking similarities between the demonstrated needs of the rural poor of the developing world and the urban poor of the developed world. While the former suffers from being underfed and the latter suffers from being overfed, both parties are undernourished and the source of that malnourishment is poverty. As Eric Schlosser notes in his book Fatland, the most powerful predictor of obesity is socioeconomic class. Not surprisingly, poverty is also the most powerful predictor of hunger. Mushroom production has proved successful in developing countries for poverty alleviation, food security, environmental remediation, and community development. These same needs are demonstrated in similar but different ways in low income urban environments and can be remedied using the mushroom as the gateway crop for an urban farming design.

1. Poverty Alleviation

The exodus of economic opportunity in low income communities perpetuates the poor educational quality, deleterious crime patterns and high poverty rates characteristic of many low income communities. As evidenced by mushroom projects throughout the world, the mushroom is an ideal crop for poverty alleviation first and foremost because it is economically feasible. Mushrooms require minimal start up capital, minimal maintenance, and can produce high yields and high returns in a short amount of time (site) (Appendix A, Figure 1). According to a study on crop profitability in Zimbabwe, mushroom production is at least twice as profitable as growing either maize or wheat (Appendix A, Figure 2) and another study on substrate production in India shows that profit margins increase up to 20 % when substrate materials are produced onsite rather than purchased (Appendix A, Figure 3). Because mushroom substrate materials are derived from agricultural wastes, this also encourages the developement of an auxilliary agricultural economy to supplement mushroom production. In this way, the mushroom can serve as a gateway crop to alternative food economies in the urban environment while helping to alleviate poverty and lower crime in low income neighborhoods.

In addition to their economic viability, mushrooms are also an extremely versatile crop. They can grow in many places at multiple scales, and they have the potential to grow and expand into alternative food markets. This makes mushroom production practical as a source of both primary and/or supplementary income...

Figure 2.1.1_Common low cost mushroom cultivation process practiced in Nepal. a) Straw chopping. b) soaking chopped straw. c) Cleaning the straw in clean water. d) draining the straw on a wooden framed net. e) Local steamer (earth pot) on metallic vessel containing water, to be covered in plastic wrap and pasteurized. f) steaming the straw in a metallic drum. g) making packets and spawning. h) incubation of packets at farmer's house. i) packets are arranged in a row with bricks underneath. j) fruiting bodies ready for harvest. k) training women farmers. Images and captions source: *MushWorld, Mushroom Growers Handbook 1: Oyster Mushroom Cultivation, Chapter 2, pgs 14-18.*


a b c d e f g h i j k

CASE STUDY: Mushroom Production for Poverty Alleviation in Nepal

Location: Neplese countryside
Type: Government Initiated
Organizations: Nepal Agricultural Research Council-NARC, Center for Agricultural Technology-CAT
Origin Date: 1974

Oyster mushroom production (P. Ostreatus) has been a staple for poverty alleviation in Nepal ever since its introduction in 1998. The appeal of P. Ostreatus is attributed to its durabiliy and ease of cultivation as well as the low start up cost and high returns that the product draws. Another aspect to the appeal of P. Ostreatus is the strain's ability to operate successfully at multiple scales. It is an ideal crop for cultivation by poor landless farmers and women being that "Mushrooms can be grown in the small space of a farmers' own house for small scale production and generate income that aids in the family support" (MushWorld???). That being said, mushroom production can easily translate from rural to urban production without making huge jumps in scale and it can operate as a source of supplementary income for the low income urban dweller who does not own land or property.

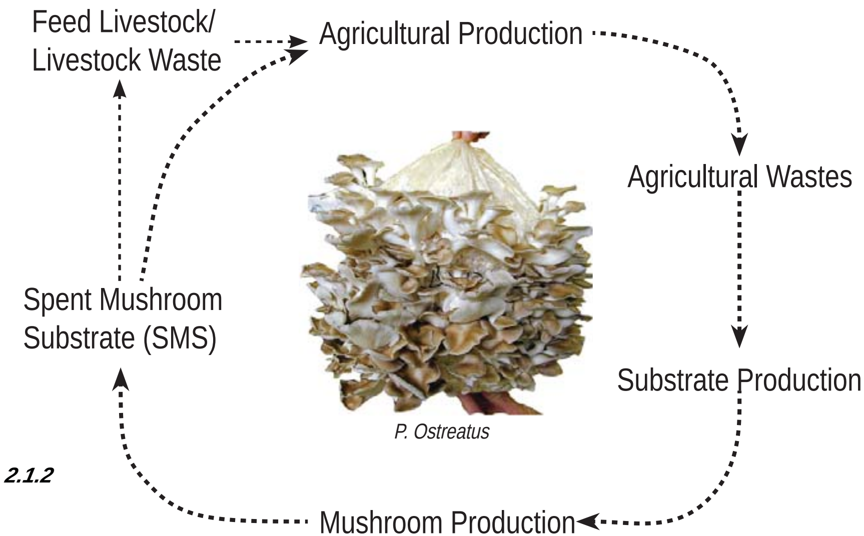


Figure 2.1.2

Figure 2.1.2_Depicts the closed loop production cycle of myco-agriculture/permaculture.

Figure 2.1.3_Shows the evolution of the fruiting oyster mushroom over a month long span.

2. Food Security

Food security is another growing concern in low income urban communities where there is limited knowledge, limited physical access, and limited capital available to obtain fresh and healthy foods. A lack of food access is one of the primary contributors to health complications such as obesity, diabetes, malnutrition, starvation, and other related diseases. Extremely high in protein, mineral, and vitamin content and low in fat, mushrooms are the ideal crop for supporting healthy living in undernourished areas of the world.

A local, community driven, urban mushroom operation has the potential to increase education and knowledge about healthy eating and healthy food production through educational programs and design for both active and tacit learning. Being located within the community of concern eliminates the barrier of physical proximity to adequate food access, and design can help contribute to the physical accessibility and walkability of the urban mushroom farm. Run by the community, mushrooms can be both profitable and affordable allowing for adequate food access to be obtained. Fur-

Figure 2.1.3

day 21

day 23

day 25

strategies

week 0

Oil enfused pile of soil is inoculated with oyster mushroom spawn.

week 6

mycelium saturated with oil, mycelium produces enzymes that break carbon-hydrogen bonds into carbohydrates; fungal sugars; toxic pile is covered with hundreds of pounds of oyster mushrooms.

week 8

mushrooms are harvested and pile begins to produce life forms: grasses, insects, birds, butterflys, etc.

Matel Laboratories, Bellingham, WA, conduct experiment on soil remediation. 4 piles are soaked with diesel and other petroleum wastes. One pile is infused with oyster mushroom spawn, one with bacteria, one with enzymes and the last is a control. After 6 weeks the mushroom pile is covered in mushrooms while the remaining three piles are, as Paul Stamets remarks in his 2009 TED talk, 'dead, dark, and stinky.' Information and Images Source: *"6 Ways Mushrooms Can Save the World"*

thermore, because mushrooms have the potential to spur alternative healthy food production within the city (including but not limited to food production for substrate material, medicinal mushroom cultivation, and community gardening), they have an exponential potential for increasing food security.

3. Environmental Remediation

There is a growing need for environmental remediation and restoration of both the physical (built and unbuilt) and social environment in low income urban areas. According to 2006 TED talk given by Majora Carter entitled 'Greening the Ghetto,' low income communities and racial minorities are more likely to live near highways, rails, dumps, power plants, distribution centers and other industry. As a result there is a lack of investment, flight of economic opportunity, and an increasingly deteriorating vacant public realm. This contributes to the sedentary lifestyle which characterizes the obese community, as well as causing asthma, attention disorders, and other health issues common in low income communities (Carter). Because mushrooms can grow without light and have flexible spatial requirements, they are a perfect candidate for repurposing abandoned and/or underutilized civic infrastructure (www.ediblegeography.com) such as the space under highways, elevated rails, and in abandoned subway tunnels, warehouses etc that has caused such blight in low income urban neighborhoods. Through careful design and articulation mushrooms can transform and restore the constructed environment and public realm.

In addition to restoring the built environment, myco-agriculture represents a closed loop, environmentally friendly approach to food production as well as a way to restore the nature environment (Figure X). Firstly, mushrooms are grown without the use of pesticides, fertilizers and do not require* the use of machinery therefore they do not contribute to environmental deterioration. Secondly, mushrooms can be grown using recycled agricultural wastes , and spent mushroom substrate materials can be used for fertilizer closing agricultural production loops by eliminating waste products. If substrate materials are produced on site, modes of environmental restoration expand through this alternative crop growth and the carbon footprint of the mushroom product is greatly reduced. The spent substrate materials are also useful for soil restoration by increasing water absorption, and decreasing fecal coliforms and heavy metal contamination, thereby transforming industrially contaminated brownfield sites in cities to spaces for occupation (of food, by people, or otherwise).

CASE STUDY: Li-Sun Exotic Mushroom Farm

Location: Mittacong Railway Tunnel, Australia.
Type: Grower Initiated/entrepreneurial
Founder: Dr. Noel Arnold
Date: late 1980s

Dr Noel Arnold has been growing mushrooms in the abandoned Mittagong Railway Tunnel for the over 20 years. Constructed in 1966 and approximately 2100 feet long and 90 feet wide, the tunnel is carved out of a rocky hillside and maintains a temperature of approximately 59 degrees Farenheit year round. This provides ideal growing conditions for many the exotic mushroom strains that Arnold cultivates,; he notes that “his mushrooms have evolved to fit in an extremely specialized environmental niche; they are species designed for architecture” (ediblegeographies.com). While Arnold does cultivate other mushroom straiins in artificial environments that are not afforded by the Mittacong tunnel, he states that this “makes their cultivation much more expensive being that their ecosystem has to be replicated mechanically rather than ocurring spontaneiously within disused infrastructure.”That being said, mushroom cultivation is ideal for repurposing abandoned/underutilized urban infrastructure such as tunnels or subways where temperatures are relatively constant and suitable for mushroom production.

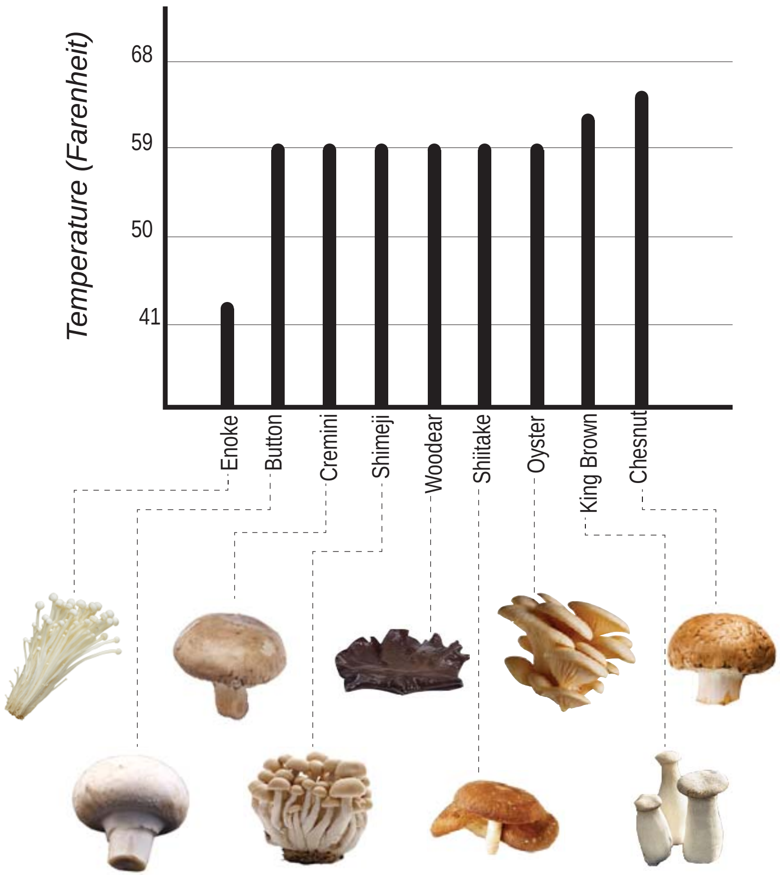
Figure 2.1.4

Figure 2.1.4_Photo of the original single track railway tunnel (left) and its double track replacement tunnel (right). The double original tunnel was complete in 1919 to allow for heavier and more frequent freight traffic through the region. Photo Credit: Nicola Twilley. Image Source: ediblegeographies.com

Figure 2.1.5

Figure 2.1.5_Photo of the original railway tunnel concstructed in 1866. Image Source: li-sunextoicmushrooms.com.au

TYP. MUSHROOM STRAINS GROW BY LI-SUN



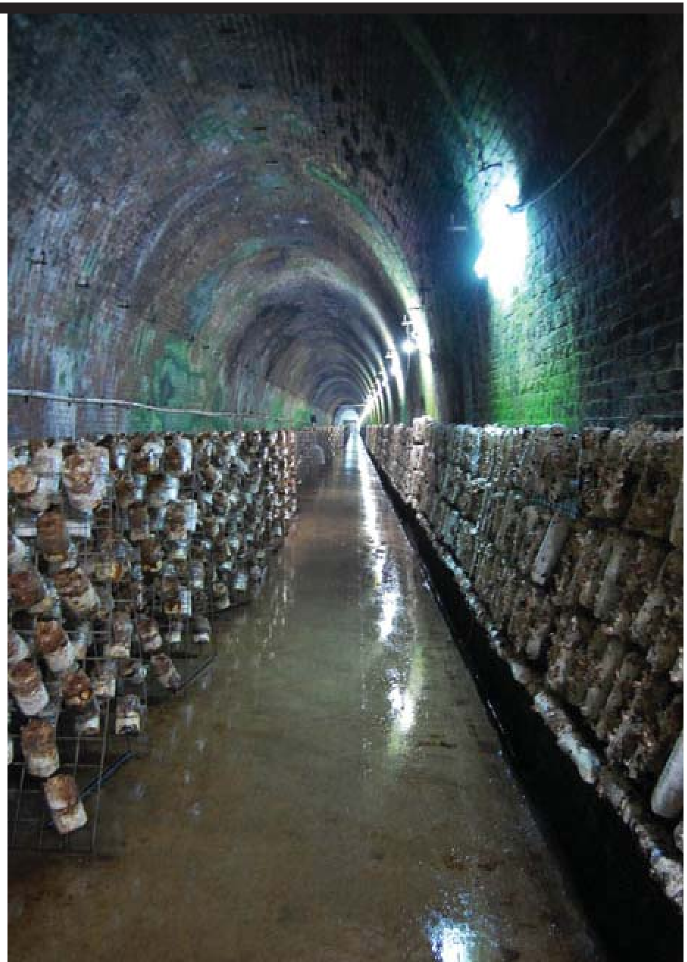
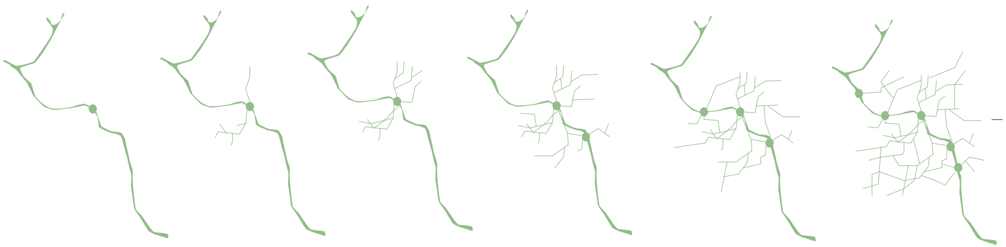


Photo Credit: Nicola Twilley
Source: ediblegeography.com

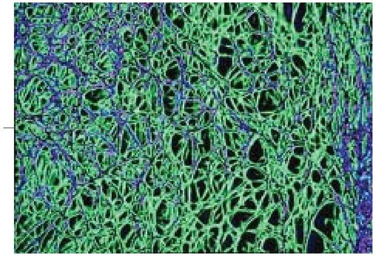
strategies

4. Community Development

Because of a lack of safe inhabitable public space and a general air of disenfranchisement felt in low income communities as a result of historic lending practices, and infrastructural development among other things, low income communities are in a continual state of deterioration. A mushroom project has the ability to decrease poverty, increase food security, and increase environmental quality of both the natural and built environment, but the project will not work without the support of the community and other stakeholders. Therefore, the mushroom project needs to be designed to engage and develop the community in which it is situated in addition to developing other partnerships throughout the city. Collaboration between growers in the community also allows for a more consistent product and the ability to set prices and create a more stable market. In this way, the mushroom can help to foster connectivity amongst different communities while developing new communities surrounding mushroom and food production.



WEB-LIKE MARKET EXPANSION ALONG INFRASTRUCTURAL SPINE



MYCELIUM NETTING

CASE STUDY: Mushroom Production in Zimbabwe

Location: Edinburgh, Scotland
Constructed: 1847

A partnership between ITDG and the Chakowa Orphanage Group in which the ITDG is sharing valuable techonological information regarding mushroom growing as well as the hands on experience and 'people' connection required for successful mushroom cultivation. The project began with only a few children, who were supplied with donated spawned bags and a grow house where they learned the basics of mushroom growing room management. Yields were 1-2 kg mushroom: 1 kg dry substrate, and oyster mushroom production proved to be 3 x more profitable than maize production and 66% more profitable than wheat production. Over time, the mushroom project has gained members throughout the community, both young and old and is proving to be an effective means of poverty alleviation within the community.

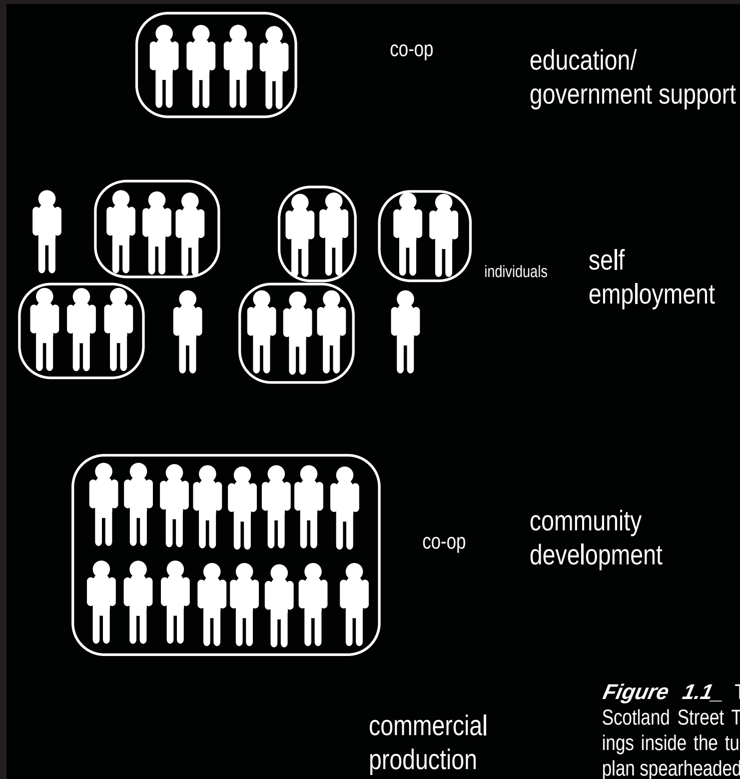


***Figure 1.1*_** The interior of the Scotland Street Tunnel. Brick buildings inside the tunnel were part of a plan spearheaded by the British Railways Board in the 1950s for a new Emergency Control Center. Only four of the ten buildings were completed. Photo Credit: Nick Catford. Image

II. *PHASED DEVELOPMENT: engaging the city at multiple scales*

Ideally, an urban myco-agricultural project will function as a closed loop system in which mushroom production, agricultural production and/or livestock production all occur onsite. Unfortunately, the lack of knowledge about food production in cities, the lack of capital resources, and the current state of natural resources (air, soil, water) makes it impractical to grow food for consumption in the native soil. For these reasons, a pilot urban mushroom project needs to be carried out in phases and partner with various institutions in order to educate potential growers, build the economic base for mushroom and agricultural production, and expand the industry and engate with the multiple scales of the city.

Phase I: Education

The first of these phases should be designed to secure partnerships and funding for educating potential farmers about oyster mushroom (p. ostreatus) production techniques and grow house management. Many mushroom programs in developing countries are government funded and farmer managed. While this is a potential model for urban mushroom production in low income communities, a more probable model as proposed by Dr. Leigh Gantner of The College of Human Ecology at Syracuse University, is a University-community partnership (site). According to this model, the University provides education and preliminary funding for the mushroom project while applying for grants and government funding to move the project forward.

As funding money is being requested, it is necessary to build partnerships with mushroom culture producers and also local agricultural producers in order to secure a cheap (or free) source of culture and/or substrate material. While the mushroom strain does not need to be sourced locally, it is extremely important that the substrate comes from a local source because, in later phases of the mushroom project, substrate materials will be produced onsite. If local agricultural wastes are not used from the get go, there will be a need for reinvestment of both time and money during later phases of the project for research and education regarding substrate.

Figure 2.2.1_Illustrates the scales of the city: city, neighborhood and site. Images are of The City of Philadelphia. Images Source: *maps.google.com*

Figure 2.2.1

Phase II: Individual Enterprise

After funding is secured, it is time for the members of the community to spawn and harvest their own crops . At this point in time the new mushroom farmers begin to operate as individual enterprise with the choice to harvest their crop for personal use or for sale at local farmer's markets. This is also the beginnings of shrinking the myco-agricultural production loop being that the spent substrate material can be used to condition toxic soils, and the conditioned soils can begin to support agricultural productions, and the agricultural wastes can be used as mushroom substrate material.

Phase III: Co-op Society

Once enough members of the community beginning producing mushrooms for profit, it is important to move away from individual enterprise and establish a community co-op and specialized market for mushroom sales and distribution. A unified market will allow mushroom producers to work together rather than compete against one another by setting prices and better controlling supply and demand. It will also give larger scale buyers such as local food markets, specialty stores, and local restaurants more purchasing power forging new partnerships with the mushroom community.

Phase IV: Market Stability & Diversification

The next step for an urban mushroom project is to centralize operations, increase visibility and stabilize the market. This includes but is not limited to the construction of a centralized mushroom production and substrate production facility, a storage facility, and a packaging and processing facility.

Phase V: Market Expansion

The next step is to diversify the industry profile by expanding into other mushroom markets and to develop the urban agricultural industry into a constituent part of the urban mushroom industry. To do this the mushroom industry needs to seek out land and encourage urban agricultural production.

Figure 2.2.2_Chart detailing the different phases and timeframes of development for a successful mushroom design project and the partnerships neccessary to propel the project forward.


PARTNERSHIPS
PHASE I: EDUCATION
private
government
community
0-2 YRS
PHASE II: INDIVIDUAL ENTERPRISE
individual
individual
farmer's market
2-4 YRS
PHASE III: COMMUNITY CO-OP
individual
community
5-8 YRS
PHASE IV: MARKET STABILITY & DIVERSIFICATION
community
community
9-12 YRS
PHASE V: MARKET EXPANSION
community
city
12 + YRS

Figure 2.2.2

site analysis

CITY

NEIGHBORHOOD

SITE

I. City Scale

The City of Syracuse is a prototypical post-indusrial city in which the urban poor are trapped in deteriorating city centers with minimal resources. Figure 3.1.1 shows the relationship between those living below the poverty line and vacant space within the city. Not surprising there is a strong correlation between urban decay, infrastructural, industrial development, and economic opportunity.

Low income urban communities also find themselves with inadequate food access. The primary farmer's market in Syracuse is located on the urban periphery accesible by bus only, and almost all supermarkets and wholesale markets are situated upon the boundary lines of the City (Figure 3.1.2, 3.1.3). People living in low income neighborhoods also have the lowest percentage of car ownership making it nearly impossible to obtain healthy and affordable food.

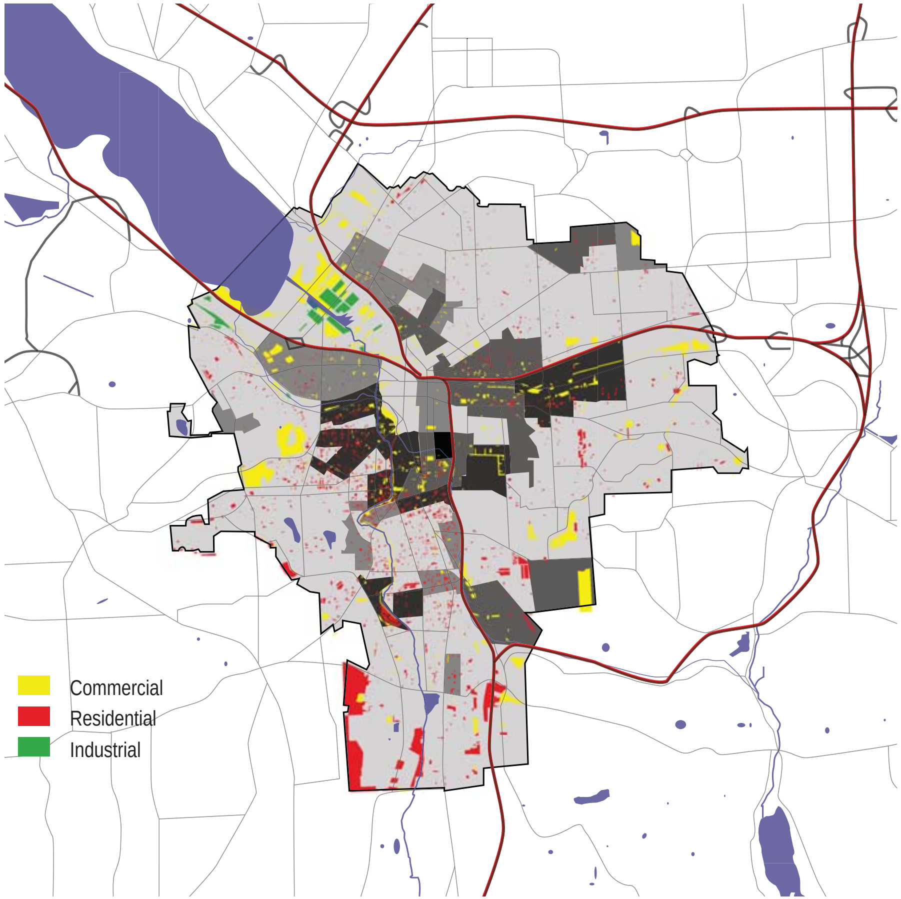


Figure 3.1.1

Figure 3.1.1 _Shows the distribution of vacant property within The City of Syracuse as it relates to poverty levels throughout the city. Information Source: *syracusehungerproject.org.*

Figure 3.1.2 _Distribution of food retailers in The City of Syracuse. a) Farmer's Markets b) Supermarkets c) Wholesale Markets.

Figure 3.1.3_a.) All food markets shown with a 1/2 mile walking radius around them. b.) The food deserts that become apparent after outlining the walkability of various healthy food distribution points.

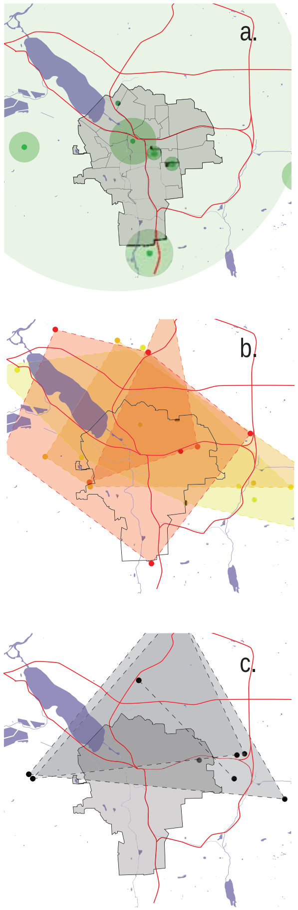


Figure 3.1.2

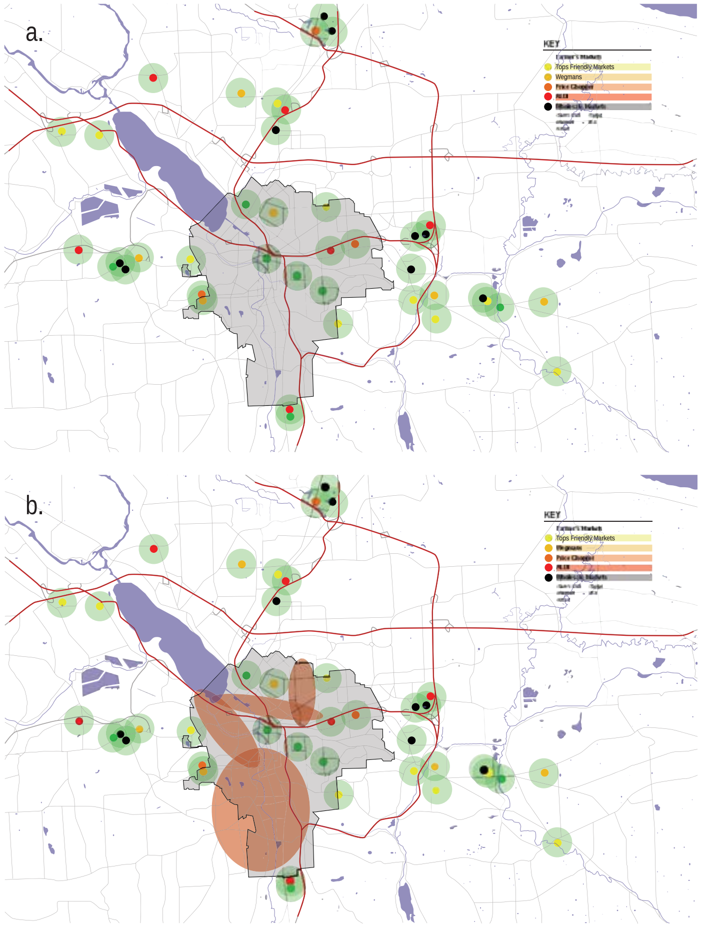


Figure 3.1.3

III. Site Scale

The site that I've chosen to test my thesis proposal for an urban mushroom driven farm is the elevated rail in Syracuse, Ny where it intersects with Onondaga Creek, the residential Near Westside Neighborhood, and the commercial district of Armory Square. The elevated rail and the creek as well as West street are three significant infrastructural barriers that exemplify the dichotomy between the presently thriving commercial district that is armory square and the deteriorating near westside neighborhood. Furthermore, the elevated rail sees minimal freight traffic and there are no longer passenger lines that operate on it, making it a nearly obsolete piece of infrastructure. For these reasons, I am proposing the design for phase IV of the mushroom production process of a centralized mushroom production facility within the elevated rail, coupled with auxiliary program that stems from the mushroom production process that acts as a connective tissue between the near westside neighborhood and armory square. This includes an urban agricultural park above, a research facility within, and a market/café below designed to educate occupants about closed loop mushroom production.

Figure 3.3.1_a.) Existing site plan. b.) Typical section through embankment c.) Typical section through subway underpass. d.) Typical section through retaining walls. e.) Typical section through sidspan

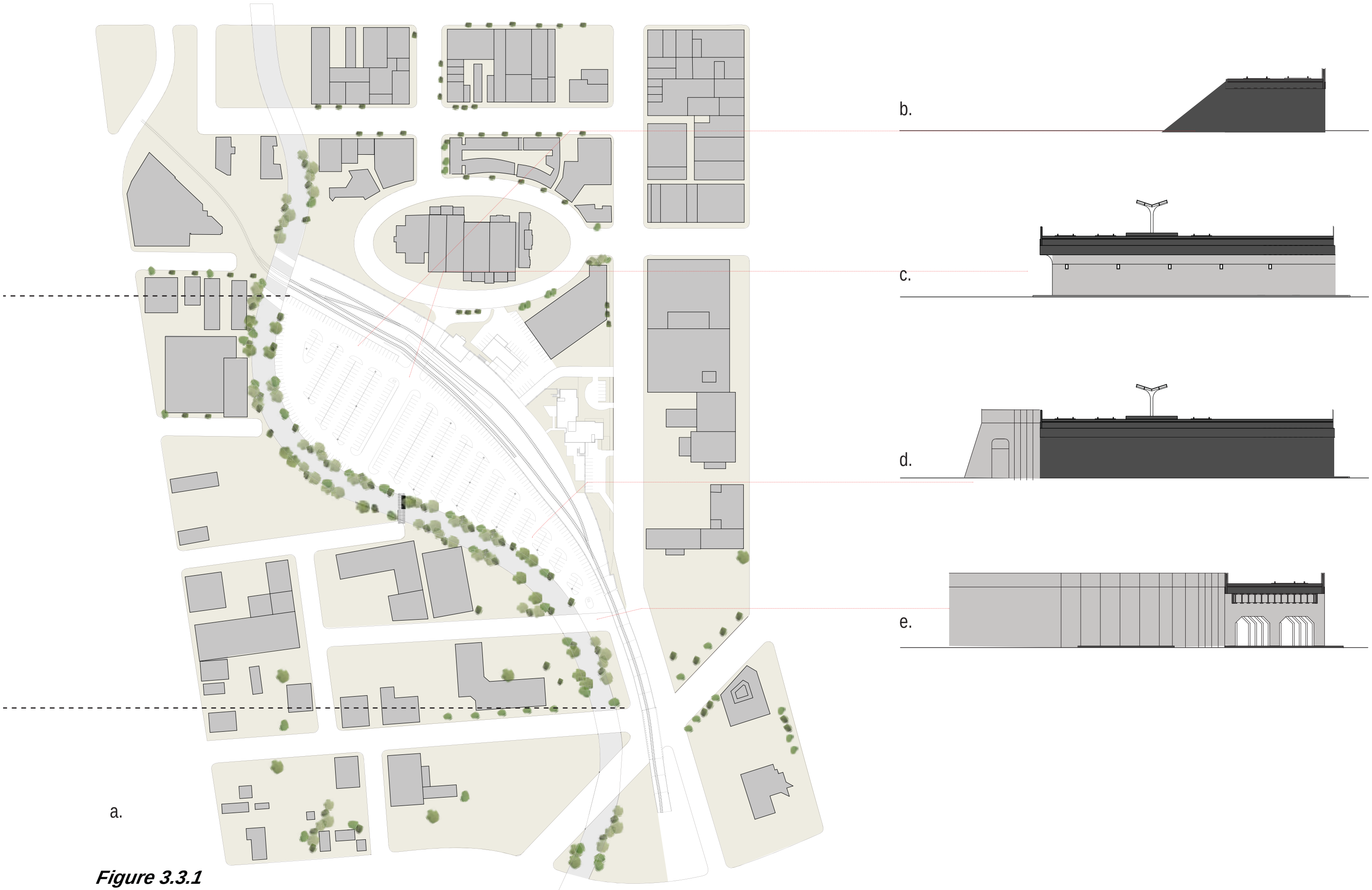


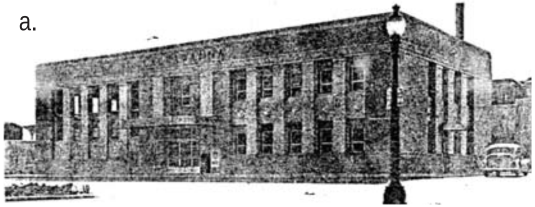
Figure 3.3.1

Delaware, Lackawanna, & Western Elevate Railway

LOCATION: Downtown Syracuse
LENGTH: Approx. 2 miles
DATE BEGUN: 1939
DATE COMPLETE: January, 1942

Two miles of elevated rail way planned through the heart of downtown syracuse in order to eliminate at grade crossings of the railway with vehicular and pedestrian traffic. Mostly raised on rammed earth embankments. Retaining walls are made of reinforced concrete included where necessary near due to minimal side clearances. Typical bridge construction is plate girder spans on conrete abutments. At extra long spans nickel steel was used to minimize girder depth. Some bridges include approach spans to afford drivers adequate view of oncoming traffic.

In addition to the elevated rail, a new passenger station was completed on the Armory Square side of the tracks and the old one was demolished. The new station was modern in its design and housed all of the trains offices in addition to a double height waiting area, an elevator, and a subway tunnel that led to a flight of stairs which brought passengers up to the platform level.

a.

b.

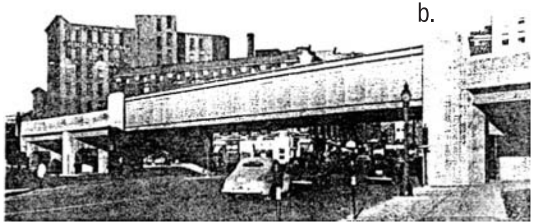



Figure 3.3.2

Figure 3.3.3

Figure 3.3.2_a.) Photo of the new passenger station constructed in 1942 . b) Photo of the Onondaga Blvd overpass and side spans in 1942. Images Source: *Railway Age. Vol. 111, No. 19*

Figure 3.3.3_Aerial view of the station and elevated rail . Image Source: *virtualtourist.com*

Figure 3.3.4_Pamphlet cover for Jubilee 1936. Image Source: *yestercuse.com*

Figure 3.3.5_Postcards depicting the old DL&W passenger station that bordered Armory Square and the Onondaga Creek Image Source: *yestercuse.com*

Figure 3.3.6_Site plan of the proposed elevated rail . Image Source: *Railway Age. Vol. 111, No. 19.*

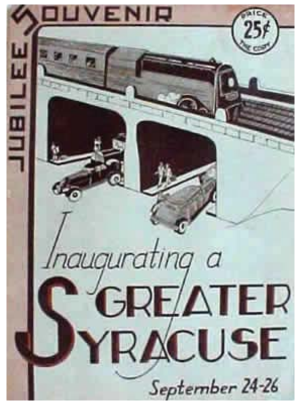


Figure 3.3.4

a.

b.

Figure 3.3.5

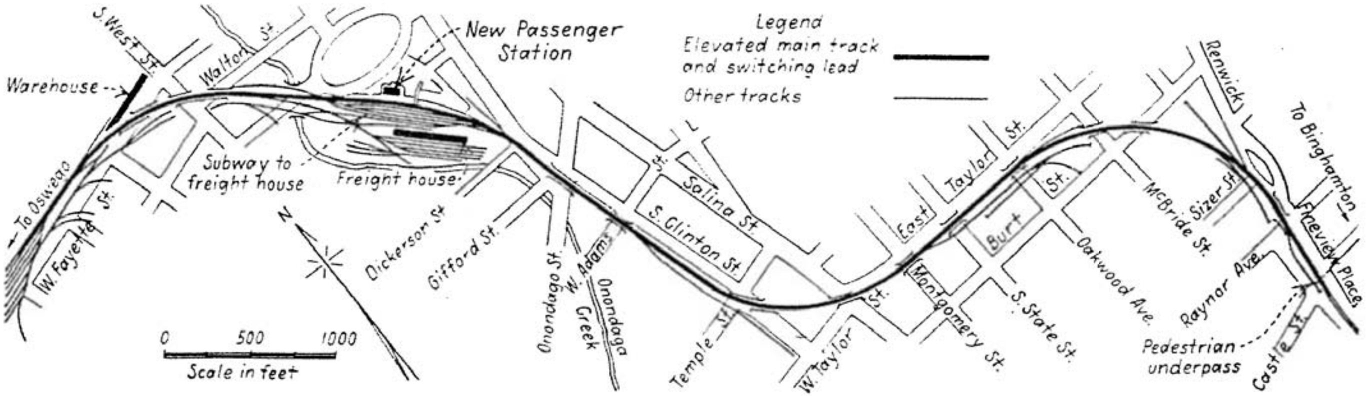


Figure 3.3.6

program

I. PHASED DESIGN

Phase I: Education

Phase I proposes a connection between Blodgett K-8 School, The Museum of Science and Technology (M.O.S.T.), and Syracuse University for the educational phase of the design project. It is also necessary at this point in time to begin to ask for alternative grants and funding and to partner with agricultural and mushroom culture producing institutions in order to secur cheap/free substrate and culture materials.

Phase II: Individual Enterprise

After the initial educational investment it is important for members of the community to begin to gain control over their own poverty alleviation, food security, and environmental restoration by taking production outside of the classroom. This could occur in a community growhouse in which each family owns its own area or it could occur in the residual spaces of the home such as a crawl space, a basement, or a closet.

Phase III: Co-op Society

Once enouch people are engaged with the mushroom production business it is important to centralize production for profitability and market contol.

The elevated rail in Syracuse is an underutilized civic urban space; it sees minimal freight traffic, no passenger traffic, and has a general air of disenfranchisement about it. The space beneath the railline between the Near Westside Neighborhood and Armory Square is the optimum location for a pilot urban mushroom farm first because it offers ideal conditions for agricultural, substrate, and mushroom production. In addition, the site is located in a fringe space between the thriving commercial district of Armory Square and the deteriorating residential distric that is the Near Westside and represents an opportunity for reconnecting the Near Westside with downtown by bridging infrastructural barriers such as the rail, the creek, and west street.

Phase IV: Stability & Diversification

As mushroom production scales up so does spent substrate material which increases the quality of local soils and allows for the expansion of the agricultural sector of the mushroom market. This is the beginning of the mycelial like network of agricultural production that will spread allow the rail line and out into the city.

Phase V: Market Expansion

Establishment of additional mushroom production centers along the rail line.

Figure 4.1.1_Identifying stakeholders and markets. Drawn in relation to major infrastructural barriers.

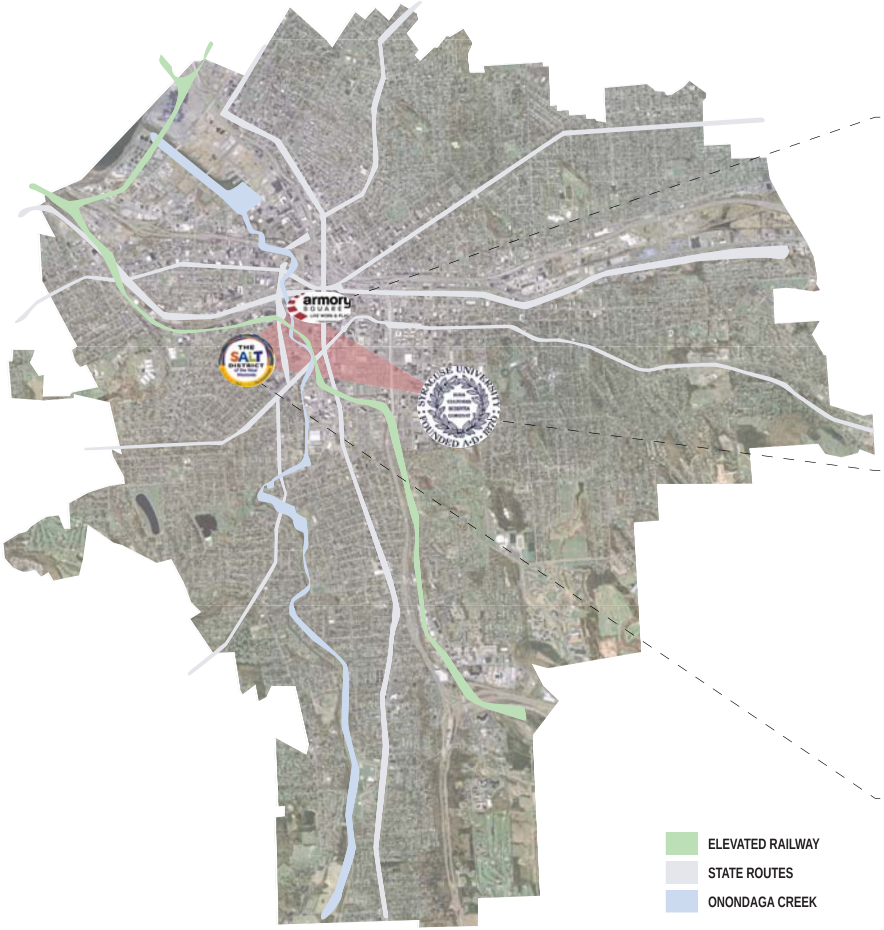
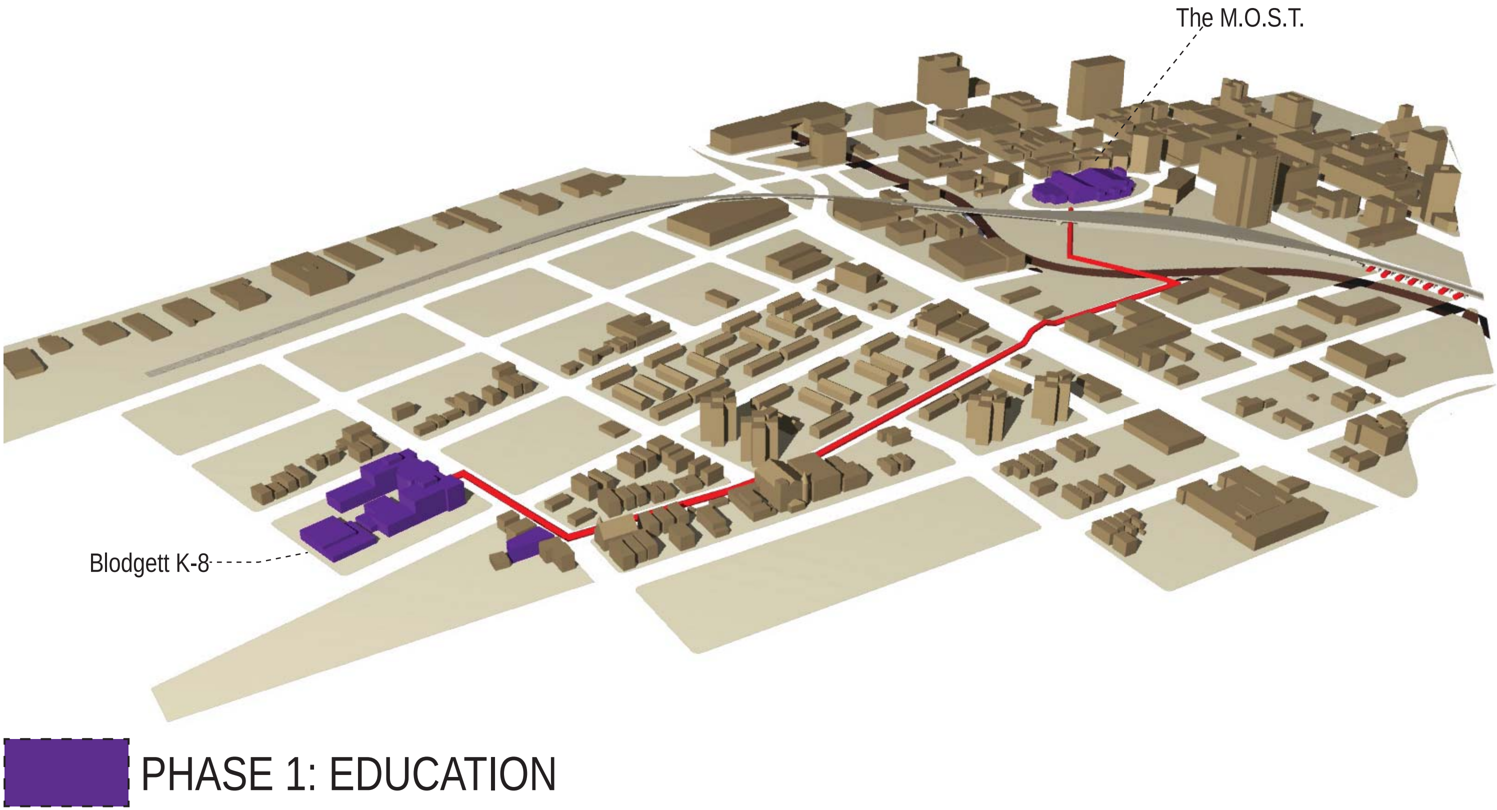


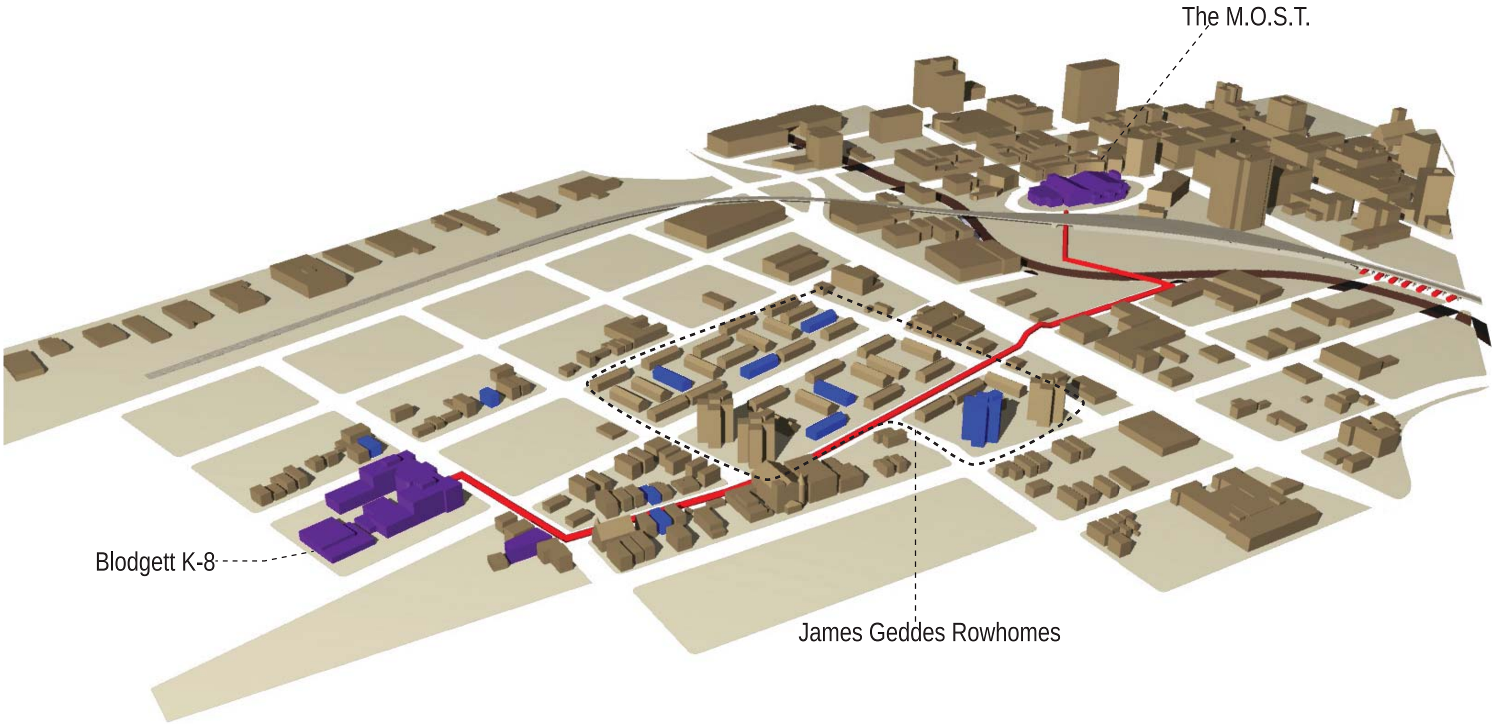
Figure 4.4.1

THE MUSEUM OF SCIENCE AND TECHNOLOGY

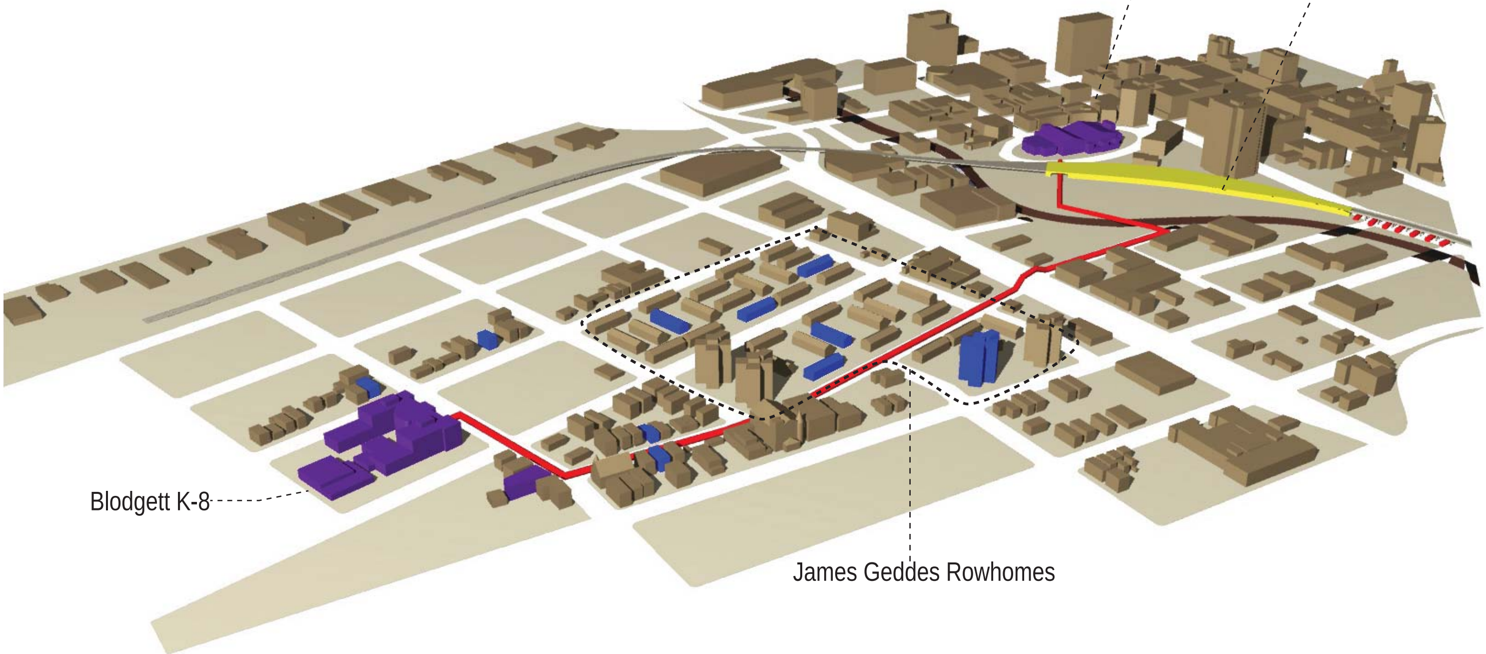
SYRACUSE UNIVERSITY

BLODGETT K-8

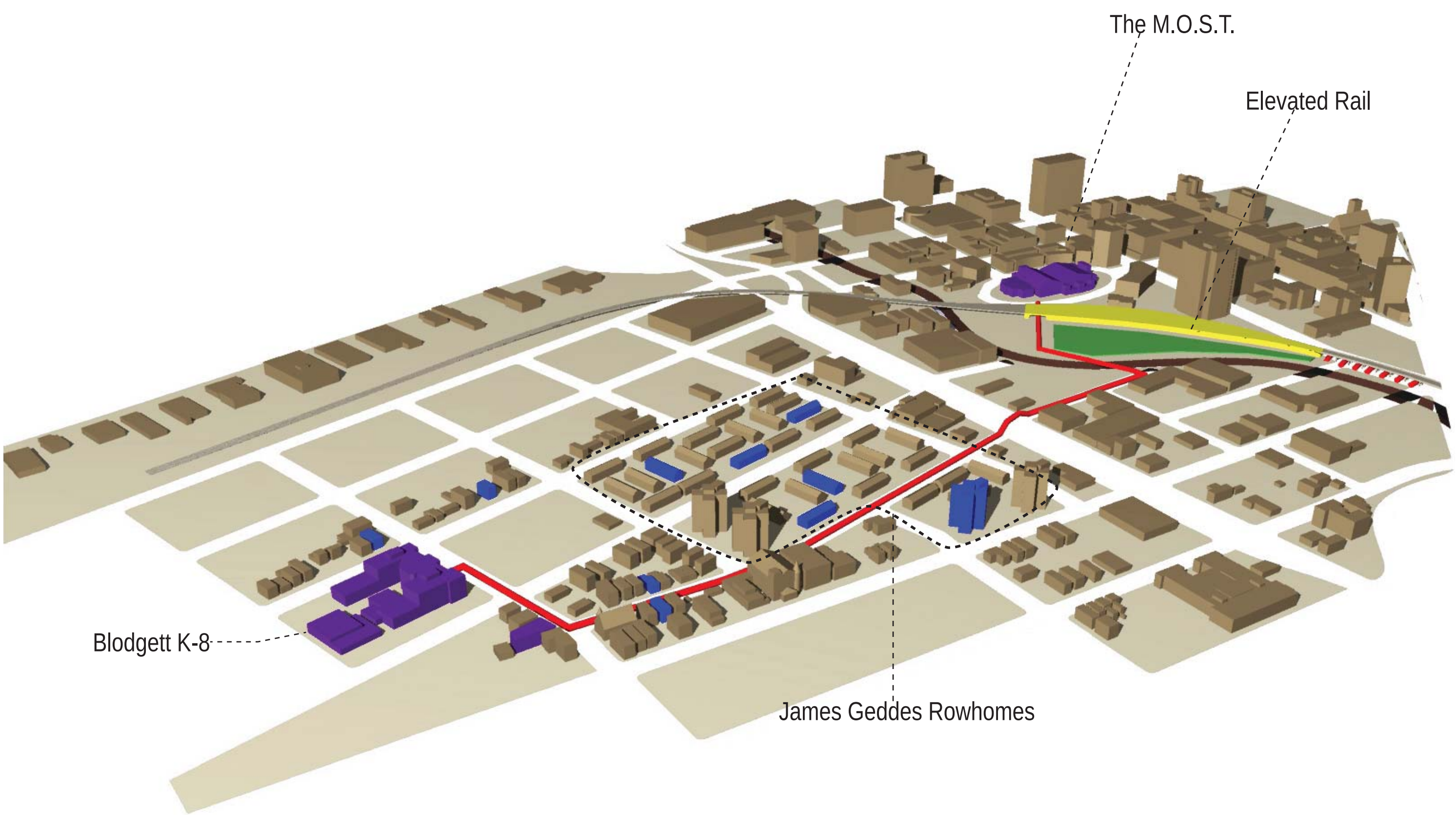

The M.O.S.T.
Blodgett K-8
PHASE 1: EDUCATION



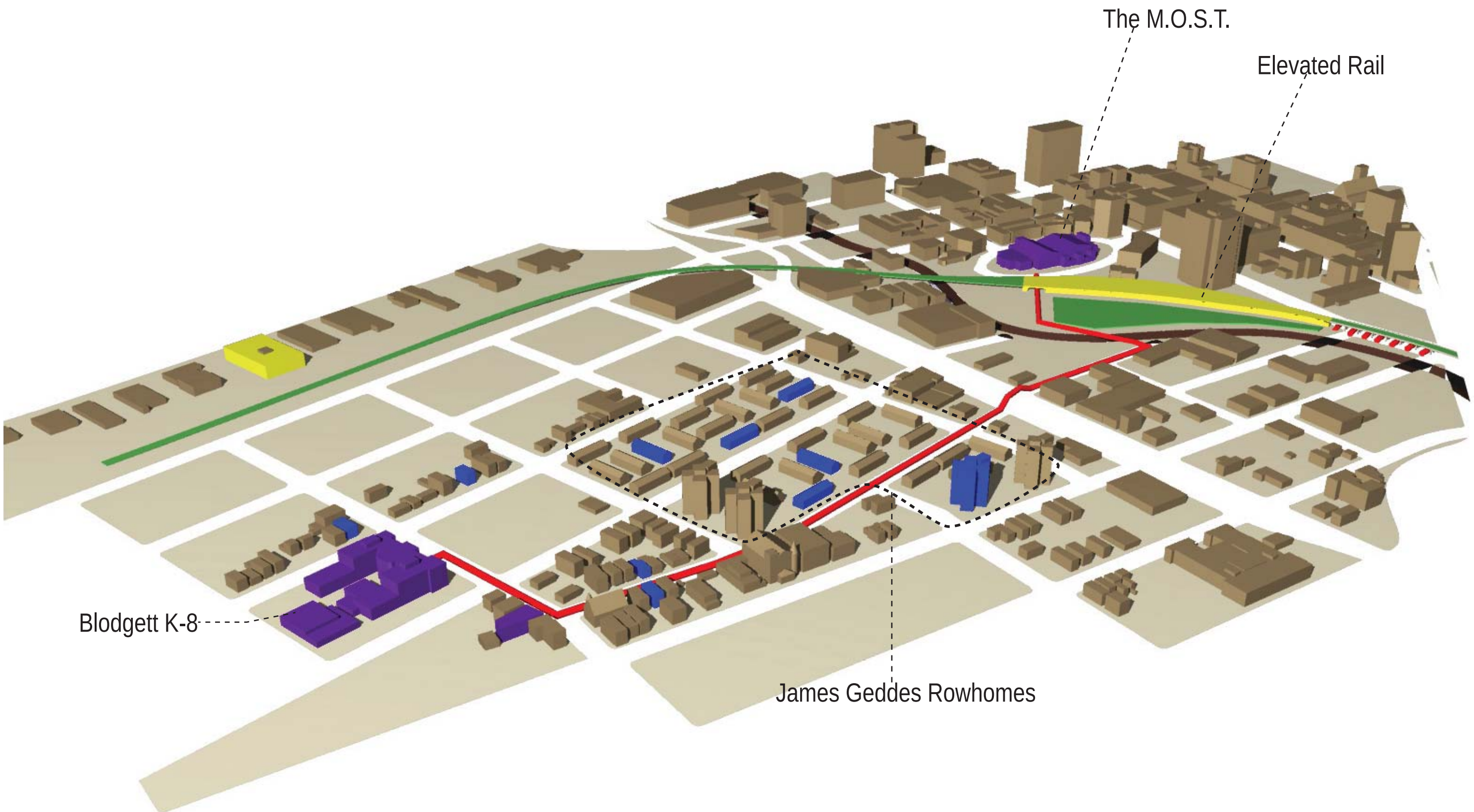
PHASE 2: INDIVIDUAL ENTERPRISE



PHASE 3: COMMUNITY CO-OP



PHASE 4: MARKET STABILITY & DIVERSIFICATION



PHASE 5: MARKET EXPANSION

III. *MUSHROOM PRODUCTION*

1. Agricultural Production

Agricultural production requires light and space, as well as healthy soil and clean water. Therefore, urban agricultural production is part of later phases of mushroom industry development. Furthermore, the wastes from agricultural production are used for susbstrate material and the spent substrate material can be used as a fertilizer for stimulating agricultural production. Common crops grown in upstate New York include beans, squash, corn, wheat, barley, sunflowers, potatoes, grapes, and tomatoes among many other things. Each plant has varying spatial, luminary, soil, and water requirements. For the purposes of this project, the focus will be on production of beans, corn, squash, and wheat. Beans, corn, and squash were selected becuase they are companion plants that are good for soil health, that together provide a well balanced nutrition profile, they occupy both vertical and horizontal space, and they provide good substrate material for mushroom production. Wheat was chosen because wheat straw, the agricultural waste produced during wheat harvest, is abundant and requires minimal energy to be transformed into substrate material for mushroom cultivation.

wheat field

sunflower field

2. Substrate Production

Agricultural wastes can be used as substrate material for mushroom cultivation. Common agricultural wastes that are available in the geographic region of The City of Syracuse include sunflower seed hulls, wheat straw, corn husks, sawdust, paper waste, etc. In order to produce consistant substrate material, it is neccesary to have a space for drying the substrate material, then a space for chopping and mixing the primary substrate material with water among other ingredients, and then a space to sterilize the material in order to kill unwanted organisms. The substrate production process does not have any luminary requirements, but each part of the substrate production line needs to have adequate ventilation and drainage systems, as well as a sterilization system because each space needs to be thoroughly sterilized between substrate production cycles.

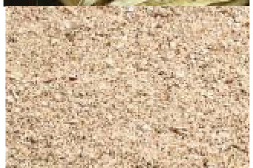
3. Mushroom Cultivation

Once the substrate material has been sterilized it is necessary to move the prepared substrate materials into a separate room for spawning. Substrate materials are packed into a fruiting vessel, in the case of this project mushroom growing bags that measure 18" X 24", in layers alternating a layer of substrate with a layer of spawn. Once the bag is full it is tied off and moved to another space where incubation, fruitbody development, and harvest will occur. Key regulatory measures for the success of a mushroom production facility include ventiliation, temperature control, light control, and moisture control.

sunflower seed hulls

wheat straw

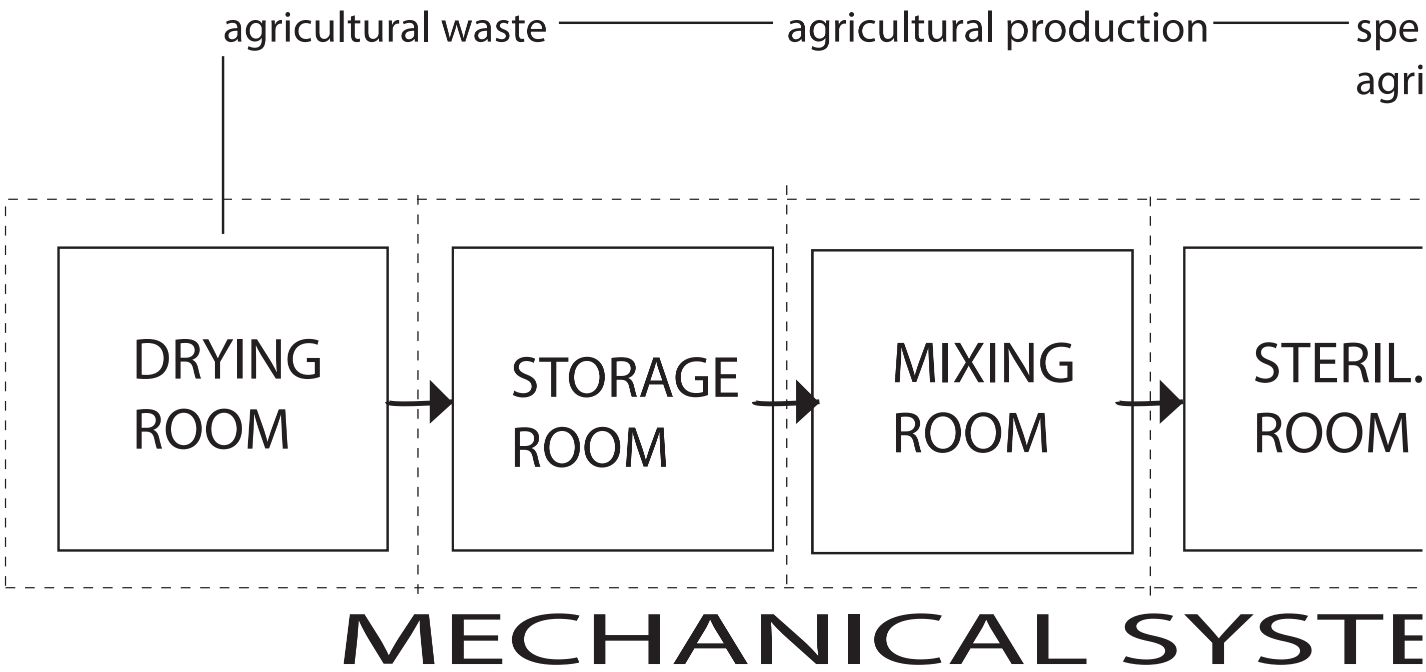
corn waste

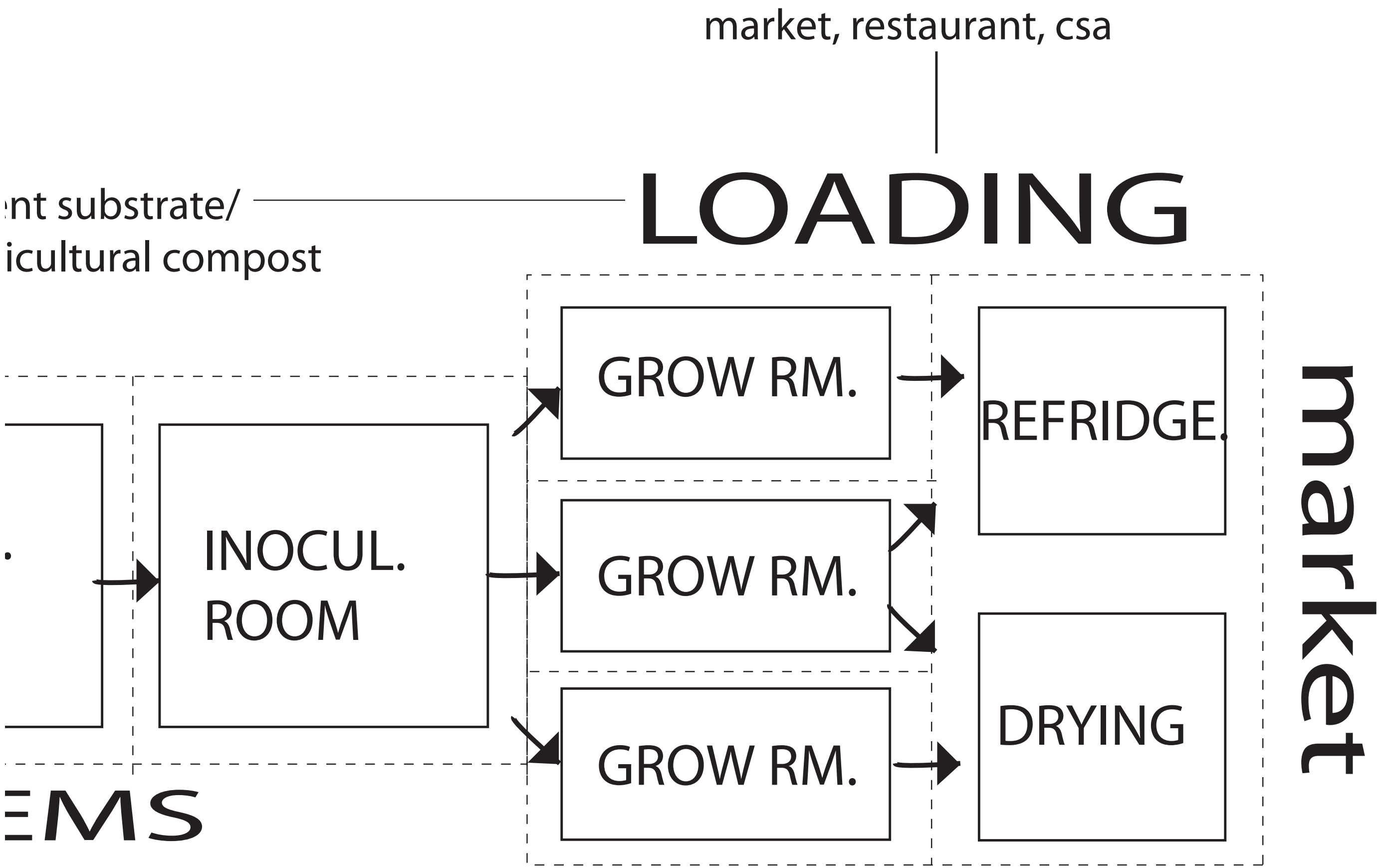


sawdust

paper waste

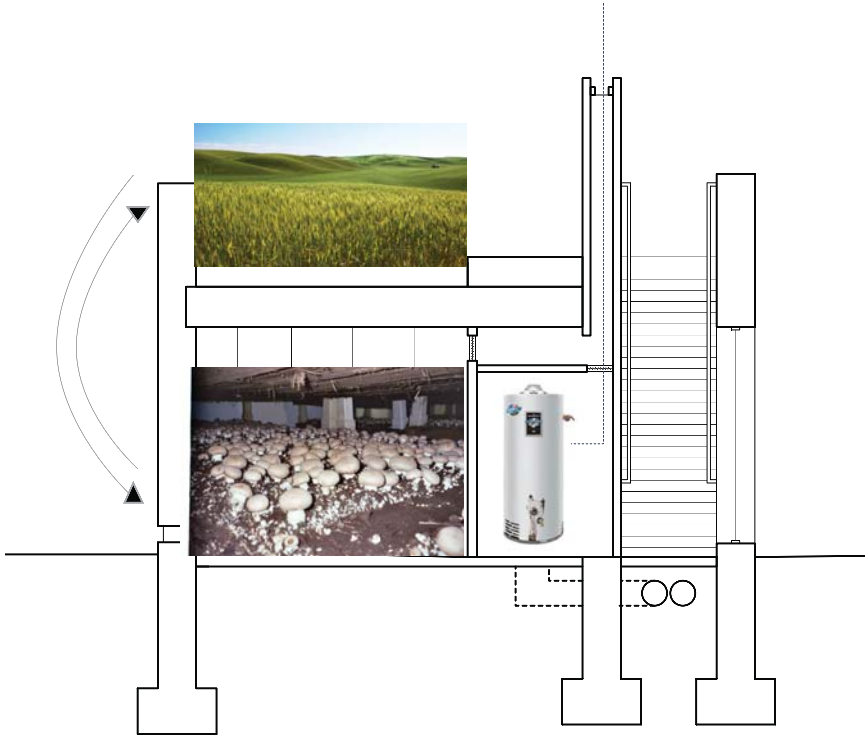
groundnut shells

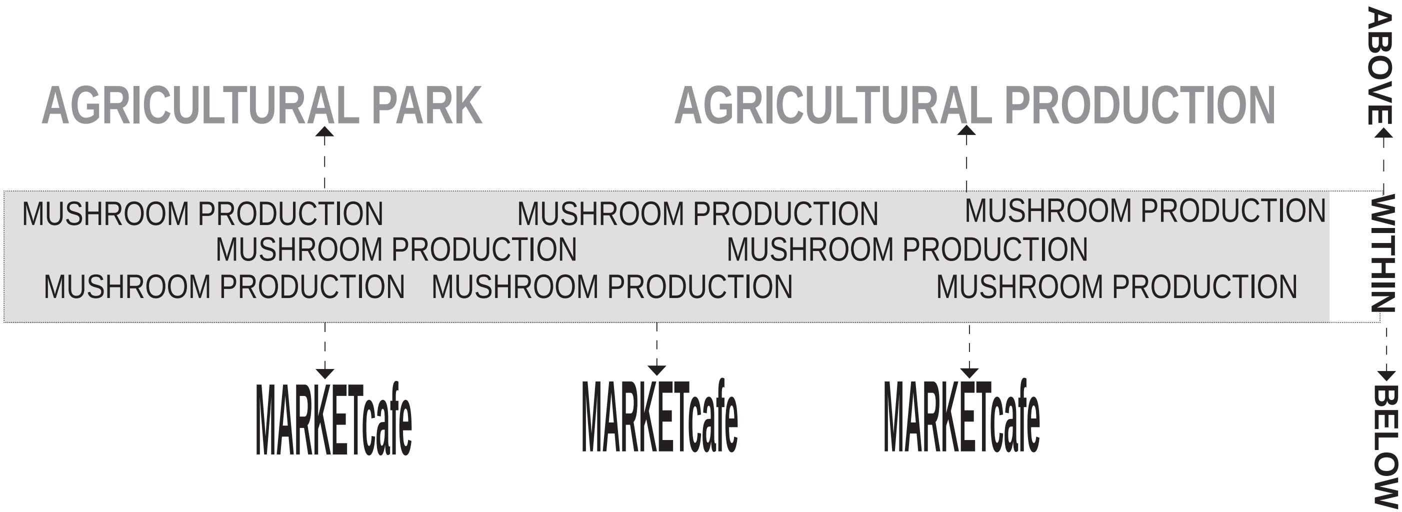

agricultural waste
agricultural production
spe
agri
DRYING ROOM
STORAGE ROOM
MIXING ROOM
STERIL. ROOM
MECHANICAL SYSTE


market, restaurant, csa
LOADING
nt substrate/
icultural compost
GROW RM.
GROW RM.
GROW RM.
INOCUL.
ROOM
REFRIDGE.
DRYING
market
EMS

IV. *AUXILIARY PROGRAM*

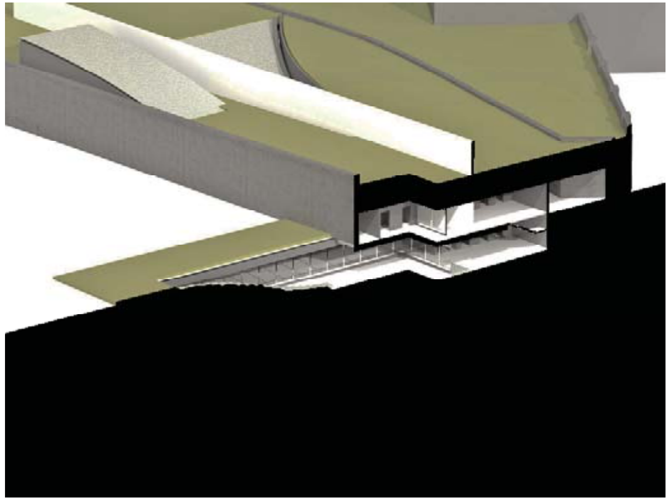
The auxiliary program consists of a park, tacit learning corridor, and market that are designed in such a way as to reveal the process of mushroom cultivation through design. The elevated public park articulates the agricultural production process, while the space beneath the elevated rail is designed for harvesting agricultural wastes for substrate material and for producing fruiting mushrooms. The market/cafe is design as a transition between the subterranean world of mushroom production in the absence of light and the world of agricultural production which requires light. Piercing this productive field leading to the public market/café is a transparent corridor/path for viewing the complete loop of urban mushroom production, sometimes separated from production by glass and other times by a rail. Because mushrooms require a carefully controlled environment for production it is necessary to completely isolate public and private modes of circulation.



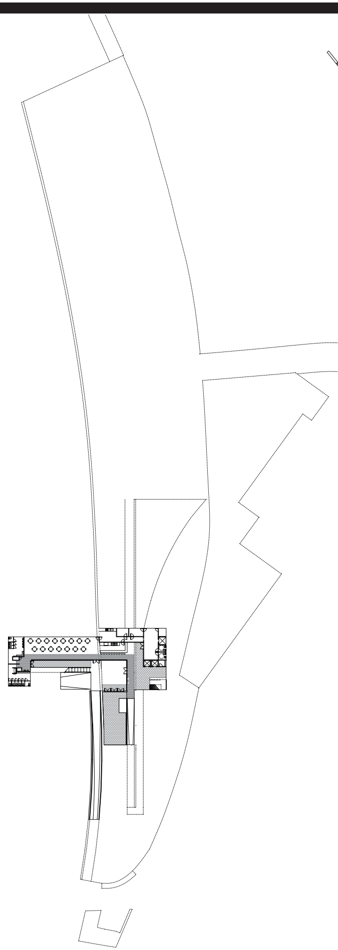


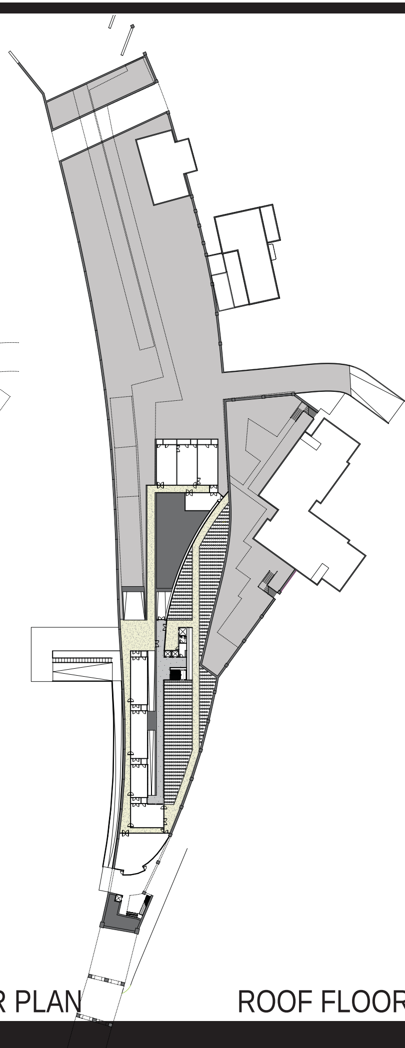
ELEVATION/SECTION & PROGRAM DIAGRAM

SITE PLAN



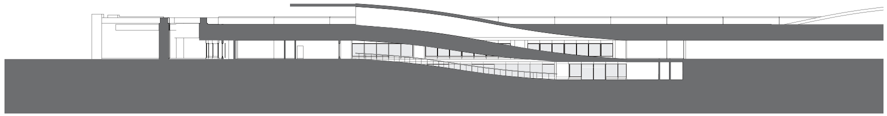
TRANSVERSE SECTIONAL PERSPECTIVE


BASEMENT FLOOR PLAN


GROUND FLOOR PLAN

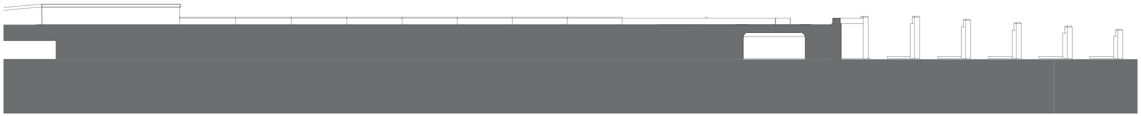

ROOF FLOOR PLAN

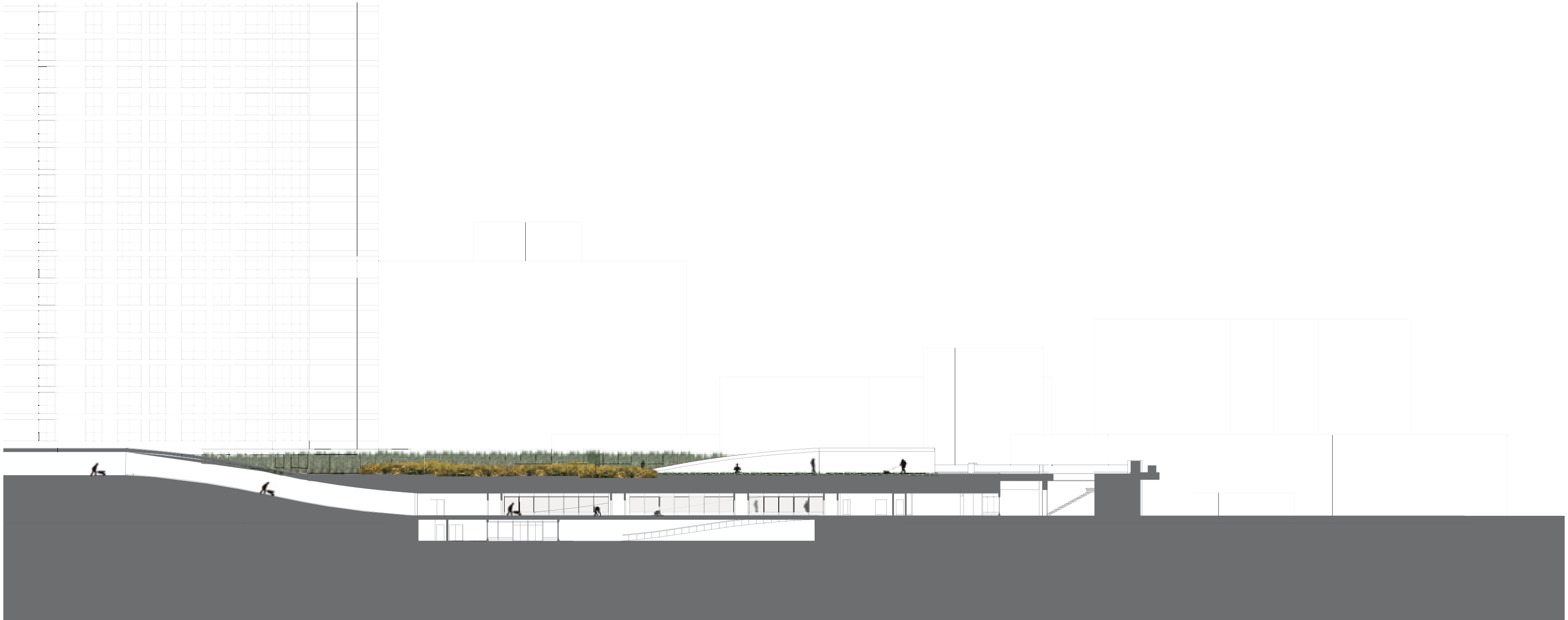
LONGITUDINAL SECTION LOOKING EAST

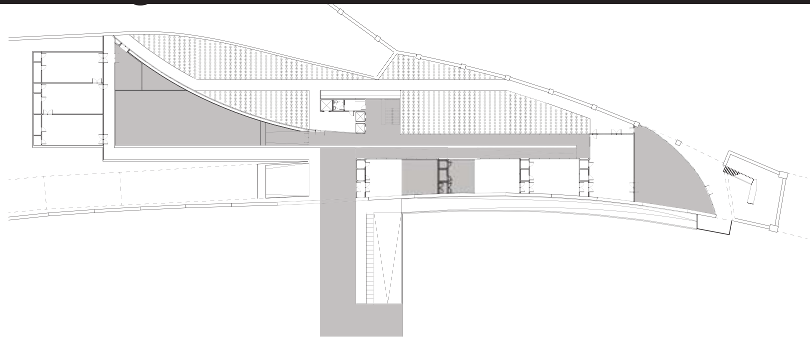


LONGITUDINAL SECTINO LOOKING WEST

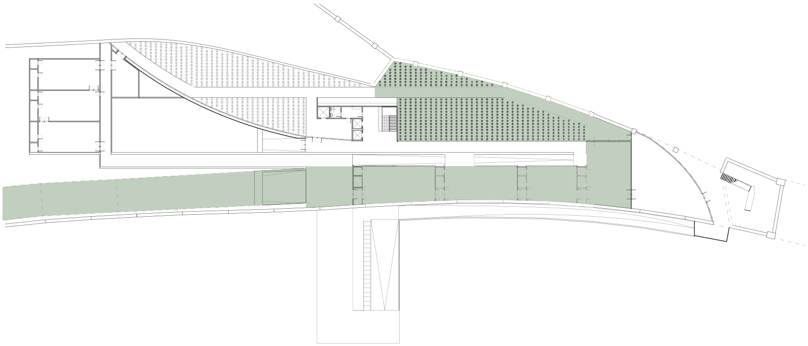
LONGITUDINAL SECTION LOOKING EAST



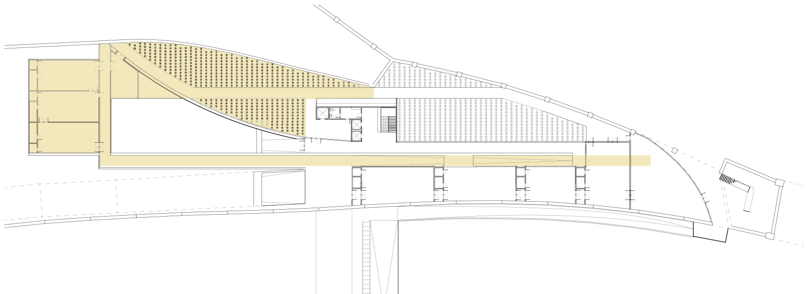




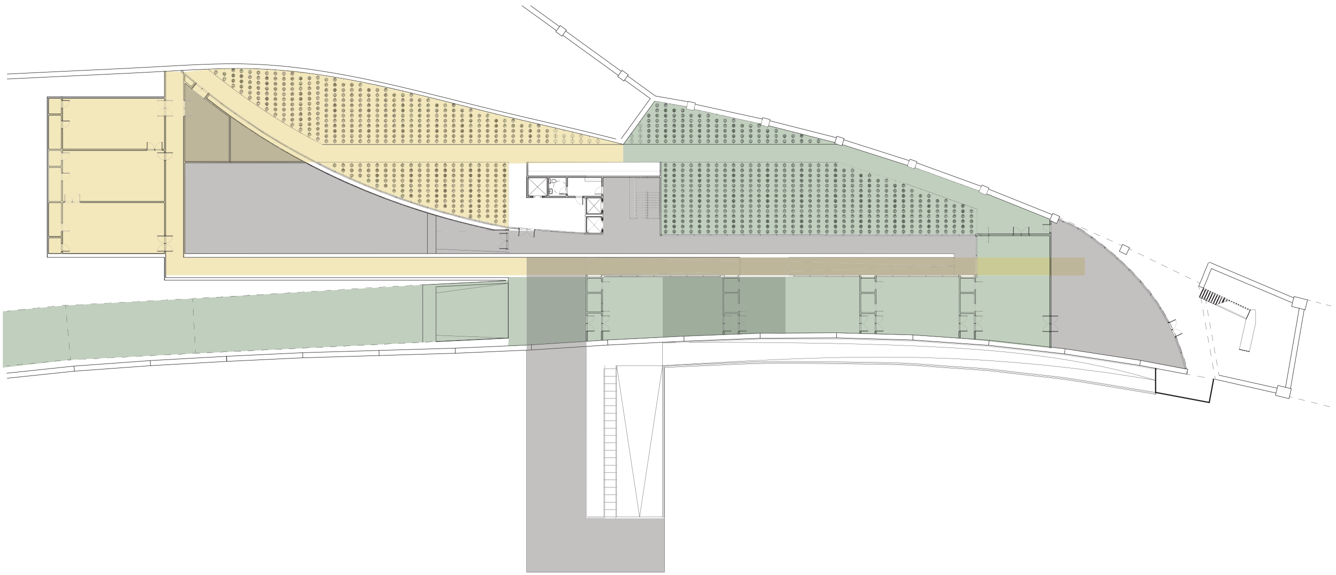
PUBLIC CIRCULATION C



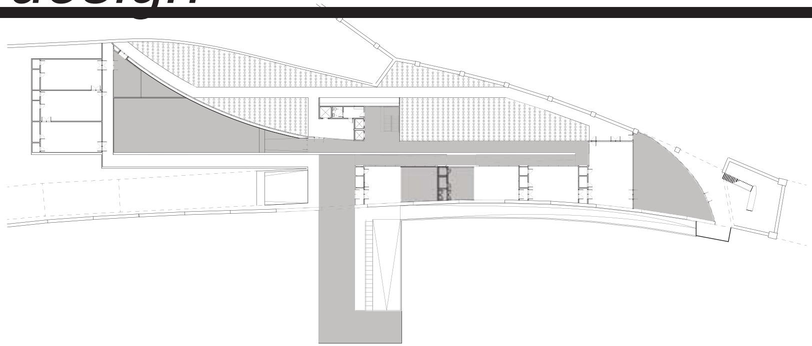
OYSTER MUSHROOM
PRODUCTION A



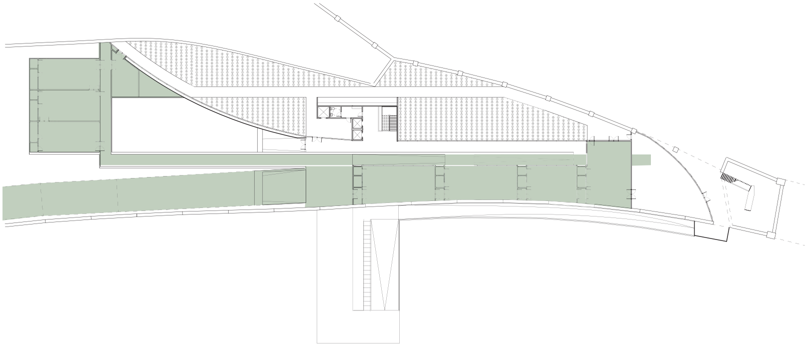
SHIITAKE MUSHROOM
PRODUCTION A



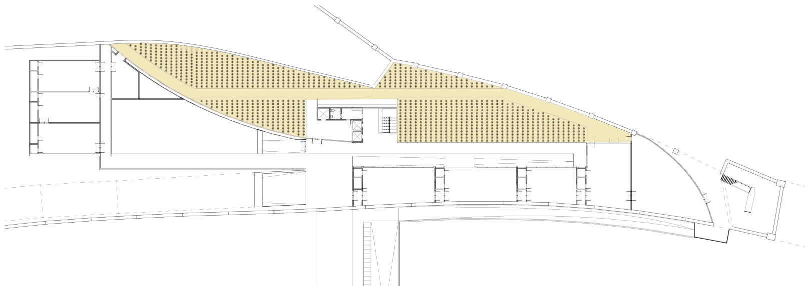
PUBLIC CIRCULATION C,
MUSHROOM PRODUCTION A,A



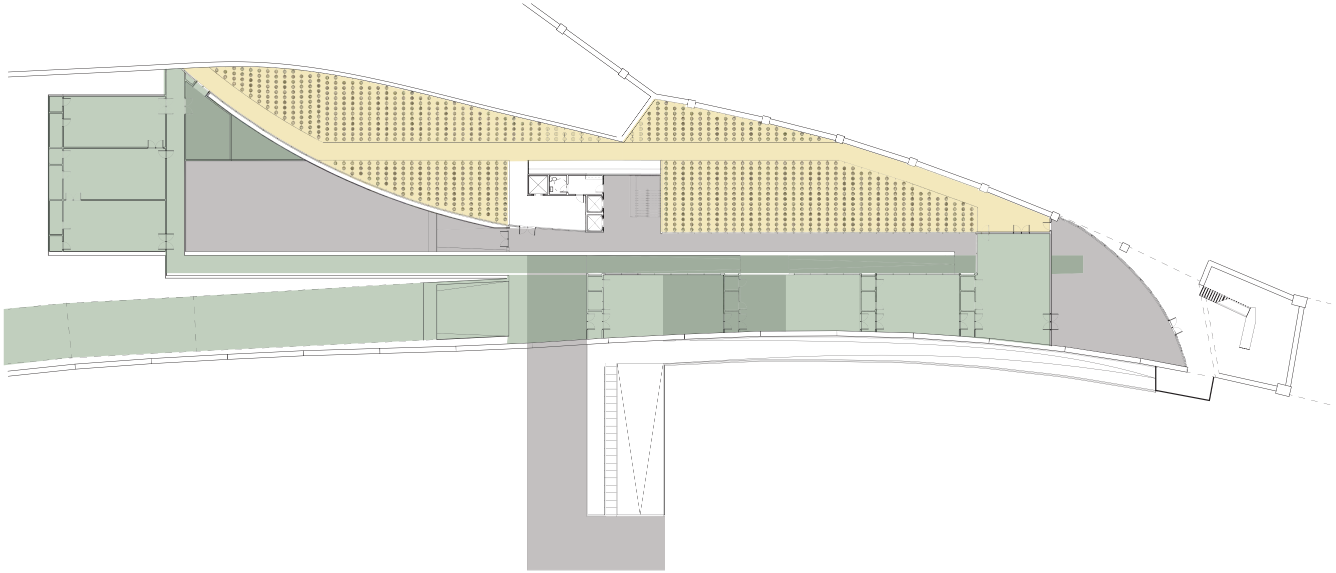
PUBLIC CIRCULATION C



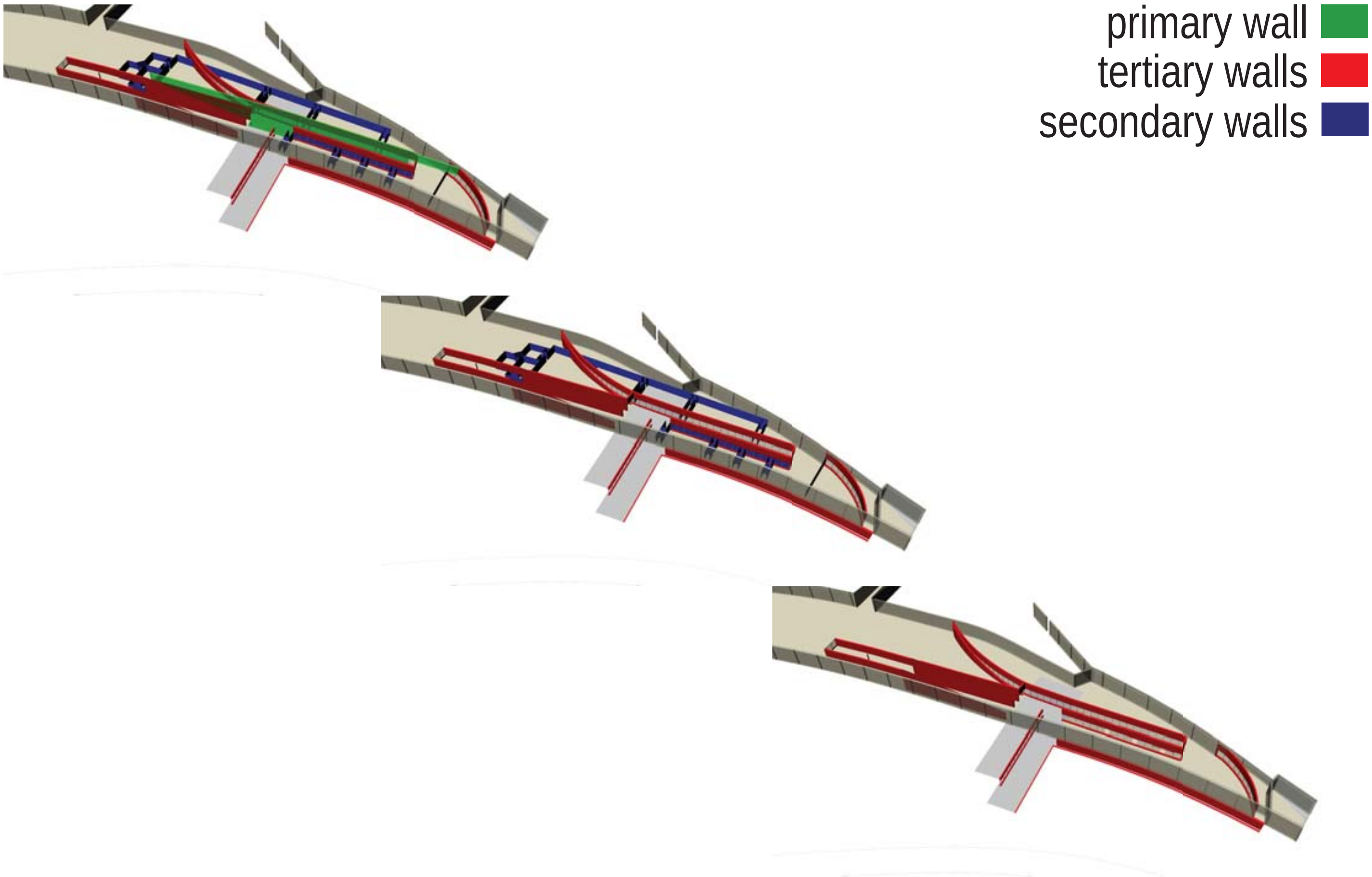
SUBSTRATE PRODUCTION B

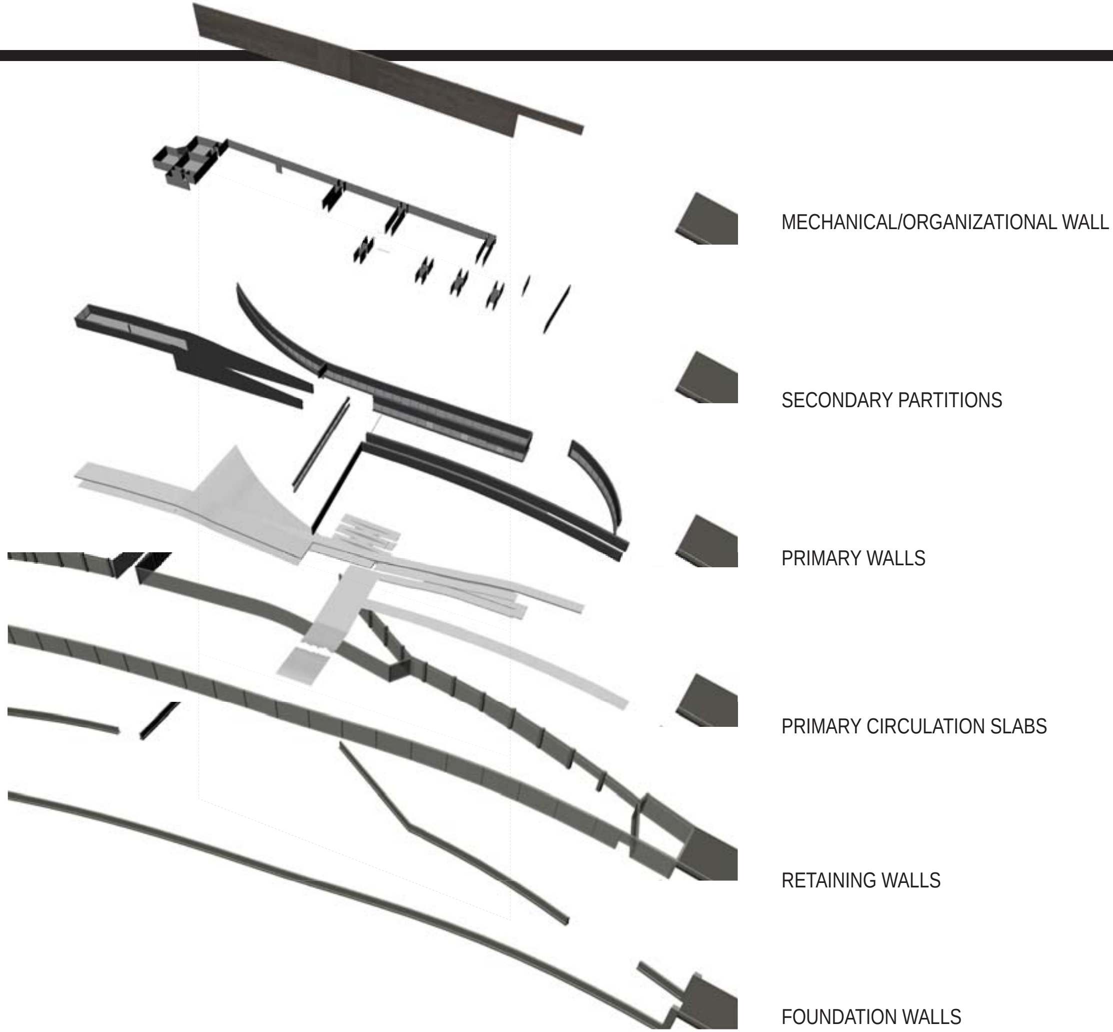


MUSHROOM PRODUCTION B



PUBLIC CIRCULATION C,
SUBSTRATE PRODUCTION B
MUSHROOM PRODUCTION B


primary wall
tertiary walls
secondary walls


MECHANICAL/ORGANIZATIONAL WALL
SECONDARY PARTITIONS
PRIMARY WALLS
PRIMARY CIRCULATION SLABS
RETAINING WALLS
FOUNDATION WALLS

COST/BENEFIT OYSTER MUSHROOM PRODUCTION IN NEPAL (2 months)

PRODUCTION COSTS

Item	Quantity	Cost in NPR
Straw for 100 packets	300 kg	1,200.00 (USD 16.13)
Plastic Bags (18” x 26”)	100 pcs	400.00 (USD 5.37)
Spawn (250g/bottle)	50 bottles	1,200.00 (24/bottle)
Rent	2 months	1,000.00 (500/month)
Chemicals		150.00 (USD 2.02)
Labor		1,200.00 (USD 16.13)
Total		5,150.00 (USD 69.26)

INCOME

Price	Volume	Value in NPR
90.00 per kg	200-300 jg (2-3 kg/ pack)	18,000.00-27,000.00

PROFIT

Cost in NPF	Income in NPR	Profit in NPR
5,1500.00 (69.26)	18,000.00-27000.00 (USD 242.09-363.14)	12,850.00-21,850.00 (USD 172.19-292.79)

COMPARED PROFITABILITY OF MAIZE, WHEAT & OYSTER MUSHROOMS IN ZIMBABWE

	Maize	Wheat	Oyster Mushroom	
GROSS INCOME	1,050,000	2,000,000		2,400,000
Expected yield	3 ton/ha	5 ton/ha		240 kg/20m^2
Average price	350,000/ton	400,000/ ton		10,000/kg
TOTAL COSTS	531,500	860,000	Labor	697,000
Labor	60,000	25,000	Firewood	50,000
Land Preparation	26,000	25,000	Spawn	20,000
Seed	35000	10,000	Spawn	180,000
Fertilizer/Lime	285,000	580,000	Bags	12,000
Insecticides	40,500	45,000	Straw	120,000
Transport	40,000	55,000	Antiseptic	15,000
Levy	12,000	10,000	Construction	300,000
Misc.	33,000	110,000		
NET INCOME	518,500	1,140,000		1,703,000

appendix a

COST/BENEFIT RELATIONSHIP BETWEEN OYSTER MUSHROOM CULTIVATION AND GROWING METHODS IN INDIA

PRODUCTION COSTS Growing Methods	Production Costs (USD)	Yearly Production (tons)	Price per kg (USD)	Value of Sales (USD)	Earning Rate
Traditional hut growing with purchased raw materials	16,383.06	27.37	27.37	31,107	45.58%
Traditional hut growing with their own raw materials	12,364.78	27.37	27.37	30,107	58.94%
Seasonal growing with purchased raw materials	6,832.34	11.4	11.4	10,830	36.91%
Sesonal growing with their own raw materials	5,156.81	11.4	11.4	10,830	52.38%
Growing in their own constructed houses	16,392.23	27.37	27.37	30,107	45.55%

COMPARING MUSHROOM PROJECTS AROUND THE WORLD

Location	Substrate Material(s)	Primary Strains
Zimbabwe	Grass	A. Bisporus (Button) P. Ostreatus (Oyster) P. Sajor-caju (Oyster)
Nepal	Paddy Straw	A. Bisporus (Button) P. Ostreaus (Oyster) P. Sajor-caju (Oyster) Volvoriella volvacea (Straw) Lentinula Edodes (Shiitake)
India	Paddy Straw Wheat Bran/Straw Bagasse	A. Bisporus (Button) P. Ostreatus (Oyster)
Swaziland	Bagasse	P. Ostreatus (Oyster)
Northern Thailand		Agaricus Bisporus (Button) Agrocybe cylindraceae (Yanagi) P. Cystidiosus (Abalone) P. Ostreatus (Oyster) Lentinula Edodes (Shiitake) Voluariella volvacea (Straw)

appendix b

COMMONLY CULTIVATED MUSHROOMS

button
saprotrophic

chantrelle
mycorrhizal

enoki
saprotrophic

lion's mane
parasitic

oyster
saprotrophic

porcini
mycorrhizal

shiitake
saprotrophic

shimeji
saprotrophic

truffle
mycorrhizal

MUSHROOM TERMINOLOGY

fungus_any of numerous eukaryotic organisms of the kingdom Fungi, which lack chlorophyll and vascular tissue. The kingdom includes the yeasts, molds, smuts, and mushrooms.

decomposer_any organism that lives and feeds on dead organic matter.

substrate_the base on which an organism lives.

spore_a reproductive body, produced by bacteria, fungi, various plants, and some protozoans, that develops into a new individual.

hyphae_a long, slender, usually branched filament of fungal mycelium.

mycelium_the mass of interwoven filamentous hyphae that forms especially the vegetative body of a fungus and is often submerged in another body.

mushroom_the spore bearing, fruiting body of a fungus which typically consists of a cap, stem, and mycelium.

pin_the earliest stage of the mushroom fruit resembling a small point or pin emerging from the surface of substrate material.

button_the emergence of the cap from the mushroom pin.

mushrooms

What they are.

How they form.

Why we eat them.

WHAT ARE THEY?

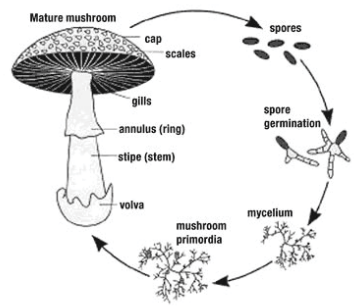
Mushrooms are the **spore** bearing, **fruiting body** of a **fungus** that grows in decaying oraganic material. Formed above or below ground, mushrooms are considered macrofungi because they are visible to the human eye. Mushrooms can grow in almost any climate and fall into 4 different categories: saprotrophic, mycorrhizae, parasitic, endophytic. Saprotrophic mushrooms are **decomposers**, mychorrizael mushrooms grow on the roots of plants in a symbiotic relationship, parastic mushrooms invade and kill host organisms, and endomorphic mushrooms invade host organisms but do so in a mutally beneficial way.

There are over **10,000 known species** of mushrooms throughout the world and countless undiscovered species. Of these species, approximately 200 are suitable for human consumption. The rest of the mushroom species are poisonous to the human body, some of which can even cause death.

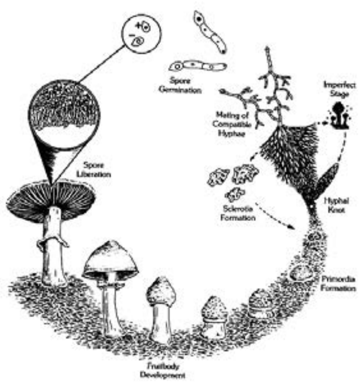
WHY DO WE EAT THEM?

Mushrooms have been **hunted** in the wild as long as humans have been on earth for their **health benefits**. In many ancient societies mushrooms were considered a delicacy to be consumed only by the elite. Today, many edible mushrooms can be **cultivated** artifically while others are still hunted, providing a low calorie, fat-free, and cholesterol free source of nutrients to all segments of the population.

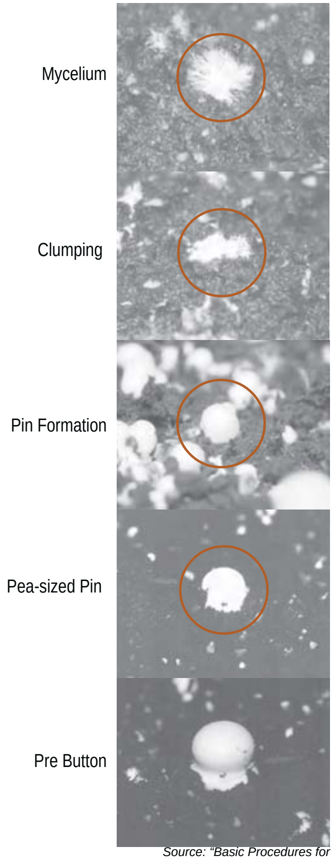
HOW DO THEY FORM?



Anatomy of a Mushroom
Source: mushroompalace.com



Life Cycle of a Mushroom
Source: fungi.com



Source: "Basic Procedures for Agaricus Mushroom Growing"

appendix b

COMMON SUBSTRATE
MATERIALS-NEW YORK

sunflower seed hulls

wheat straw

corn waste

sawdust

paper waste

groundnut shells

COMMON CULTIVATION
TECHNIQUES

1. tray culture
2. column culture
3. bag culture
4. log culture
5. bottle culture

mushroom
cultivation

background process
materials techni ues

~~FAST~~ FRESH FOOD

BACKGROUND

Mushrooms have been cultivated in the United States since the mid-1800s and around the world for centuries more. The most important factors determining the profitability of a commercial mushroom enterprise are the quality of the **mushroom culture**, the quality of the **substrate material**, and **environmental control.** Key conditions to monitor include temperature, moisture, and ventilation of the growing space. Other factors that affect profitability are the availability and **affordability** of local substrate material, the **suitablility** of the mushroom to its immediate environment, and the **scale** of production. If grown in the right environment, mushrooms can be cultivated without the use of machinery, fertilizers, or light, with minimal start up costs making mushroom production a popular crop for cultivation throughout the world.

PRODUCTION PROCESS

The typical cropping cycle for a mushroom farmer is approximatley **2 months**, and a mushroom farmer will plant **4-5 crops per year**. The first step of the production cycle is substrate preparation. While many mushroom farmers grow and prepare their own substrate material, substrate materials can also be purchased raw or prepared. The next step is spawning; the inoculation of substrate materials with mushroom culture. Almost all mushroom farmers obtain mushroom cultures from an outside source to ensure purity, quality, and consistancy of strain. The third step is fruit body development and the last step is harvesting.

1. PREPARING SUBSTRATE MATERIALS

DRYING/STORING

preparing substrate materials to be mixed together.

MIXING

combining different substrate components to form a uniform substrate material.

STERILIZING

killing unwanted organisms that ma be present within the substrate and hamper mushroom growth; may be done naturally or artificially.

2. SPAWNING

inoculating prepared substrate with mushroom culture within the fruiting vessel.

3. FRUIT BODY DEVELOPMENT

INCUBATING

period of time in which m celium populates the substrate material.

PINNING

the fruiting bod emerges from the m celium within or above the substrate material.

CROP MATURITY

the fruiting bod is prepared for harvest.

4. HARVESTING

picking the mushrooms (which fruit continuously for about one month after crop maturity) and preparing for market.

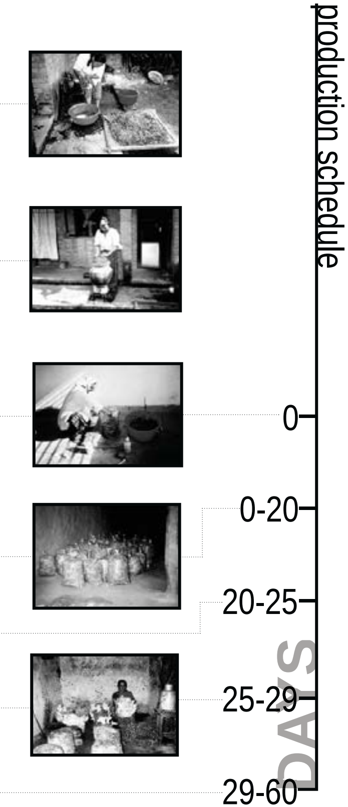


Image Source: Mushroom Growers Handbook, Ch. 2

appendix b

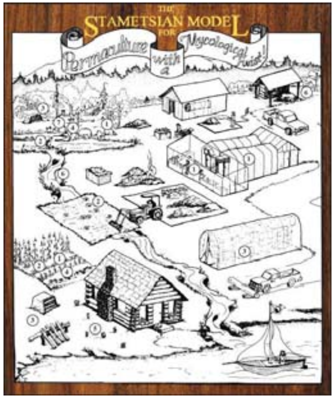


Image Source: reprinted from "Growing Gourmet & Medicinal Mushrooms" by Paul Stamets.

1. Oyster Mushrooms
2. King Stropharia
3. Shiitake, Nameo, Lion's Mane
4. Maitake, Reishi, Cluster Woodlovers
5. Shaggy Manes
6. Morels
7. Myccorhizal Species
8. Sacred Psylocibes

- sustainable food source
- m coagriculture

- sustainable food source
- mycofiltration

- sustainable food source
- m coforestr
- m coagriculture

- m coremediation

- sustainable medicinal source
- m coforestr

- sustainable food source
- mycofiltration
- m coforestr

- sustainable food source
- m coforestr

- spiritual properties
- m coforestr

MYCOrestoration
remediation
filtration
forestr
agriculture
pesticides

MYCORESTORATION [1]

Mycorestoration is the use of fungi to rehabilitate stressed or contaminated environments. This will be acheived through **mycoremediation**, **mycofiltration**, **mycoforestry**, **mycoagriculture**, and **mycopesticides**.

MYCOREMEDIATION [2]

Mycoremediation is the use of fungi to bring a polluted/contaminated environment usuall soil to a less contaminated state.

Benefits

1. Toxic/radioactive heav metal removal
2. Biological cleanup E.coli, malaria
3. Chemical cleanup VX, Sarin, petroleum products, pesticides, etc
4. pH correction
5. Speed decomposiiton of celluosic material paper b products, woodchips etc.
6. Erosion control

MYCOFILTRATION [3]

Mycofiltration, uses the m celium of fungi as a biological **filter** to clean contaminated water.

Benefits (filtering of)

1. Pathogens viruses, bacteria, protozoa
2. Chemical toxins
3. Silt/heav metals

MYCOFORESTRY [4]

Mycoforestry, is the use of fungi to **rehabilitate** public lands, forests, and open spaces.

Benefits

1. Preservation of native ecos stems
2. Rec cling of woodland debris
3. Enhancement of planted trees
4. Increased biodiversit
5. Erosion control m coremediation
6. Contaminated water filtration (mycofiltration

MYCOAGRICULTURE [5]

Mycoagriculture, also known as m cofarming, is the use of fungi to complete the process of sustainable agriculture permaculture . This will be achieved with the utilization of **saprophitic** and **mycorrhizal** fungi in a **closed loop** agricultural production s stem.

Benefits

1. Remediation of agricultural wastes
2. CO2 production
3. Spent substrate as fodder for livestock/fertilizer for garden
4. Increased yields
5. Increased water absoprtion
6. Reduced fertilizer usage
7. Reduciton of fecal coliforms/heavy metal contamination (mycofiltration)
8. Sustainable food source

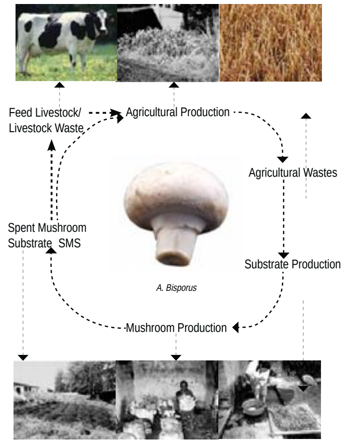
MYCOPESTICIDES [6]

Mycopesticides are fungi used to **exterminate** pests.

Benefits

1. Not harmful to plants, mammals, bees or beneficial insects
2. Replaces toxic pesticides (protects ground water
3. Worker insects implement own death, while spreading spores to entire colony
4. Low tolerance buildup
5. Long term protection of treated sites
6. Allows use of building materials otherwise susceptible to insect destruction

1,2,3,4,5,6 M co information sourced from http //amateurm colog .com



Mycoagricultural Process

Parasitic fungi kills insect

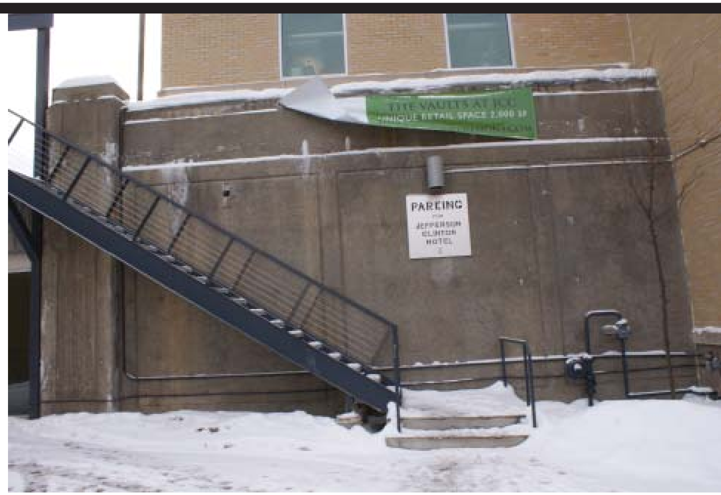

PARKING
ARMORY SQUARE
M.O.S.T.
LANDMARK


LOW CLEARANCE 7-0" BEYOND


PAY


ARMORY SQUARE
DOWNTOWN SYRACUSE


COMMERCIAL AND RESIDENTIAL
SALES & LEASING OFFICE
JC COMMONS • POMEROY BUILDING • TRAIN STATION
JEFFERSON CLINTON


PARKING
JEFFERSON
CLINTON
HOTEL

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