Our Grass Groweth Over: A Built Network to Reclaim the American Lawn

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Abstract

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The future promises to be rife with ecological change. Ultimately, climate change - coupled with population growth, will require the development of new strategies regarding food production and urban space; there will be less arable land, and more people feed. This thesis addresses a problem of cultural values, how urban space is wastefully used in spite of the problems facing society. Why do Americans choose to grow grass instead of food?

Architecture has always been involved in the construction of the city. As a profession, architecture has an opportunity to gain new importance as one directly responsible for environmental strategies and questions. Architecture is the language to integrate the food system into built environment and build local, sustainable loops. This thesis proposes uses architectural programming and built intervention to develop and support a network of small urban farms, together forming a viable and significant piece of a local food system. The design of this project is threefold, and includes a network, a shed, and a central hub, that work together as a cohesive system.

For my family, friends
Thank you for your unwavering love and support

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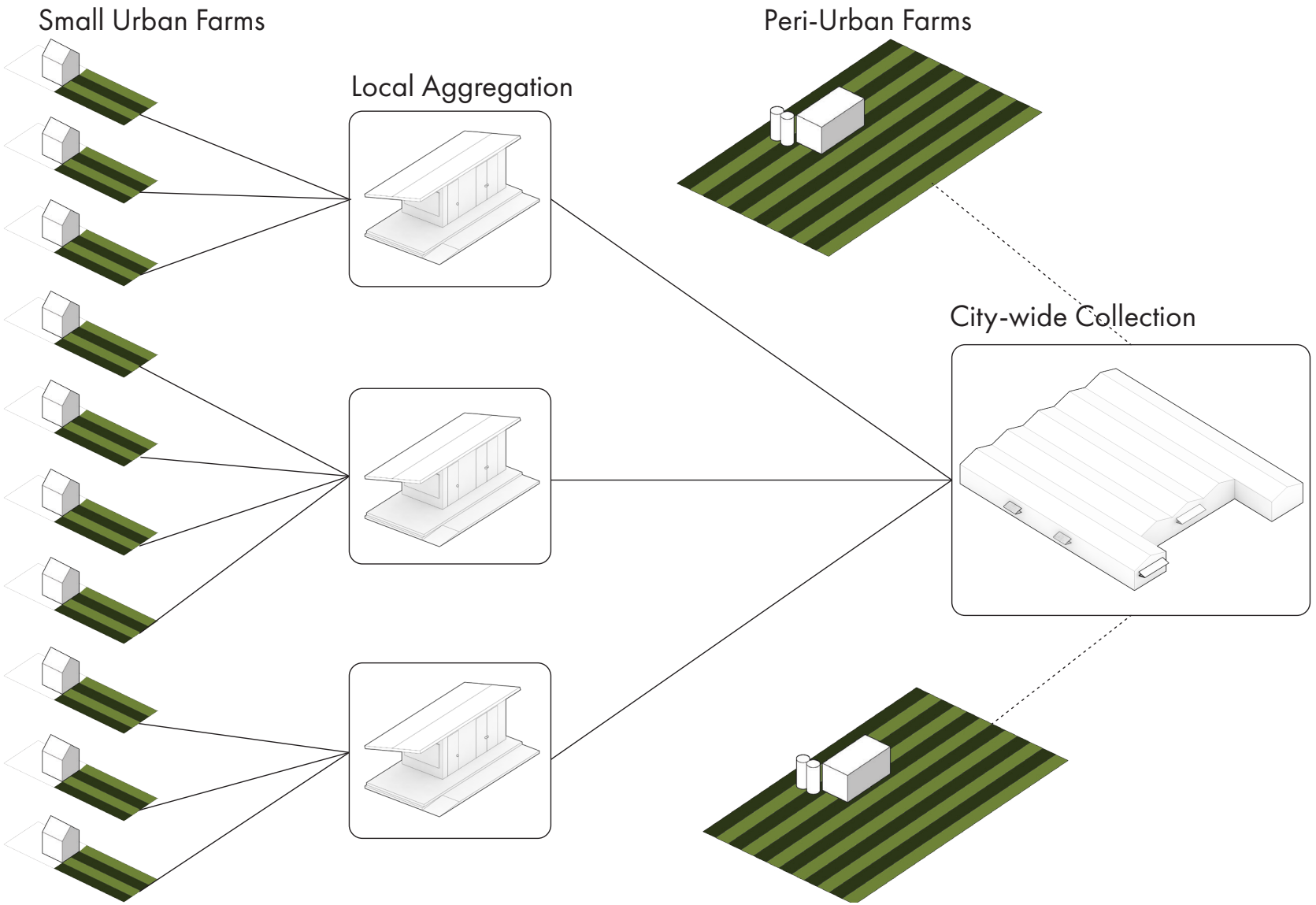


Fig. 0: *Network Diagram.*

Introduction

The future will be rife with ecological change. Ultimately, climate change will affect how and where humans can produce and collect food and water. Consequently, as a culture, our lifestyles will shift in many unforeseeable ways. Despite the looming problems, the future is also a time of unbridled optimism, as there is a chance to heal social and ecological problems with roots centuries deep. The architecture profession has a unique opportunity to gain new importance as one directly responsible for environmental questions (Koolhaas 2011). As urbanization trends continue, city dweller's access to food and space will invariably become stressed. Running parallel to growth is the need for urban areas to mitigate their substantial environmental impact. Food production and distribution is one of the largest contributors to climate change and acts as a great social stressor. Strategies regarding urban food systems must be given a thorough rethink.

This thesis addresses a problem of cultural values, Specifically, that urban space is wastefully used in spite of the problems of climate change. Why do Americans choose to grow grass instead of food? Lawns, the ubiquitous green carpet that covers America, are an unproductive, harmful, and an outdated social symbol.

Fig. 1: *Kansas City, MO.*

However, in lawns - or rather the space that lawns occupy - there is massive untapped opportunity. If lawns across America were turned to farms, or even native plantings, the change in food access, water use and fertilizer pollution would be significant. However, lawns are not just grass and do not just concern the environment; lawns operate as social symbols of wealth and morality, and are deeply embedded in American culture. American's have transformed their lawns into gardens before. Both World Wars saw the large scale adoption of "victory gardens" across the United States, that is to say, a garden framed as a moral and economic tool for national survival. The capacity for change exists, only now the catalytic crisis is rapidly mounting climatic issues.

Ultimately, both food and the city are about individuals and the result of their habits and desires. This thesis developed out of questions about an individual's role in the city and in mitigating climate change. What is one lifestyle change an individual can make in their daily life to lessen their ecological impact? A second question is, can that change be beneficial to the those individuals and communities as well? Social change, like the conversion of lawns to gardens starts with individuals and communities making daily choices, and seeing those choices positively reinforced. Incentives like "saving the environment," while admirable, are hard to quantify, and may not be a priority to a family struggling with rent and food security. Healthy, local, cheap food is visible and can have a immediately tangible effect for families and the environment. Environmental awareness is a longer-term and culturally deeper issue, but like healthy food, change starts with education and ends with daily practice. Communities facing economic and food insecurity have a direct incentive to participate in a solution that would provide food and jobs. For many Americans, the crisis impetus is clear, even without considering climate change, which is ultimately another factor that will disproportionately affect poor communities.

This thesis proposes an architectural framework for developing and enabling economic incentives for individuals to participate in ecological and social remediation. As an architectural intervention, this thesis project contains program supporting the conversion of lawns to farms by presenting farms as both practical and accessible means of economic opportunity.

While the problems of lawns, food, and the environment are national concerns, this thesis will address one specific site, promoting change from a literal grassroots level. Site specific responses benefit the individuals of local communities to the maximum extent. Detroit, for instance, has an abundance of vacant lots, many of which have been converted to viable urban

farms. Los Angeles, a city of cars, has seen success with urban farming in parking medians between roads and sidewalks. Tacoma, Washington was selected as the thesis site because the city sits at an intersection of ample lawns, poor food access, economic concerns, yet strong community activism and a favorable climate. Tacoma is another example of an urban environment with little incentive for the continuation of the grassy status quo and ample reason and opportunity for change.

The lawn as a land use strategy has been a remarkable failure. New systems are required. Several experimental land use systems were considered as viable replacements for the lawn, including agroforestry and edible gardens. Both agroforestry and edible gardens require an extensive initial investment in terms of time, money, and education. With this in mind, a strictly agricultural system was chosen as the prefered form of lawn replacement due to its overall lowest barrier to entry.

Small plot intensive farming, or SPIN farming, is an agricultural system based on small plot sizes, relay planting techniques, and the use of high value crops. SPIN farms typically exist on plots smaller than 2,000 square feet, an area smaller than that of a prototypical urban lawn. As a business model, SPIN farms rely on a proximity to urban markets, typically selling their high value crops direct to restaurants and Community Supported Agriculture (CSAs). This thesis supports the development of a network of SPIN, together with other urban farms, into a viable local food system.

The challenge of this thesis was to bring together diverse programmatic components at two distinct scales. Many of this thesis' individual elements have been used to address food security or ecological disruption in isolation. To the best of the author's knowledge the combination of addressing land use, education and outreach, as well as food aggregation and distribution is untried. A two-part approach is proposed: a system of neighborhood-scaled sheds providing essential functions will be inserted at key points in the city; these are connecte to a city-scaled central hub providing broad support, aggregation and distribution services, and important market space for locally grown food.

The thesis will be organized as follows. The history and problem of the lawn will be laid out to demonstrate the scale and ridiculousness of the urban grass. Next, problems with the food industry, and how it damages some local communities will be covered. The American cultural relationship to the lawn and garden will be presented, as well reasons why that relationship can and has changed over time. Lastly, the proposed solution: network, design context, shed, and hub will be explained.

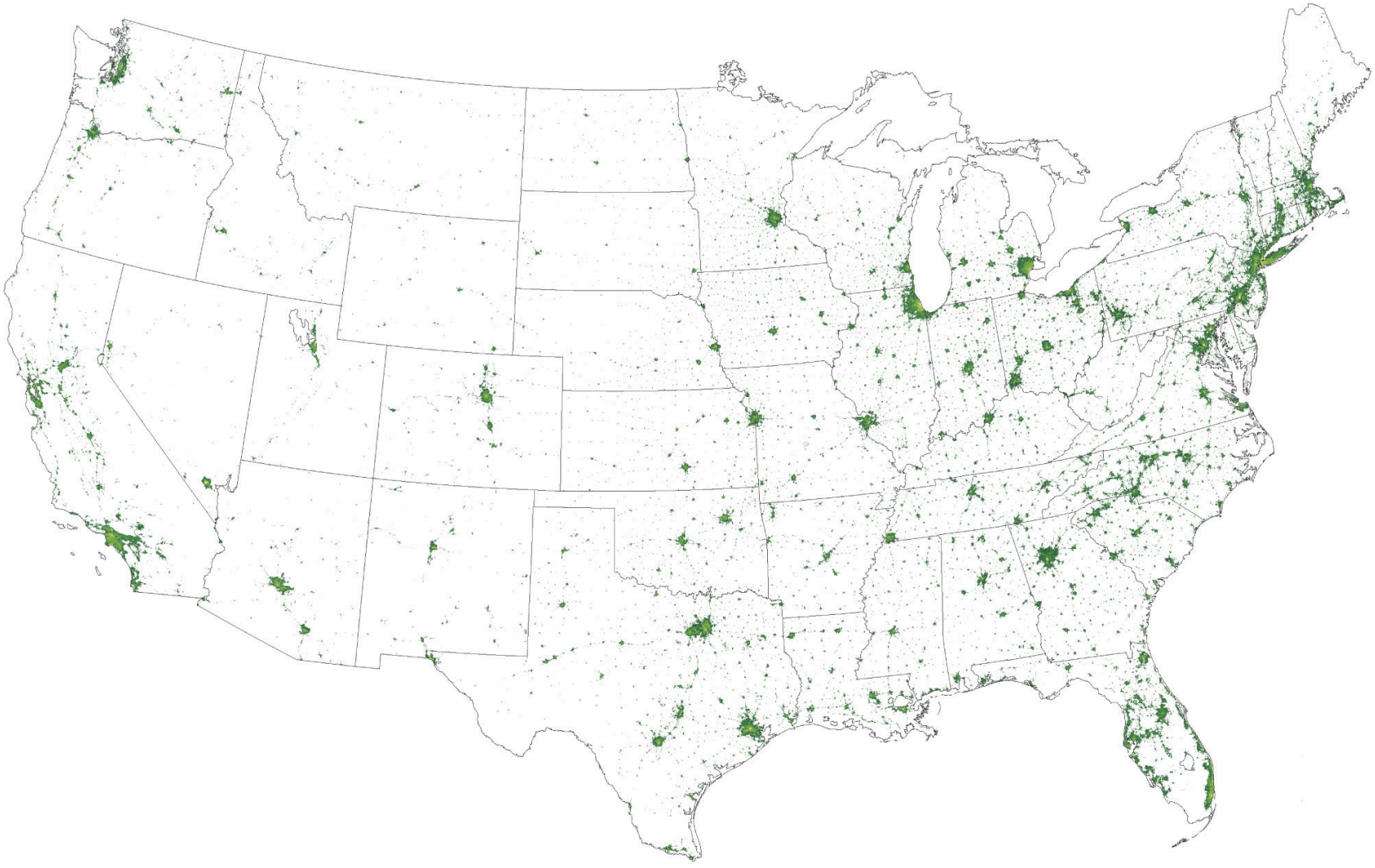


Fig. 2 *Lawn Coverage.* This image from NASA maps lawn coverage across the United States. Darker green indicates higher instances of lawns. Lawns clearly aglomerate around urban and suburban development

Conceptual Issues

Our Grass Groweth Over

The American culture of lawns is deeply rooted, first emerging in feudal Europe. Cultivated grasses were first seen in small scale, village based agriculture, pastures essentially, although substantially different in ecology and form. During the late 17th century, the first lawn as we know it appeared at Louis XIV's Versailles gardens. Louis XIV called his lawn the tapis vert, or green carpet, and it was a sign of utter wealth and prestige. In the days before lawn mowers, lawns would be hand cut by peasants with scythes. The possession and maintenance of a lawn was a sign that one had excess wealth, land and labor that did not need to be used for agriculture or grazing (Jenkins 1994).

The notion of land as a "pleasure ground" quickly spread through the North Atlantic's landed elite. The trend expanded, and moved to the new world along with colonial ambitions. Notably, George Washington and Thomas Jefferson had non-productive leisure gardens and lawns at their grounds at Mount Vernon and Monticello (Jenkins 1994, Pollan 2007). Despite Jefferson's well-known propensity for the agricultural landscape and the yeoman farmer, is unlikely that Jefferson allowed grazing on his lawns. Monticello's grounders were hand-scythed several times a year (Pollan 2007).

Fig. 3: *Versailles.* Birthplace of the lawn

Fig. 4: *Mount Vernon.* George Washington's Manor

Fig. 5: *Monteciello.* Jefferson's Yeoman Farmer Palace

The grass lawn entered the vocabulary of middle-class America with the help of Frederick Law Olmstead. Olmstead's large public lawns in parks popularized the ideas of recreational open spaces. It should be noted that the author gives complete approval of ecologically responsible lawn care in public facilities like parks. What better place to display societal wealth and prestige than in a public setting available for all? Later, after the success of Central Park, Olmstead's planned the Chicago adjacent village of Riverside, Illinois. Riverside was one of the first suburbs, where homes were prescribed to be setback a minimum of thirty feet from the road, as well as set apart. Olmstead's vision was that each home should feel part of a single park (Pollan 2007). Riverside became the model for the American suburb.

Frank J. Scott, a landscape architect, made Olmsted's ideas even more accessible to the growing middle class. Scott preached that the value of lawns was as a symbol of a virtuous community (Scott 1870). Scott was one of the first landscape architects to work with suburbs, and his ideas became seminal. In his view, "a smooth, closely shaven surface of grass is by far the most essential element of beauty on the grounds of a suburban house." Scott placed lawns at the center of the suburban typology, and relegated all other plantings to the periphery. Here the distinction between an English lawn and the suburban American lawn becomes clear; the English lawn was never a piece by itself: it was always the setting for games or a neutral ground to stage flowers or trees. The American lawn in comparison is monolithic and manicured, a distinctly American invention (Robbins 2007). Scott framed lawns as a Christian and democratic duty to one's neighbors. He believed that "it is unchristian to hedge from the sight of others the beauties of nature which it has been our good fortune to create or secure (Scott 1870)." The lawn has become a signifier of neighborly intent and moral values -- "the beauty obtained by throwing front grounds open together, is of that excellent quality which enriches all who take part in the exchange, and makes no man poorer (Scott 1870)." Scott's influence saw the lawn transition from a symbol of the estate and aristocracy to a symbol of the growing middle class. The American psyche--and indeed, the

Fig 6: *Riverside, Illinios.* Frank Law Olmstead's planned suburb. The image is a yard, although it clearly reads as a lawn.

Fig 7: *Levittown.* The sprawling suburb built for vetrans returning home from WWII. This is one of several nearly identical "caucasian only" suburbs built by developer William Levitt.

The post-WWII expansion of the American middle class and subsequent cultural change saw the spread of lawns across America. Abraham Levitt and his son William Levitt, known as the fathers of the American suburb, planted lawns in their massive suburban developments, because they were cheap and quick, perfect for post-war suburban development (Robbins 2007). A community could be made immediately, and then given social validation through the use of a cultural signifier, endless green lawns. The lawn has been referred to "the anti broken window" (Mars 2014). Perhaps the lawn, and indeed the suburb, took hold because of the endless and "unoccupied" landscape available in North America. The lawn as symbol for manifest destiny. The triumph of the American over the landscape.

Somewhat ironically, the lawn offers unique opportunity for the now shrinking American middle class. Large swaths of open land still exist in the nation's cities. Conceivably, this land could be used for food production, bioremediation, urban species habitat, sun shading, rain water retention. Jefferson's dream of a nation of farmers is not dead, but it has been overgrown for some time.

Lawn Problems

The United States is a complex amalgamation of geography: sweeping mountains, endless plains, and deep forests, which divide the country into distinct geographic regions each with a multitude of climatic variations and soil qualities. The country also has deep cultural divides, some centuries deep and falling along demographic lines. The American lawn is a unifying element, as ubiquitous and symptomatic as the freeway system or fast food. Lawns can be found at the genesis of multiple environmental problems (Pollan 2007, Stein 1995).

Private lawns cover more than thirty-two million acres of the country, which can be conceptualized as an area the size of New York State (Milesi 2005). This number does not include parks, golf courses, corporate campuses, or public spaces; those included, turf covers 2 percent of the continental United States. These statistics indicate that grass lawns are America's favorite crop. There is three times more acreage devoted to lawns than to corn in the United States (Milesi 2005). The water usage to irrigate a lawn the size of New York State green is immense; the nation's lawns consume about 200 gallons of fresh, drinking quality water per person per day, 270 billion gallons of water a week (EPA 2014). To think of that

Fig 8: *New York State.* 32 million acres of lawn.

another way, 200 gallons of water per person per week is enough water to cultivate 81 million acres of vegetables successfully. Eighty-one million acres of average vegetables would produce a conservatively estimated 800 hundred billion pounds of produce annually (USDA 2012).

Despite the ubiquity of lawns in America, lawn grasses are still a distinctly European invasive. The lawn grasses that Americans know and use -Kentucky Bluegrass, Carpet grass, Rye grass- are all European imports. Grasses in Europe adapted to survive heavy grazing from domestic animals and foot traffic from European farms (Robbins 2005). When domestic animals were introduced to North America, native grasses could not survive and replenish themselves under pasture conditions. European species could, and in fact did quickly take over in areas disturbed by European influence. As European influence (and the animals that came with them) spread, so did invasive grasses. Today, the vast majority of prairie lands in the United States are cultivated or disturbed by urban settlement. Most of the native grass species in the continental United States have become extinct (Pollan 2007).

Fig 9: *Williams Praire, Iowa.* Much of North America was once covered in diverse grassland, proviing rich habitat and grazing land for large mammals like the bison.
Fig 10: *Commerce City, Colorado.* Much of North America is now covered in single species invasive turf lawn, which provides little habitat.

As a country, America spends over $20 billion dollars a year on lawns and lawn maintenance (Garber 2015). This does not include the lost economic output of personal time spent on lawns. Mowers, which typically use inefficient engines, contribute to urban air pollution. On a country-wide scale, mowers become problematic for carbon emissions (Banks 2015). Lawn care products are also tremendously damaging, as the average lawn uses up to 10 times more chemical product per acre than industrial farming (Pollan 2007). Pesticides, herbicides and fertilizers contribute directly to the degradation of the nation's waterways and estuary systems, and have also been linked to cancers, heart disease, and birth defects (Robbins 2007). Documentation of the chemical problems with lawn care has existed since 1962, yet little regulation has changed (Carson 1962, Pollan 2007). Pesticides and fertilizers are also linked to honey bee colony collapse, which will lead to a global catastrophe if honey bees continue to disappear (Traynor et al. 2016). While lawns could act as a carbon sink in theory, lawn clippings are often garbaged and left in landfills to release carbon dioxide and methane, rather than being transferred to composting sites or even left on the lawn to decompose, cycling nutrients back into the soil and reducing the amount of valuable topsoil lost each year (Pollan 2007). One positive is that the nation's lawns indicate the the vast amount and time and money Americans are willing to invest in their land.

The issues above do not touch the unspecified economic and ecological damage, including top-soil degradation, lack of urban tree cover, and loss of habitat and biodiversity. The absurdity and scale of the lawn problem is shocking. This thesis offers a use for the lawn, and an opportunity for those willing to change the status quo.

Fig 11: *Extreme Mower.*
Fig 12: *Herbicide.* Highly toxic, marketed to kill broadleaf plans

Fig 13: *Water Pollution.* Water runoff carries significant amounts of fertilizer, causing an algae bloom in the North American Great Lakes.

The American Food System

Food accounts for roughly half of the average American's ecological footprint (Moore 2011). Therefore, the production and distribution of food offers a tremendous opportunity for ecological change. Currently, most food is produced industrially: Ten multinational companies produce more than sixty percent of the food consumed in the United States (Lyson 2004). However, food production is in the midst of a slow cultural shift, returning to locally and organically produced agricultural. The Seattle-Tacoma metro area has demonstrated, through multiple city ordinances and the success of local farmer's markets and pea patches, that a strong demand for local and organic food exists. The Pacific Northwest--and western Washington specifically--is home to a temperate climate, fertile soils and an abundant water supply that make the local, small scale production of food viable.

Most American citizens are dependant on industrial scale agri-business and multinational food systems, which can be tremendously ecologically damaging, nutritionally poor, and harmful to local economies. Maybe not coincidentally, lawns emerged into the mainstream American cultural landscape during the same timeframe as Industrial agriculture, indicating both are symptomatic

Fig 14: *Coronado Feed Lot.* Industrial scale ranching

of environmental ignorance and distinctly post-WWII American values of uniformity.

However, the American food system has not always been dependent on industrial scale farms and vast food networks spread across the country. For most of history, farms in the immediate vicinity of cities would provide food locally and seasonally. Food would be purchased by urban dwellers at market locations, with vendors typically specializing in one type of good (meat, fish, vegetables). This established a direct relationship between the farmer, the vendors, and the consumers.

Industrially produced food is characterized by mono-culture crops and heavy fertilizer and pesticide use that ultimately damage soil and long term viability (Horrigan 2002). The Dust Bowl of the 1930s come to mind as an example of the failure of industrial agriculture. Chemical fertilizers have long been proven to damage water quality and river systems (Norberg-Hodge 2002). Unreliable quality control dependent on individual countries has spurred health issues stemming from the global spread of disease, for both crops and humans. Food production has shifted away from intensive manual labor, providing local jobs and a visible and personal connection to food. Global disruptions in a global shipping chain can result in a local community's starvation; typically cities hold no more than three days of fresh food in case of emergency disruption of supply.

Fig 15: *Industrial Farming.*

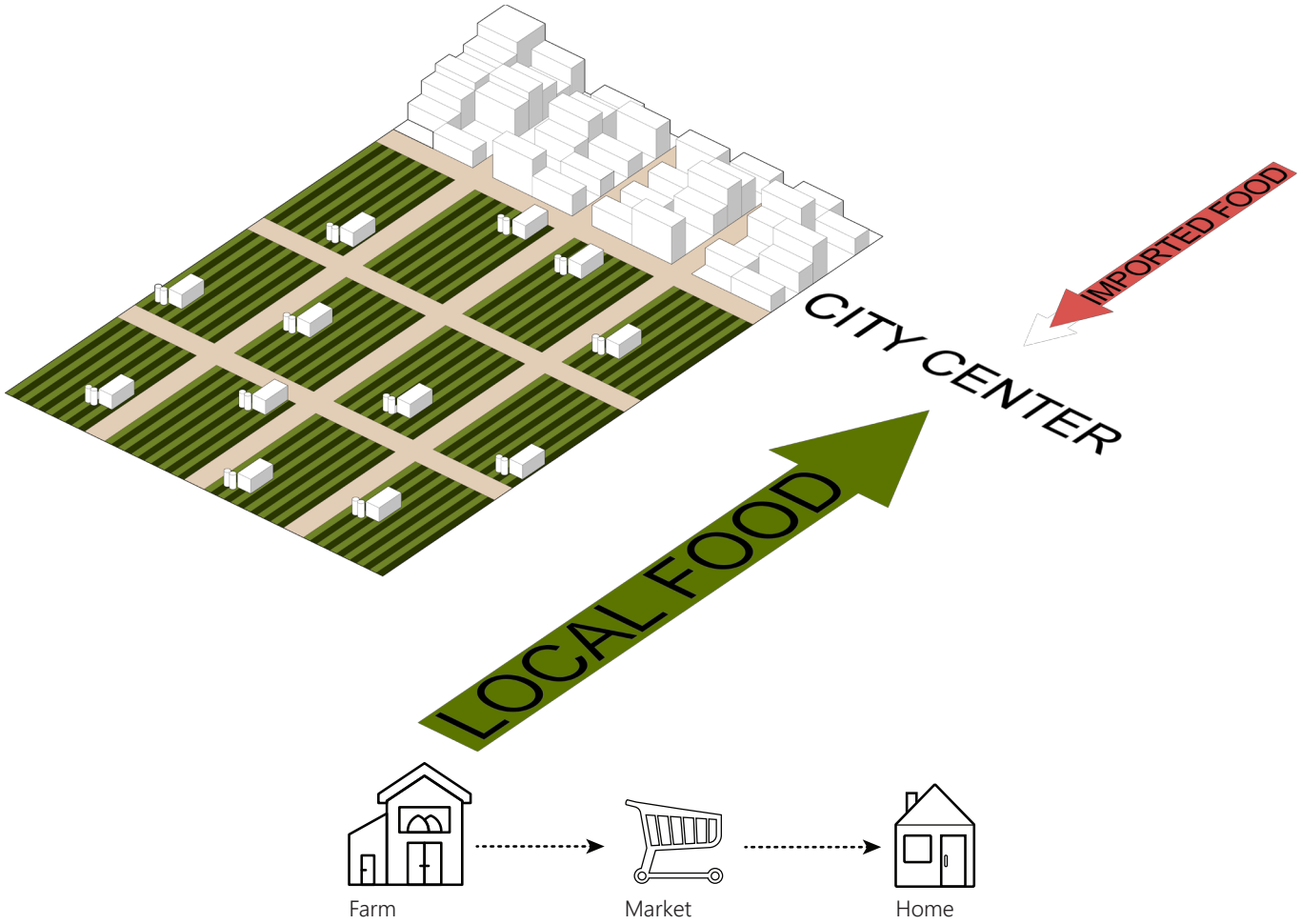


Fig 16: *Historic Food Sytem.* Produce was local out of nessesity, and typically sold at local markets.

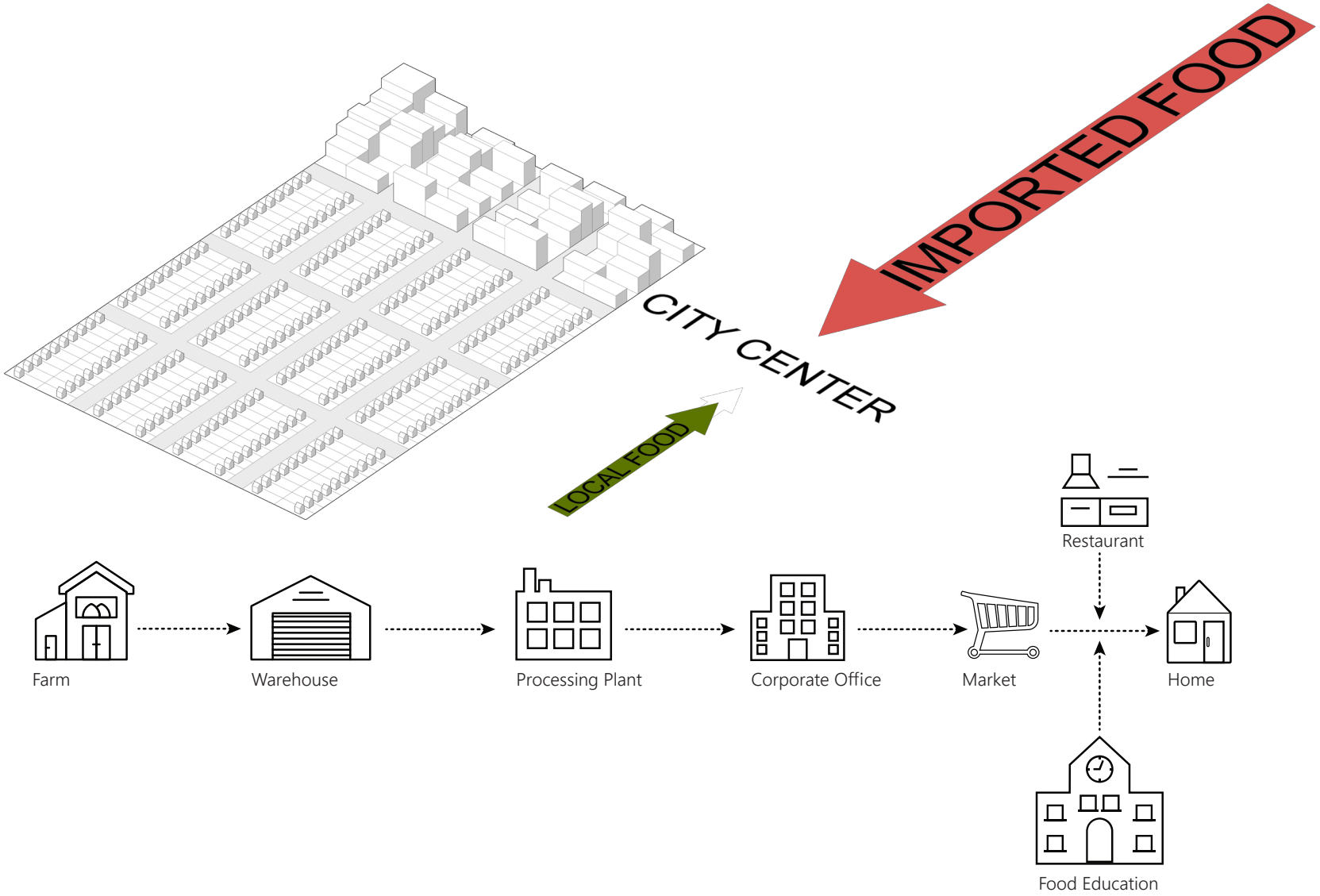


Fig 17: *Modern Food Sytem.* As a consequence of a globalized food system, more architectural spaces exist along the food path

A local community should not be dependent on global developments for survival. Industrially produced food removes individuals' control over what goes into their own body. Personal and community gardens offer the opportunity to grow local food organically, placing control and security back in the citizen's hands.

Locally produced food has been demonstrated to have less of an ecological impact than industrially produced food. Eating regionally reduces the carbon emissions associated with transportation (shipping, refrigeration, packaging) and supplying food to local markets, as well as reducing the amount of food waste that occurs in transit. Additionally, local food also has tangible benefits for the community in terms of dietary health, economic development and local food security (Norberg-Hodge, Merrifield & Gorelick 2002). Food security refers to the "state where individuals have access to culturally acceptable, nutritionally adequate food through local, non-emergency sources at all times" (Winnie, Joseph & Fisher 1997). Food security means access to healthy and affordable food distribution systems for all (Winnie, Joseph & Fisher 1997). If an individual has to bus several miles to a grocery store, they lack food security. Sadly, local food production faces an uphill battle to become as cost effective as industrial scale agriculture. Often large-scale farms are government subsidized, whereas small and local farms lack the required acreage to reach a government subsidy. Therefore, locally sourced and organic food often costs more, placing it outside the economic reach of many communities.

In addition to the health and social benefits of local food, an economic impact would be job creation. Typically, agricultural jobs are low-skill, low-wage jobs that do not exist near urban centers. Localizing food production in urban centers would provide fresh food and new economic opportunities in communities otherwise lacking the same access to social mobility, education and job centers. Local food production should be paramount for any community working towards resilient and equitable development.

Lawn in the American Psyche

Despite the problems of both lawns and the American food system, citizens have been remiss to change how they cultivate and manage their land. The lawn is not just a lawn for a homeowner. Our landscapes are full of meaning; the way cities are built and inhabited are physical expressions of culture. Kevin Lynch demonstrated that "human inhabited landscapes operate as ecological systems, but they also operate as communication systems, people seek information about other people when they experience the landscape" (Lynch 1960). To have a home and have a lawn (or not), is to make a statement about oneself. The meaning that is generated from landscapes has direct impact on the environmental and social health of place.

In general, Americans identify ecological health and nature with "pictorial conventions of the picturesque" (Nassauer 1995), essentially idealized and manicured presentations of nature, stemming from British landscape painting. Unsurprising, given the United States colonial history and domineering approach to natural systems. This is problematic because often ecological health looks messy and unkempt, not picturesque. Swamps and wetlands, for instance, are unappealing for developers and residents but provide a tremendous ecological service retaining and filtering water, as well as providing unique animal habitat.

Indeed, that humans see ecological quality through distinct cultural lenses. As a culture, Americans value landscapes that bear the touch of the human hand or are maintained in "orderly frames," a term used often by Nassauer to describe the American culture's preferred relationship to nature (Nassauer 1995). Americans tend to incorrectly recognize aesthetic value as an ecological role. Nassauer's seminal theory explains the American preference for the lawn aesthetic. Neat, mowed grass is recognized as a marker of, in American eyes, ecological quality and nature, as well as a marker of the citizen's own virtue. Indeed, this heavy-handed attitude towards the landscape was visible nearly a hundred years ago. Aldo Leopold, one of the nation's seminal environmentalists once said, "The landscape of any farm is the owner's portrait of himself," (Leopold 1939).

The lawn as cultural marker is not exclusive to any particular demographic in the United States. Paul Robbins, author of *Lawn People*, demonstrated that lawns are not exclusive to a certain geography, class, age, or education level in the US. The lawn is in fact a cultural "vehicle" for indicating family and community values. Converse to general views of the educated populace, Robbins then demonstrates that people who are more knowledgeable

about the damaging effects of fertilizers are more likely to use fertilizers on their lawns, indicating a conscious decision to trade cultural approval for environmental health (Robbins 2007). Nassauer also demonstrated that citizens who may care about ecological quality and health are willing sacrifice ecological health for a "culturally proper appearance" of their own landscape (1995).
Nassauer found that ecological function must be actively represented for human experience if humans are to maintain ecological quality. A concise summary of her views, and indeed a central theoretical tenet of this thesis, is as follows:

"How we show we are good citizens and good neighbors by the way we care for the landscape and make it look neat or picturesque, safe or inviting, how we use the landscape to express power or wealth - these will establish the framework within which ecosystems are manipulated on a planet dominated by human beings. In an urban or countryside contexts, people tend to perceive landscapes that exhibit biodiversity as messy, weedy, and unkempt. A central problem in introducing greater biodiversity and heterogeneity to the urban landscape is that these characteristics tend to be mistaken for a lack of care." (Nassauer 1995).

The ordinariness of daily decisions make problems easy to overlook, even as they combine to create larger problems (Robbins 2007). This is, in essence, the problem of the lawn: small plots of private lawns cause slight damage, but multiplied at a national scale lawns are cause tremendous ecological damage, waste billions of dollars, and occupy some of the nation's most fertile land. However, lawns are problem that is solvable on a individual family-unit basis.

The lawn is a problem of perception and culture, rooted in a historical ignorance of the environment and classist symbols of wealth and prestige. Why do lawns exist in neighborhoods where residents struggle with food access? Why do lawns exist in cities that ration water? If planners, designers, and citizens are to the change the relationship of the lawn owner to their land and ecology, they must frame ecological quality within recognizable forms, for example: small urban farms and gardens.

Dig On For Victory

In times of crisis, Americans have performed a large-scale shifts towards domestic gardening. Both world wars saw the rise of "Victory Gardens" across the USA. Gardens were framed as civic and patriotic responsibilities (Smithsonian Institute 2007). Disruptions in the global and national supply chains created an immediate need for the local production of produce. Woodrow Wilson in WWI, and Franklin D. Roosevelt in WWII publicly spoke of the need for domestic, local gardens so that food could be cheaply sent to the troops abroad (Smithsonian Institute 2007). Some 18 million gardens appeared in the United States during WWII, 12 million of those in cities (Popular Mechanics 1943). Victory Gardens produced more food than traditional rural farming operations during WWII (Smithsonian Institute 2007). Regrettably, the vast majority of those gardens disappeared after the war's end. However, the brief existence and effectiveness of Victory Gardens demonstrates that large scale cultural shifts are possible when the American public is presented with crisis.

Given the enormity and severity of inevitable climatic changes, a real problem that has seemingly been ignored for socio-political reasons, it remains to be seen if gardens will again be adopted as a solution to crisis. For gardens to overtake lawns as a cultural symbol of moral value, as they did in WWII, changes to the presentation of farms and gardens will also be required. Farms and gardens need to be presented in a manner suggestive of prestige, wealth, intentionality and patriotism for it to be recognized as a moral or prestige symbol (Nassauer 1995; Nassaur, Wang & Dyrell 2009). First Lady Michelle Obama planted an organic garden on the White House lawn in an effort to make gardening more visible to the American Public. This is the first time a garden has existed at the White House since WWII (The WHO Farm). Robbin's evidence that lawns exist and represent similar social values across the United States, indiscriminate of demographics, suggests high-quality productive farms and gardens could be accepted in nearly any American community, if they demonstrate value and morality.

In addition to access to food, there are clear ecological benefits converting lawns to small farms. Small farms and productive gardens have been demonstrated to contain more species diversity, and both in terms of plant and animal richness than lawns (P Lindemann-Matthies, T Marty 2013; Nassauer 1995). Gardens, especially organic gardens, provide more food and habitat for species ranging from soil-based microbes, worms, and insects and small vertebrates. While generally insects are thought of as pests they provide valuable services in

Left: Fig. 18: *Dig on For Victory.* WWII era domestic propaganda poster
Center:Fig. 19: *Our Food is Fighting.* Gardens as patrotic duty
Right: Fig. 20: *War Gardens for Victory.* The cause needs your vegatables

pollination, and as food for more visible and appreciated species like birds. Organic farms also use less fertilizer than yards, which at scale would reduce pollution levels and affect local watershed quality (Pollan 2007). Yards demonstrating orderly ecological quality were found to be more aesthetically pleasing and prefered than lawns (Nassaur, Wang & Dyrell 2009). Small farms can offer an ecologically beneficial space that fits within the socially and culturally acceptable standards for public-private space currently occupied by the lawn. Small farms are ready to replace the lawn as a signifier of moral and social values in the United States.

Urban Agriculture

Considering climate change, globalized economics, health, and urban form and ecology--as well as cultural values and expectations--the value of urban agriculture is central to this thesis. For the first time since the Garden City movement, architects and designers are reconsidering the implications and promise of food production as a factor in the development of the built environment (Gorgolewski et al 2011). Warehouses, grocery stores, restaurants, markets, pea-patches and park spaces are all pieces of the urban fabric that must be rethought as the food system changes.

American urban agriculture's modern roots are in the community garden. Community gardens, as they exist today, are distinct from the Victory Gardens of the world wars. Although urban gardening exists in a multitude of phases, local movements, and implementation strategies, most find their origins in the ecological and local activism of the 1960s (Lawson 2005). Many community gardens exist on public property, and have struggled with long term funding, privatization of sites, and political barriers (Lawson 2005). Despite the challenges their challenges, community gardens demonstrated tangible community building benefits, including decreased obesity for participants (Davis et al. 2011), and decreased incidences of

Fig. 21: *Danny Woo Community Gardens.* Seattle, WA

vandalism in the adjacent community. It should be noted that a decrease in crime is a correlation of community gardens rather than proved causation, however residents feel safer when adjacent to greened lots (Branas 2011). Community gardens have consistently emerged during times of crisis, both social and economic, and are typically deployed as a strategy for improving urban conditions (Lawson 2005).

Thus far, designed urban agriculture, as an attempt to address the changing food system, often occurs on the rooftops of existing buildings or at the intersection of hydroponic technology. For example, Whole Foods has experimented with hydroponic facilities on top of its grocery stores as a way of integrating production, storage and point of sale into a single building. Design features like farmable green walls or roofs, greenhouses on roofs and inside of facades, spread awareness and do provide good food, but do not represent an accessible (in terms both of education and finances) option to most people. This thesis argues that in-ground agriculture is the most accessible form of urban agriculture.

Fig. 22: *Gotham Greens.* New York, NY

Lessons From Cuba

In-ground agriculture represents the majority of urban agriculture in many underdeveloped countries and cities, and still represents a significant and vital piece of the food system for their people. For example, Cuba was forced to fundamentally alter its food system almost overnight, from imported industrial to local production As the result of complex geo-political relationships, the collapse of the Soviet Union left Cuba without 57% of its food, and forced the small island nation to be responsible for its own food production (Clouse 2014). Without choice, the people of Cuba were forced into a post-oil economy, and started to grow their own food. Without the possibility of fertilizer, Cuban urban agriculture adapted to the implementation of organic and permaculture principles as a means for pest control and nutrition (Clouse 2014). Cuba is now the recognized leader in urban agriculture (Koont 2011). A compelling case study, Cuba's agricultural history exemplifies that structural changes are possible, particularly if the adapting communities are offered support.

The Cuban government responded to the food crisis by forming the Urban Agriculture Department, which took several key steps. First, the Department changed the law, effectively making it free and legal to farm on

Fig. 23: *Raised beds in Cuba.*

unused, public land. A government trained and supported network of community members was then established to monitor and educate urban farms in their respective neighborhoods. The Cuban state also introduced built interventions in the form of "seed houses," which provide resources and education on a neighborhood level, as well direct-sale markets to make urban agriculture financially viable (Clouse 2014). Since the collapse of the Soviet Union, urban agriculture has helped to increase the average caloric intake of a Cuban citizen, as well as provide employment for a significant 7% of the urban population (Koont 2011). Cuba demonstrated that policy and infrastructural support is a sound and reasonable strategy for building a urban agricultural network.

Of course, the economic model of Cuba is fundamentally different than that of the United States, as was the scale and immediacy of the food crisis. While Cuba's crisis was undebatable and politically expedited, the U.S. food crisis is tied to the crisis of climate change and the insidious disconnect between humans and their land. A major hurdle in the United States is convincing some Americans there is a climate (and by extension a food crisis) at all. However, the success of Cuban urban farming demonstrates that urban agriculture is a viable model for increasing the quality and amount of food available to a local population (Viljoen 2009). In fact, Viljoen, a noted urban agricultural academic working out of the UK, found that a Cuban model for urban agriculture would be successful in a British context, which compares much more readily to the American economy. The multi-layered Cuban strategy of using unutilized urban space as agricultural land provides a model for taking advantage of swatches of fallow urban land; in America, this is the lawn. This thesis borrows from Cuba's example of restructuring its food system--from largely industrial to small-scale urban agriculture production--and reimagines it in the American context.

Fig. 24: *Urban farm in Havana.*

SPIN Farms

Food production is a designed system that has been established over a millenia and is regulated by climatic concerns: sunlight, weather and soil quality, as well as economic concerns like marketing, distribution, consumption patterns, and trends. Farming is not new, and in-ground agriculture does not see significant innovation regularly. However, SPIN farming (Small Plot INtensive), combines existing knowledge and commonly used techniques to act as a new and successful model for small farms. SPIN farming depends on quick turnaround high value crops, many of which are not necessarily staple crops. SPIN farming also makes use of relay planting techniques, meaning the second crop is planted while the first is still growing; one is harvested while the other grows, and both crops tend to benefit from increased microfauna and better root habitat (Borghi 2011). Different soils cater to specific crop combinations, and as farmers gain experience they tend to specialize in specific crops. In fact, a network of SPIN farmers is needed for a diverse harvest, which further reinforces its collaborative and communal value.

SPIN farming is the ideal method of farming proposed in this thesis because of the low barrier to entry, substantial gains for community members, and use

Fig. 25: *SPIN Farm.* Saskatoon, CA

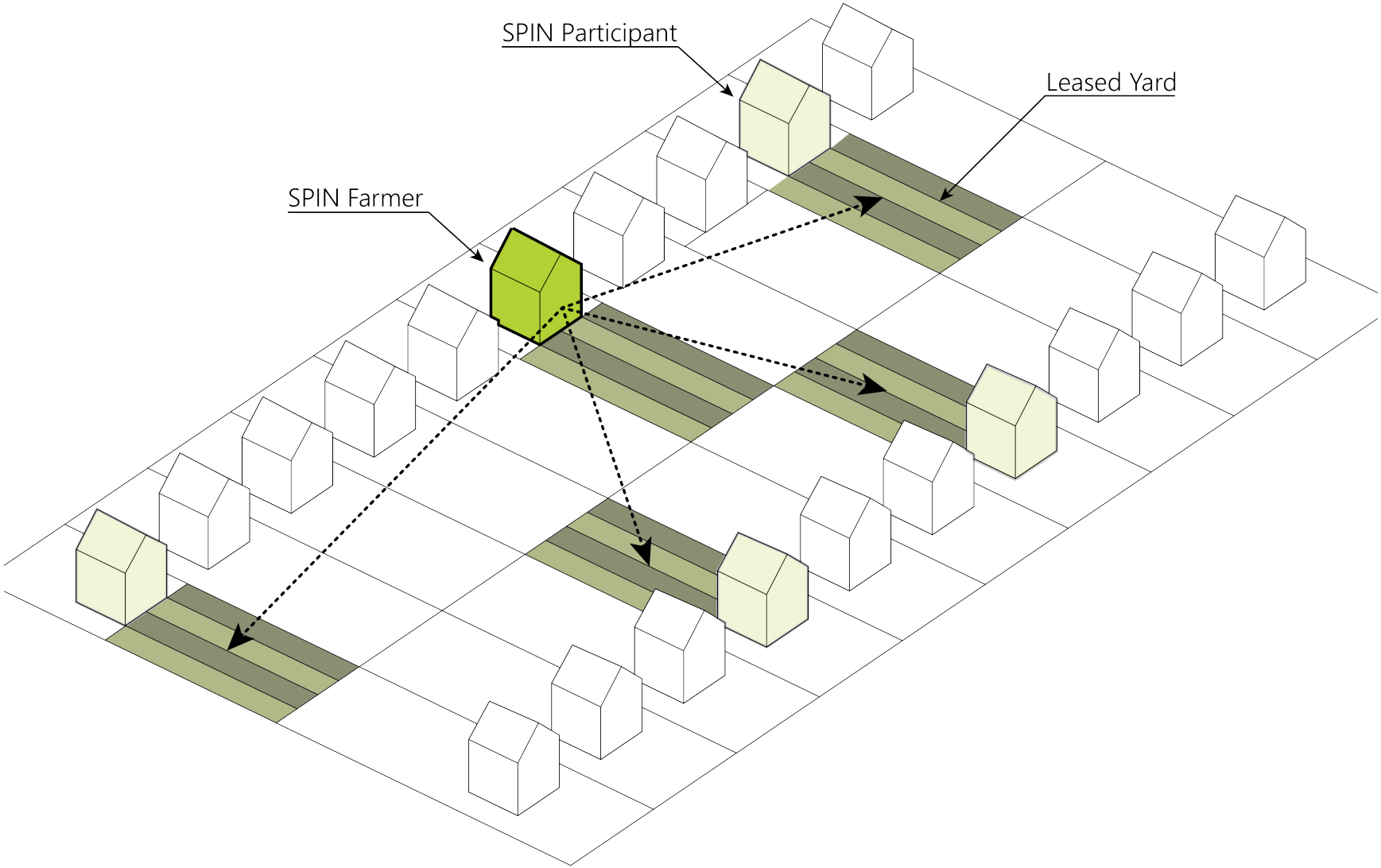


Fig. 26: *SPIN Farm Network Diagram*

of neighborhood lawns. SPIN farmers have commonly claimed revenue of $40,000 working on just a 2,000 sq ft plot--a smaller than average lawn in Tacoma (Borghi 2011, R. Christensen & W. Satzewich 2011). SPIN farmers have found success across Canada - a country with a generally more challenging growth system than the United States. Produce is often sold to groups who depend on high volume of single ingredients, typically restaurants and schools. SPIN farmers must network with individual buyers and typically handle delivery themselves, which can be a significant time commitment. The SPIN system leverages what already exists, city water instead of expensive irrigation systems, and yards instead of purchased farm land. Urban farms also have the unique advantage of existing without the burden of large-scale insect infestations or pests like deer and rabbits, which exist in far greater numbers outside of the city. Typically, a farmer will start with their own yard, and then reach lease agreements with neighbors to farm their yards; a single SPIN farm operation could be farming several acres worth of land spread across a neighborhood (R. Christensen & W. Satzewich 2011). Lastly, SPIN farmers use hand or small machine tools, which cuts down on initial investment and yearly maintenance. SPIN farming is an accessible system, that does not depend on technology or capital investment.

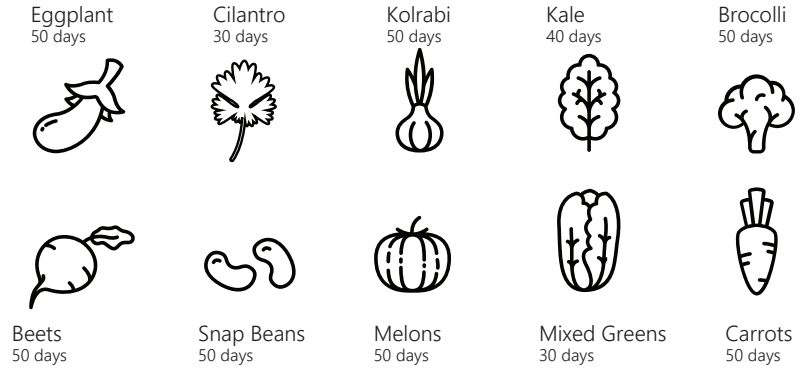


Fig. 27: *Example Crops.*

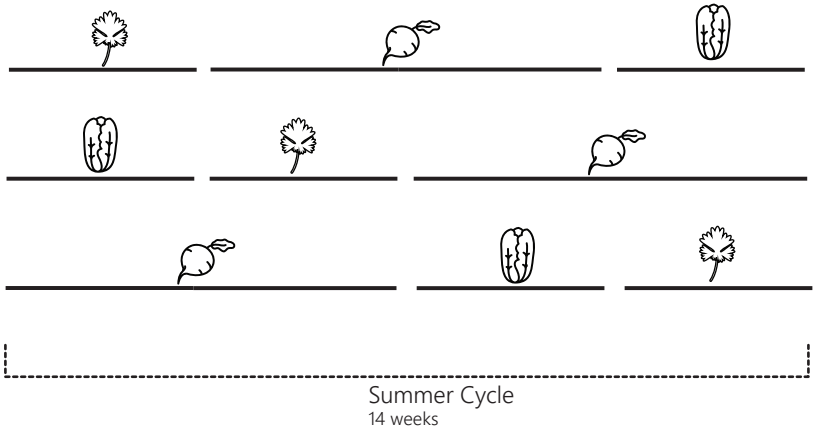


Fig. 28: *Seasonal Produce Cycle.*

Design Solution

The Network

In an attempt to address the crisis of climate change and its impact on the American food system (and indeed, the failure of the current food system), a pressing question surfaced: what is the architect's responsibility? And what role does architecture play in solving a problem that is, at its core, social and cultural? Thus, the initial focus of this thesis was to establish a network - a logical connection of architectural spaces and urban agriculture solutions - which could conceptually exist in any given American city. Indeed, most cities have lawns and social problems, often correlated to the accessibility (or lack thereof) to food.

As previously discussed, the global food system that most Americans depend on has had significant negative impacts on many local communities. Local food systems have not had the infrastructural support to exist as an independent option, which is why designing a network is the first step. In addition to drawing upon Cuba's example of urban agriculture, there is also the Food and Agriculture Organization of the United Nations, which has supported "city region food systems" as viable options to feed urbanized regions. A CRFS depends on a "complex network of actors, processes and relationships to do with food production, processing, marketing, and consumption." No CRFS exists in the United States, despite its significant potential for providing healthy food, localized economic opportunity, and environmental benefits (Food For the Cities 2009). This thesis proposal aims to build a urban food system that resembles a CRFS--in terms of institutionalized and built support--but which leverages the unique form of the American city, relying primarily on urban farms,

An urban food network must exist outside of the infrastructure set up to support the industrial food system. Typically, industrial aggregation happens on a farm by farm basis, before regional aggregation, shipping, further aggregation, and further shipping. With a difference in scale of production and "regionality", this networks aggregation must happen at regional points to keep the barrier to entry low. SPIN farming works directly with the network, because SPIN farming produces large amounts of specific crops, an individual farmer must depend other farmers to produce different crops to a) not encroach on market share of any specific crop and b) complete an consuming institution's nutritional needs. At the scale of the city, that means the neighborhood-scale aggregation. Neighborhood scale aggregation takes the form of Sheds, which are placed at key points in the urban fabric. Sheds also contain program key to the essential functions of an urban farm. After produce is aggregated at a Shed, it

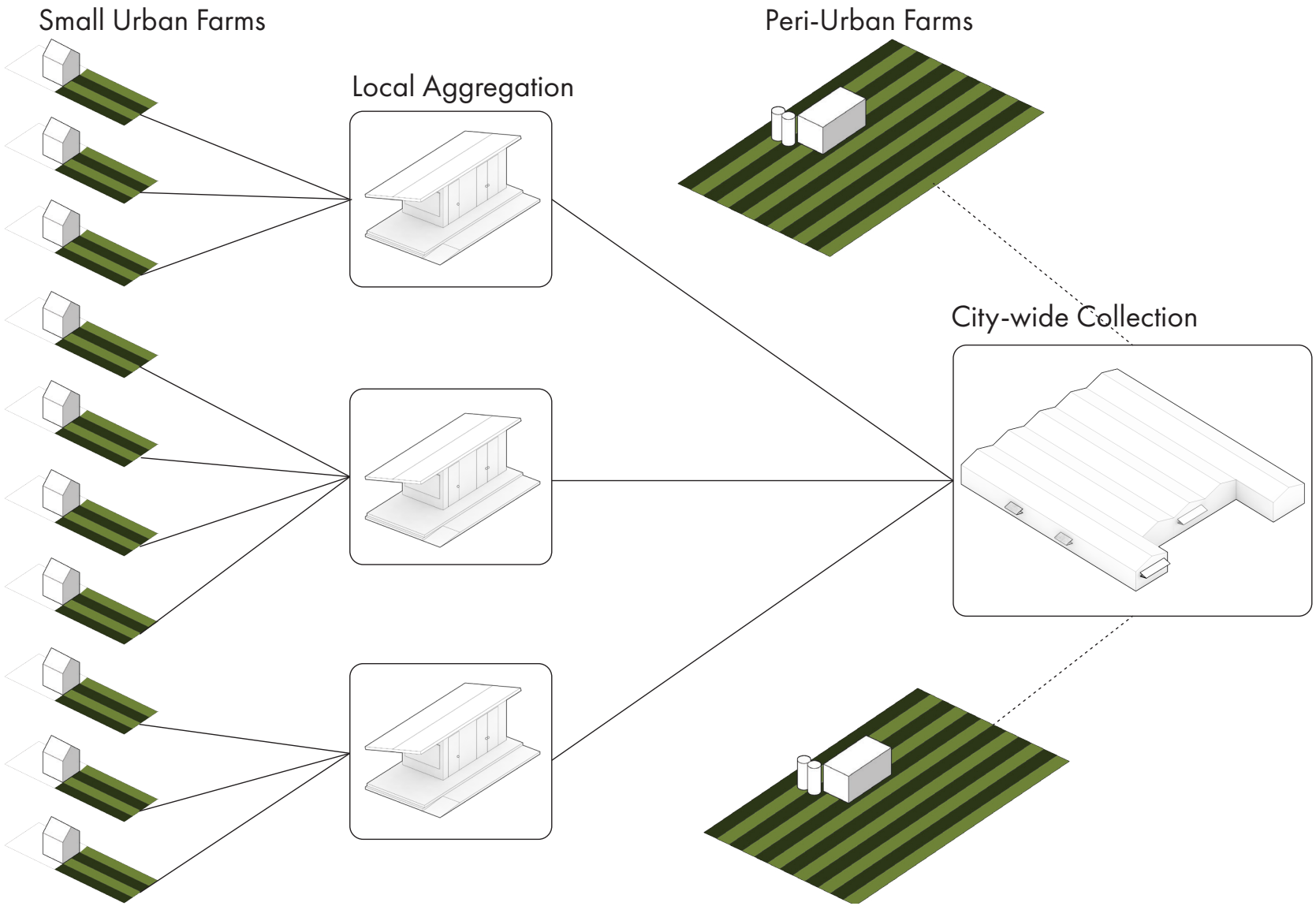


Fig. 29: *Network Diagram.*

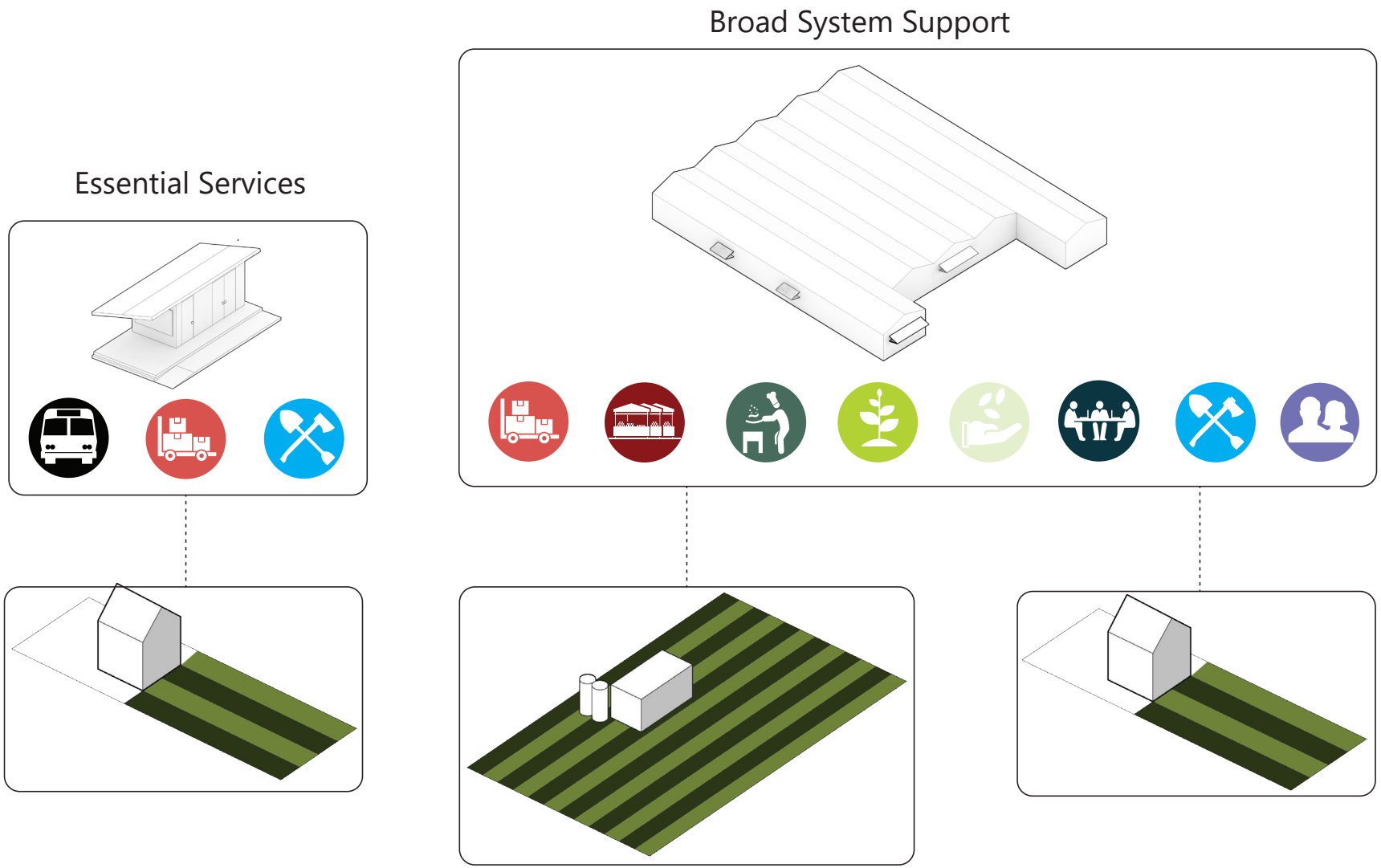


Fig. 30: *Program Diagram.* The Shed supports program immediately essential to the day-to-day of a farmer: access, aggregation and storage, and eqiupment. The hub provides access to key pieces of the food system including preparation, marketing, and point of sale.

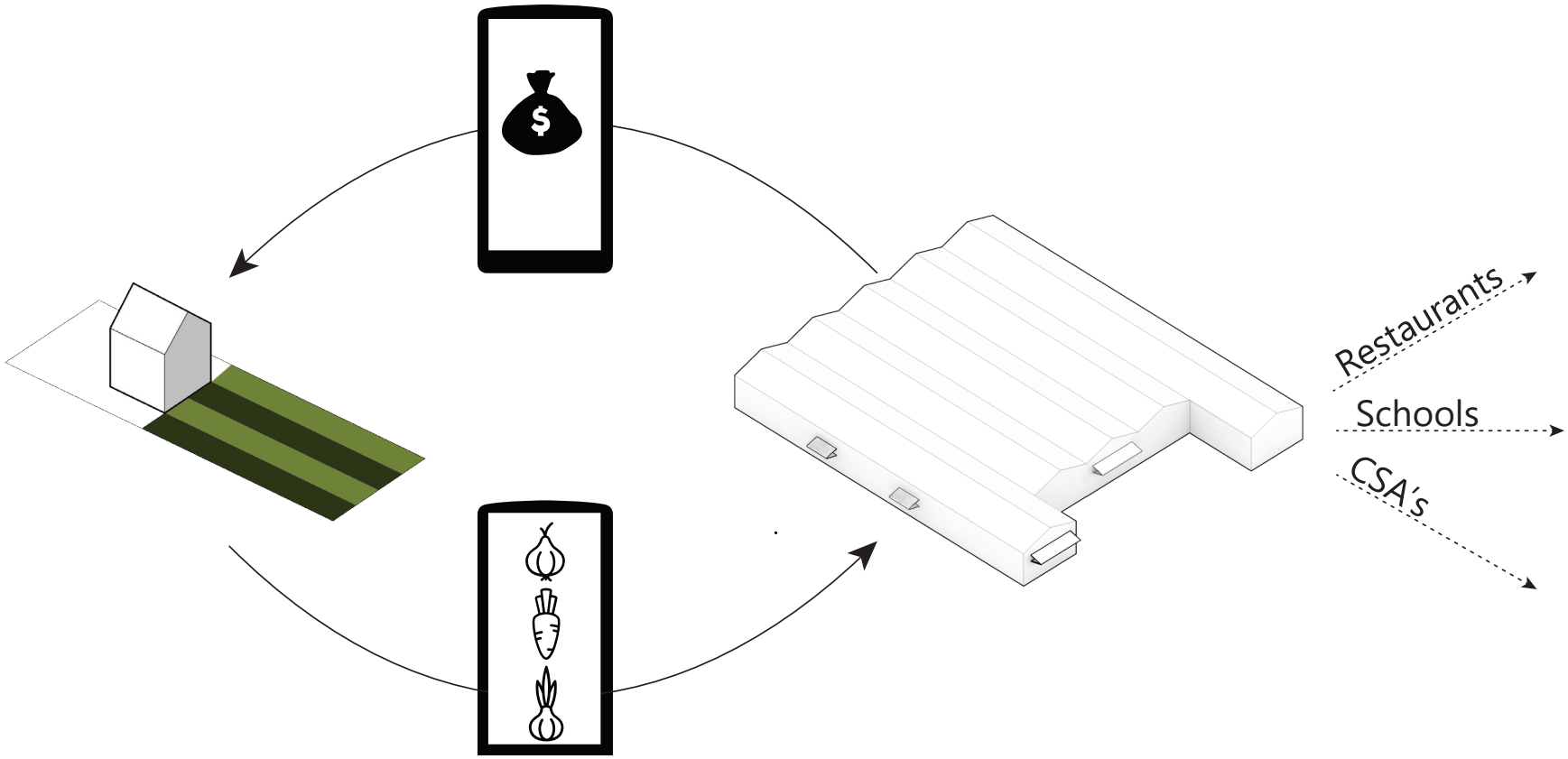


Fig. 31: *Farm-Hub Interface.* Farmers notify the hub when they drop of produce at a shed. The hub evaluates the produce before paying the shed through mobile banking. Produce from multiple farms are aggregated before being distributed across the city.

is transported to the central hub. The central hub acts as the spoke to the network's wheel, providing support to individual Sheds, as well as paying and supporting individual farmers. Once food is aggregated, it is sold at either shipped out to city businesses and institutions or sold directly at market.

Food In Washington State

Washington State is fortunate to contain nutrient rich soil and an abundance of arable land. In 2007, the state produced 9.2 billion dollars of agricultural product; however farmers exported over 80 percent of that product out of state, well over $7 billion worth (USDA 2012). Washington is the second largest producer of vegetables and third largest of fruit nationally (USDA 2012). Despite the state's agricultural richness, local hunger remains a substantial issue, especially outside of the Seattle area (Northwest Harvest 2016). It seems that regional small-scale food production, along with farmer's markets and food hubs, have so far been ineffective and inadequate responses to food scarcity and security. This is especially true in less affluent neighborhoods, where additional problems like poor transit choices affect an individual's ability to even get to farmers markets, let alone afford local or organic produce which is generally available at premium prices.

One in seven Washingtonians struggle with food security, and even worse one in five children don't have consistent access to food. Washington ranks as the 23rd hungriest state. This issue is more prevalent in African American and Hispanic households (Northwest Harvest 2016). The 2010 Child Nutrition and WIC Reauthorization bill expired on September 30, 2015, which helped fund free and reduced-fare lunch as well as summer food programs for teens, and has not yet been renewed by Congress (Northwest Harvest 2016). Additionally, food stamps are not accepted everywhere food is sold, and have also seen cuts in recent years. Again, access to food is controlled far away from the individuals that struggle with the consequences of bureaucratic decisions. Food access in a state with a strong agricultural background should not be so difficult. Converting lawns to food would provide fresh, local food in lower-middle income communities otherwise without choice or access.

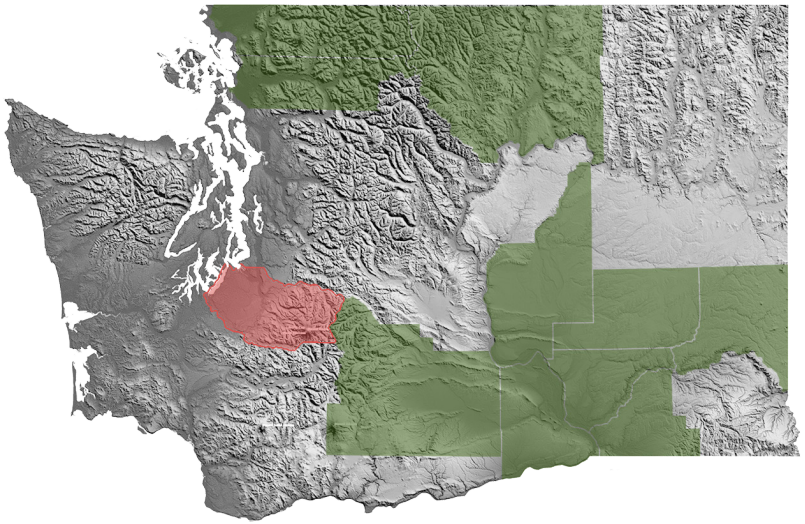


Fig. 32: *Washington State.* The state's ten most significant agricultural producers are highlighted in green, Pierce County, home of Tacoma is high lighted in Rred.

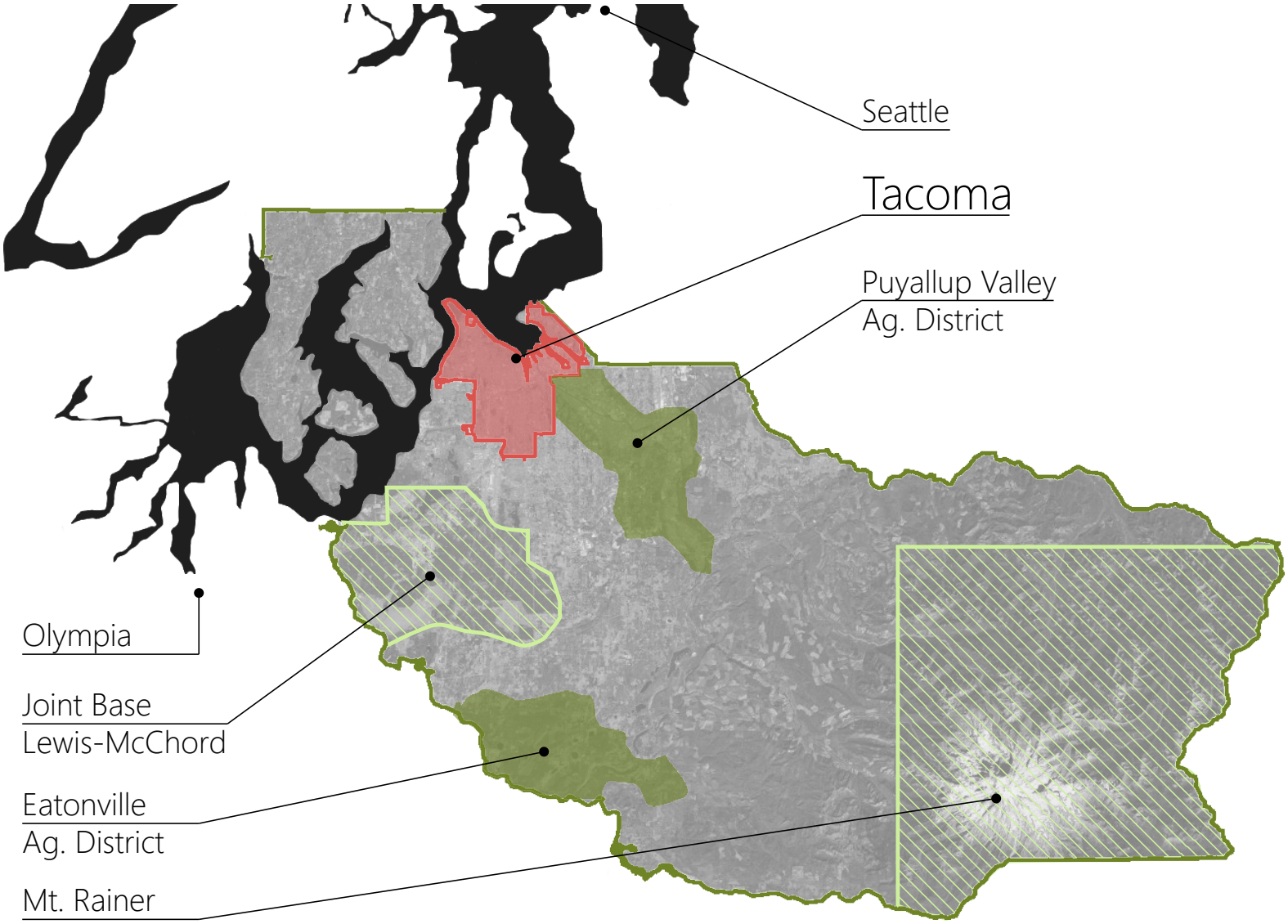


Fig. 33: *Pierce County.* Tacoma is highlighted in red, agricultural areas are highlighted in green. 25% of the Puyallup Valley Ag. District, adjacent to Tacoma, is slated for development. This will further exacerbate the shortage of local food available in the city.

Tacoma

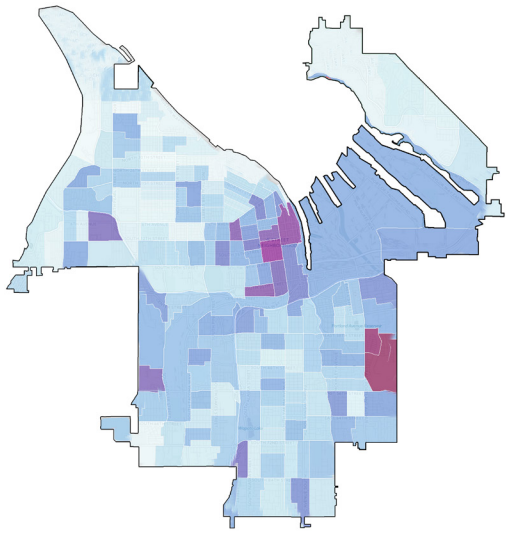
Tacoma, Washington, a mid-sized urban port city and county seat of Pierce County was chosen as the site of this thesis for several reasons: the city has a proclivity for lawns, arable soil, economic and food security issues, and an active political community. In truth, many American cities would have presented an interesting opportunity for this thesis, as almost all American cities have lawns and social problems. However, the nutrient rich soil and abundant supply of good water that have made Washington a successful agricultural contributor also make the region tenable for urban farms and gardens. Much of the southwestern United States were not considered for the reason that the water use was already too irresponsible. Tacoma lacks the prestige and wealth of its northern neighbor, Seattle. Space and housing are still available to less affluent residents within the Tacoma city core to. The city was developed largely from the 1890s to the 1950s, and the urban plan spawns large lots, small houses (by modern standards), and generous setbacks; there are an abundance of lawns in Tacoma's city core.

Initially a frontier boom town, Tacoma was the terminus of the Pacific Railroad and largest of the Puget Sound Cities. Surpassed in population and prosperity by Seattle in the late 1800s, Tacoma suffered a long and painful decline, due to suburbanization and movement of blue-collar jobs characteristic of the middle 20th century (Hilltop Subarea Plan). Crime and homelessness were endemic problems for the city for much of the late century, only fading in the late 1990s through a combination of grassroots activism and investment in education and arts. Today, downtown Tacoma is experiencing a revitalization, led by the University of Washington–Tacoma, and the successful establishment of a museum district.

Fig. 34: *Tacoma.* The port city sits in the shandow of Mt. Rainer.

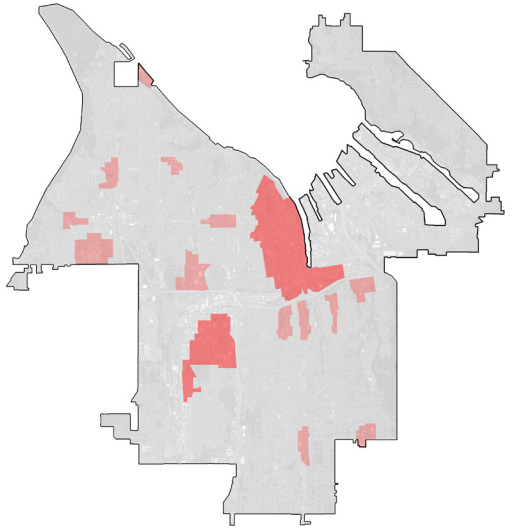
Demographically, a citizen of Tacoma is younger, poorer, and more racially diverse than the average Washingtonian. Conversely, residents have a higher cost of living than that of an average Washingtonian (Census 2015). Residents have limited access to fresh food, grocery stores and even restaurants. Additionally, citizens of Tacoma have higher than average levels obesity and diabetes (USDA FEA). Obesity and diabetes are commonly results of poor access to nutrition and education, and are often seen in higher numbers in minority communities for that reason.

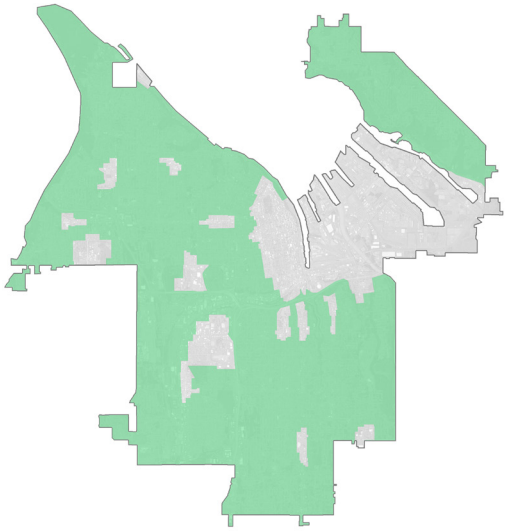
Under the Washington State Growth Management Act (WSGMA), established in 1991 and updated in 2010, Tacoma is expected to add 125,000 residents to its urban core by 2040 (WSGMA). However, much of that growth is concentrated in urban village concentrations, and the vast majority of the city will remain single family housing, with ample growable land. The WSGMA takes a progressive stance on urbanization, expecting cities to densify rather than expand into environmentally and economically critical areas, protecting the state's forests and farmlands. As the WSGMA applies to this thesis, the need for better strategies regarding urban land use is clear. The addition of 125,000 residents to a city of 200,000 (Census 2010) is significant, especially given the inequality and food security issues already present in the community.



Above: Fig. 35: *Poverty Rate.* Brighter colors indicate higher rates of poverty.

Below: Fig. 36: *Urban Villages.* Brighter colors indicate density of planned development





Above: Fig. 37: *Single Family Housing.* Green indicates zoned single family

Below: Fig. 38: *Food Access: Large* blue dots indicate grocery stores, small blue dots indicate marts and convenience stores

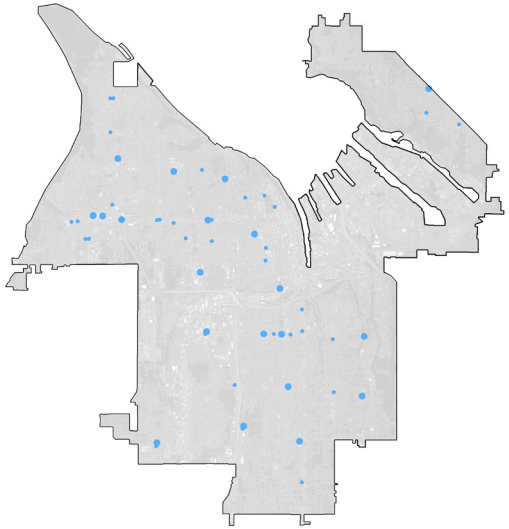


Fig. 39: *North Tacoma.*

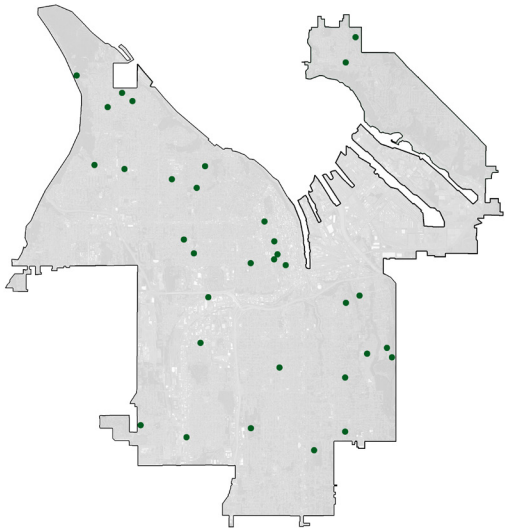
Fig. 40: *Hilltop.*

Fig. 41: *Central Tacoma.*

Fig. 42: *East Tacoma.*

The city of Tacoma boasts more community gardens per capita than any other city in the state. 33 gardens exist in Tacoma, and 70 exist across the county. This indicates a strong desire to grow and farm produce. Community gardeners have also been active in the community, in 2014 Harvest Pierce County donated 120,000 pounds of local produce to those in need, using an all volunteer force of gardeners (Harvest Pierce County). The municple and county governments have played a role fostering the development of urban agriculture with fruit tree gleaning programs, the establishment of a food forest, and wide support for community gardens. The active and involved community of urban gardeners is an important asset for the city.

Hilltop, a generally poor neighborhood, and site of the central built component of this thesis, has a network of seven urban farms (Hilltop Urban Gardens), with a nine more farms planned through support with the city of Tacoma. Hilltop Urban Gardens (HUG) functions as a non-profit and opperates within a framework of social equity, and commonly trades produce for work. Additionally, their farms opperate mainly in private yards through lease aggrements with the yard owners. HUG demonstrates that Tacoma residents are ready and willing to turn lawns into farms

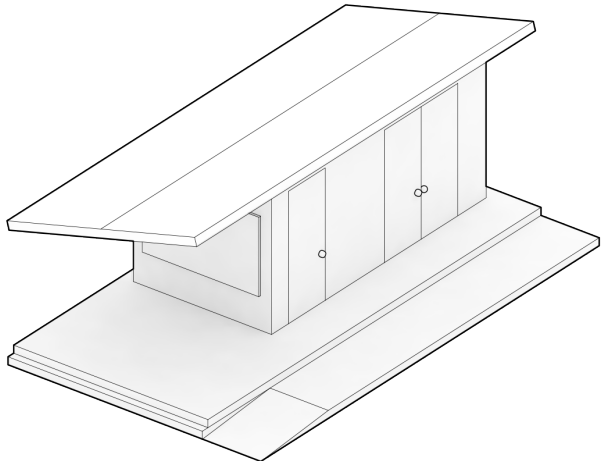


Above: Fig. 43: *Community Garden.* Green dots indicate location of community garden

Below: Fig. 44: *Hilltop Urban Gardens.*

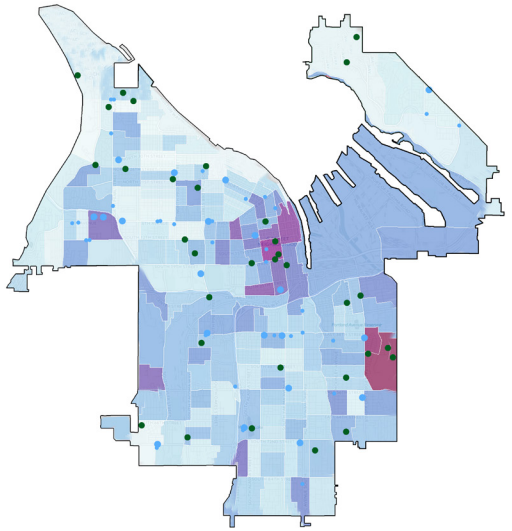
The Shed

Limited access to food, higher rates of poverty, combined with the existence of community gardens and bus routes, form the basis for the placement of the first piece of thesis intervention, neighborhood scaled sheds. Sheds act as bus stops, food aggregation points, and small tool libraries, providing farmers with three essential pieces to kick start successful farms: access, markets, and equipment. Placement adjacent to community gardens insures that the sheds are visible, and in secure locations with high community value. Placement on bus lines works to maximize the amount of potential farmers by removing potential barriers like tool and crop movement.



Above: Fig. 45: *The Shed.*

Below: Fig. 46: *Overlay Map.* Commercial Grocers (blue dots), Community gardens (green dots) and rates of poverty (brighter colors) inform the placement of Sheds across Tacoma, seen below (Fig. 1: *Network Interventions*)



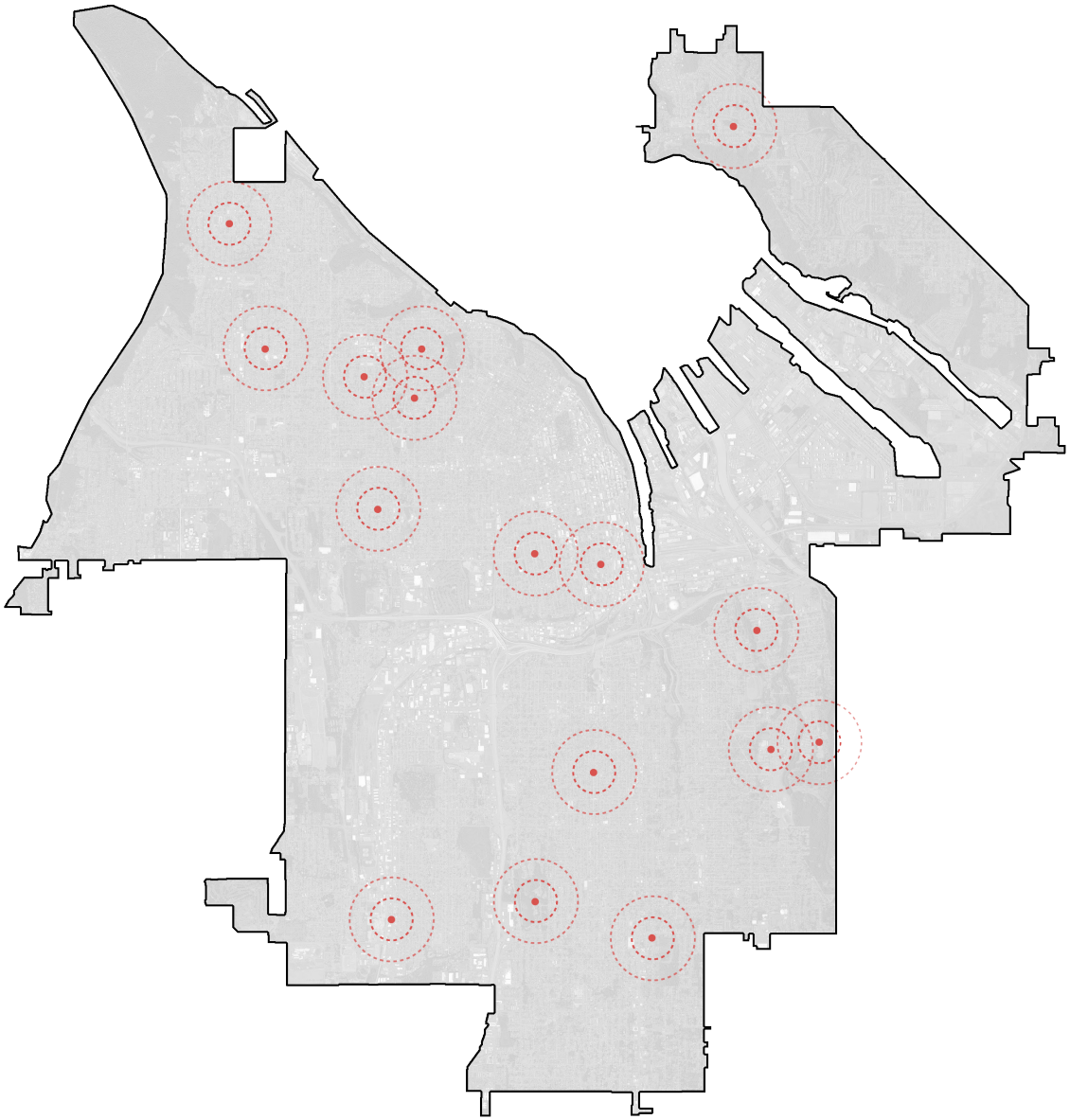


Fig. 47: *Intervention.* Red dots indicate individual neighborhood interventions, sheds. Circles indicate walkable radius, the closer circle at 400 metters, and the larger at 800 meters.

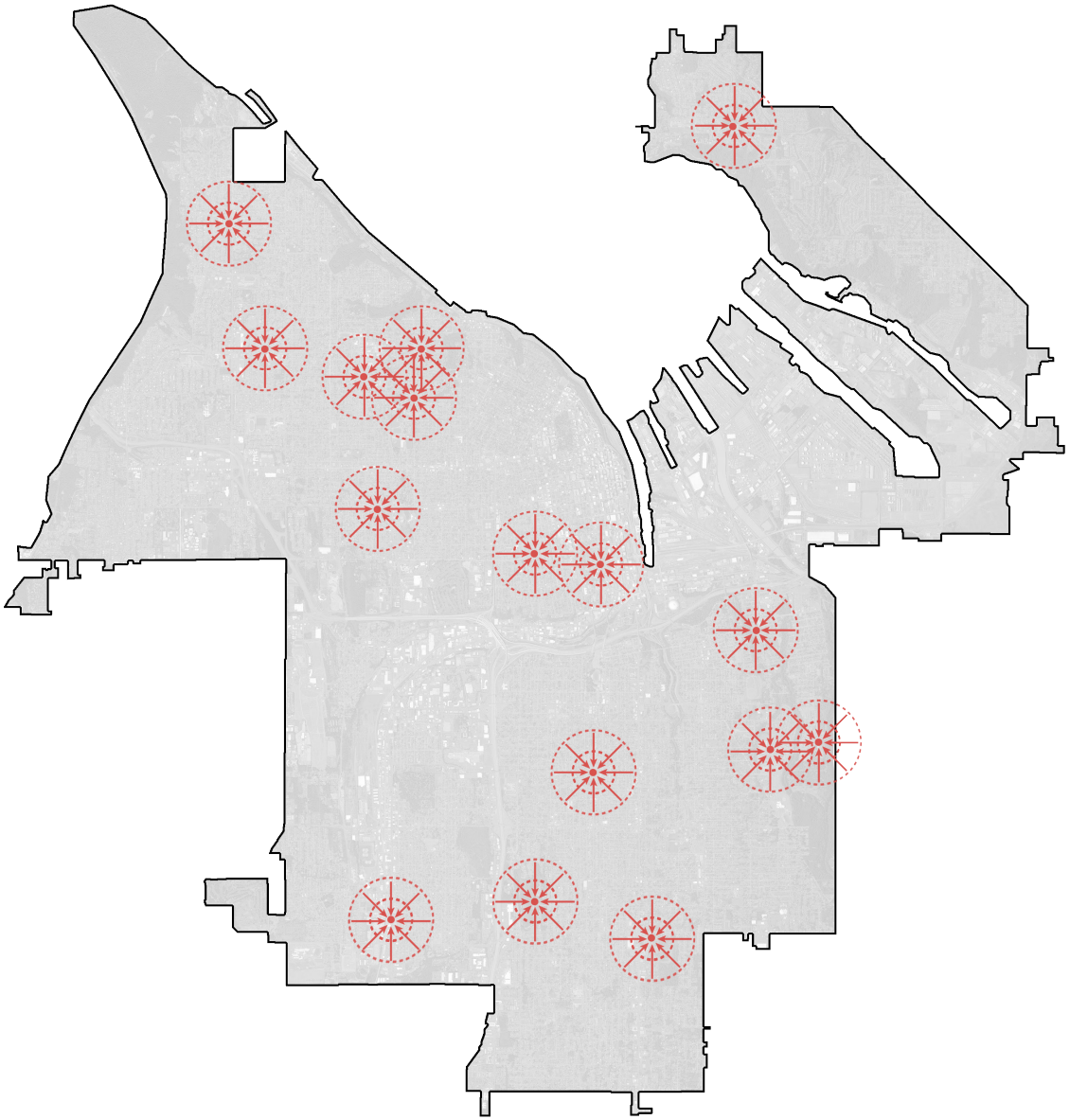


Fig. 48: *Aggregation.* Interventions spur development of urban farming in a neighborhood. Once farmers harvest, they drop their produce off at sheds.

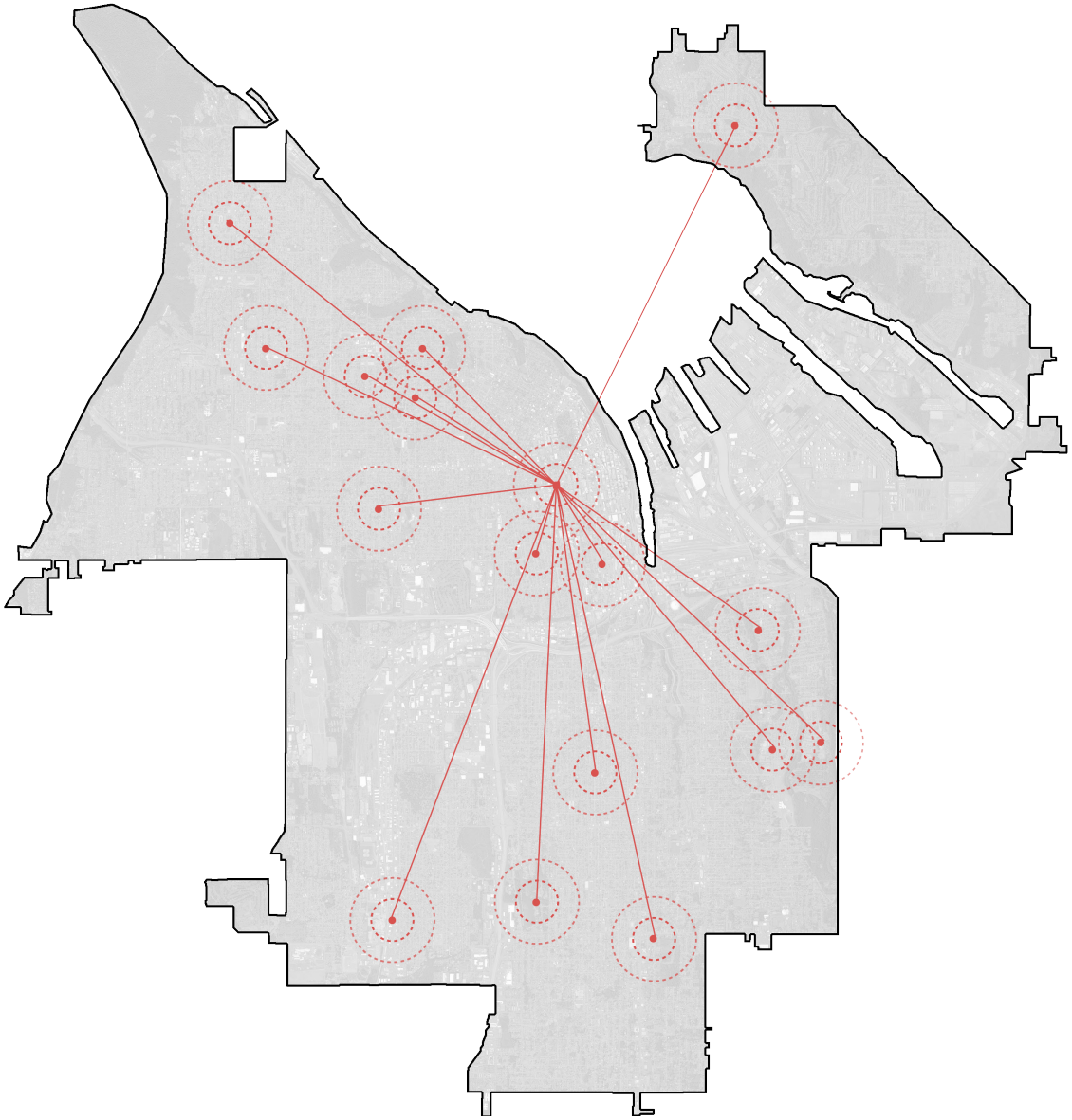


Fig. 49: *Collection.* Afte initial neighborhood aggregation, .

Fig. 50: *Experiential Perspective - Summer.* As the garden grows, the community takes ownership of the shed, using the information board as they see fit and painting the shed to better reflect their locality

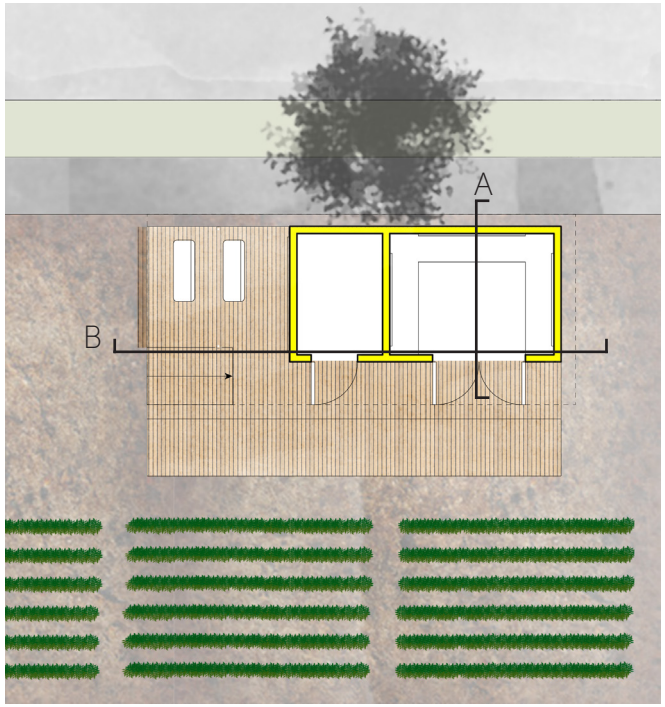
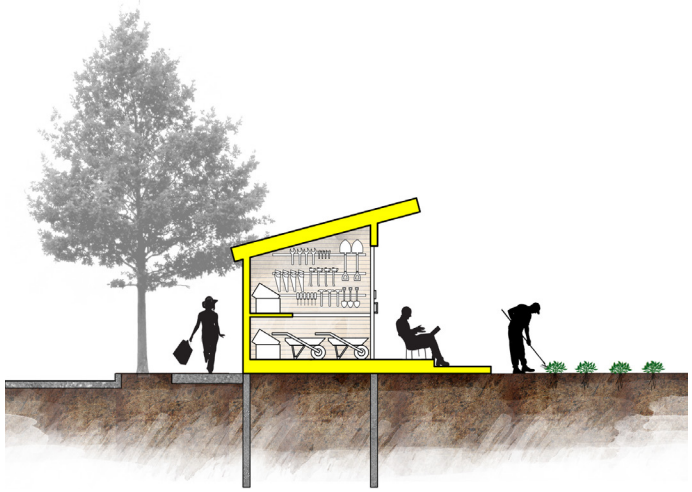


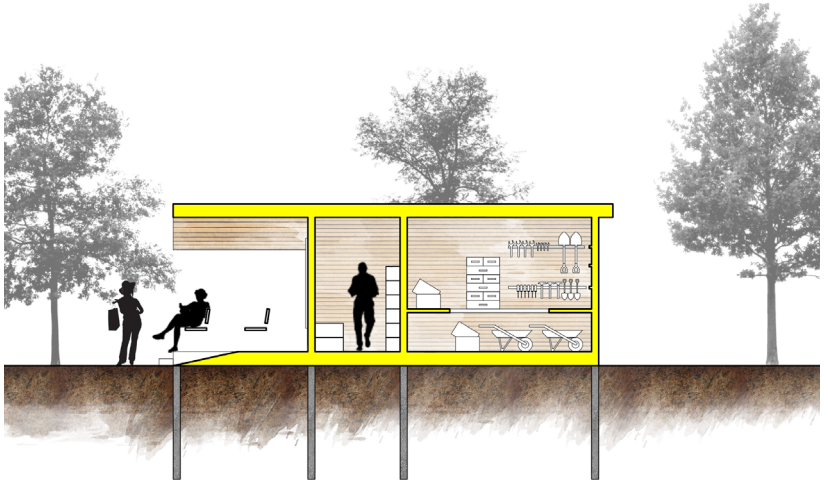
Fig. 51: *Shed Plan.* Sheds measure 10' x 20' and sit on platforms that measure 17' x 30'. Food aggregation measures 10' x 7', while the tool librirary measures 10' x 13'.

The Shed is constructed primarily out of pre-milled CLT panels. This allows for flexible arrangement based on site orientation. CLT allows for a significant roof calteliever, which is used to cover the bus stop. Platforms act as a porch for gardeners, while also being used to tie the shed to concrete piles. The use of piles instead of a foundation has a lighter environment impact and allows the shed to be deconstructed and moved with relative ease.



Above: Fig. 52: *Shed Section A.*

Below: Fig. 53: *Shed Section B.*



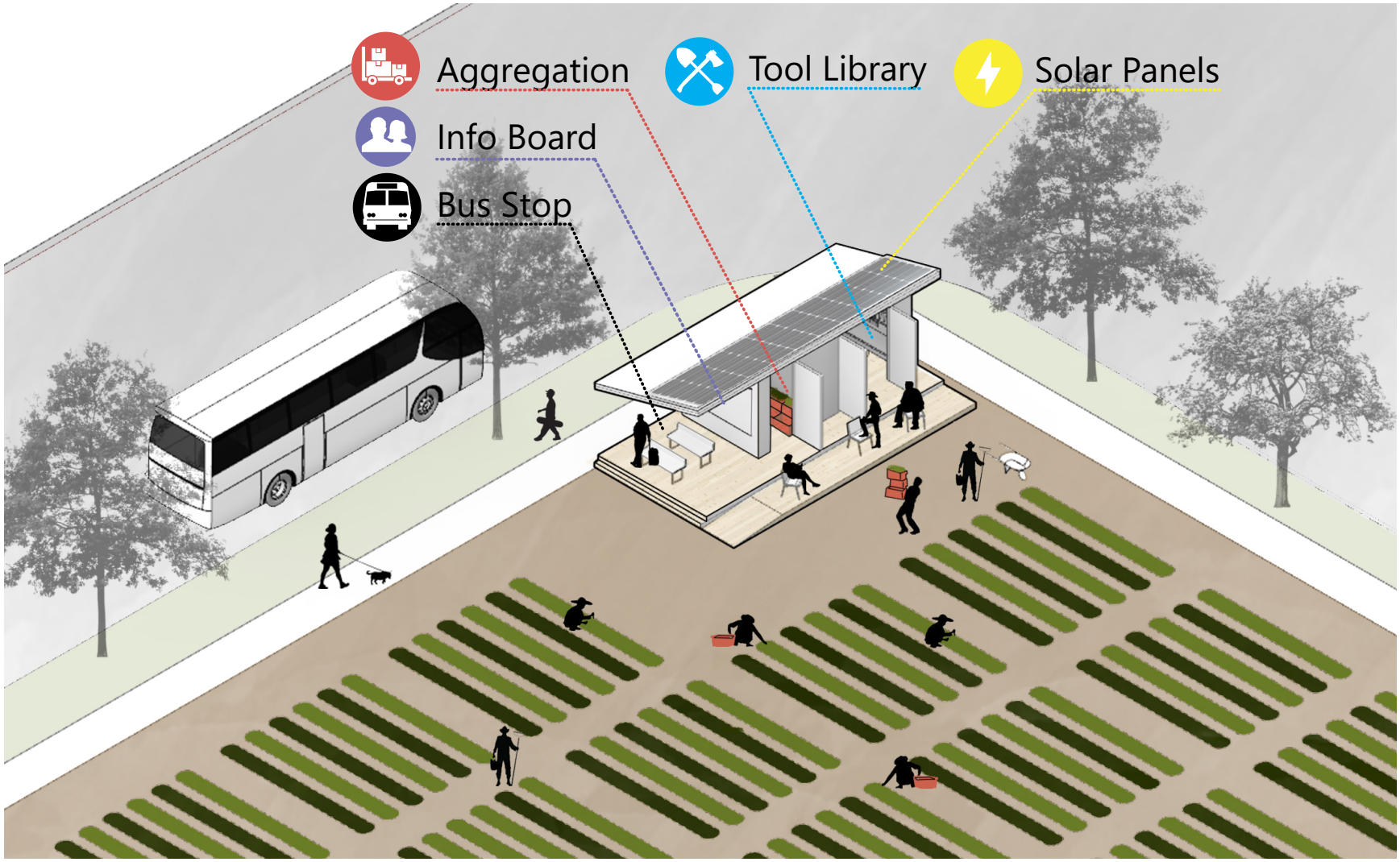


Fig. 54: *Shed Programmatic Diagram.* The shed sits in the community garden, providing access to tools, produce distribution systems, bus lines, and a neighborhood information board

Fig. 55: The Shed is inserted at a real locatation in Central Tacoma, on a bus line and existing community garden. Circled in red, the Shed immediately has a presence as a neighborhood amenity

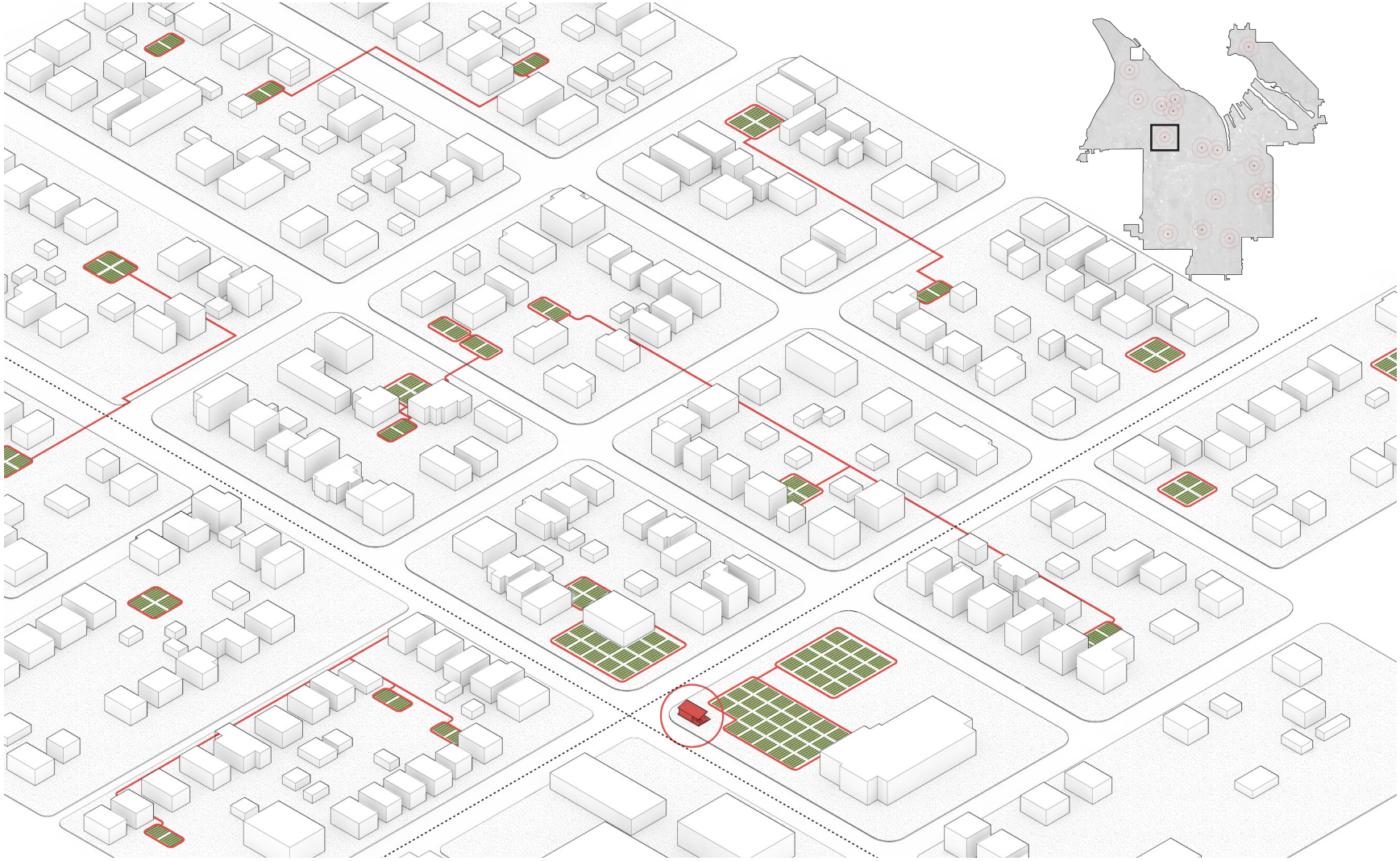


Fig. 56: Several years after the insertion of Sheds, farms have spread throughout the neighborhood. Red lines represent connections between farmers and their leased small farms, existing where lawns once did.

The Hub

The central hub represents the primary component of this thesis's architecture. The hub is the physical and administrative center of the network, the gathering point for food and the network in the city. Sheds are only neighborhood support and aggregators, and require the central hub for tool and food delivery and pickup.

This design is a response to the specific site in Hilltop, Tacoma. As the network is applied to different cities, the hub could be scaled smaller or larger depending on context. The hub as it is represented here, is sized for the programmatic needs of Tacoma.

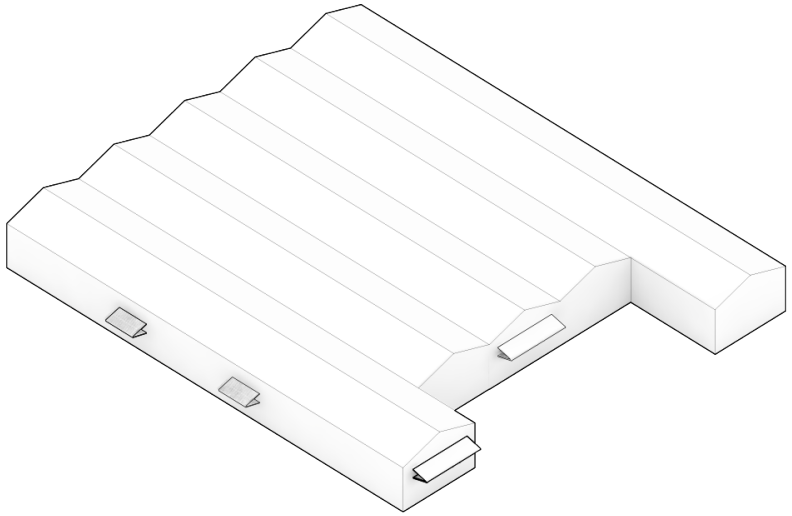


Fig. 57: *The Hub.*

Fig. 58: *Hub Section Perspective.*

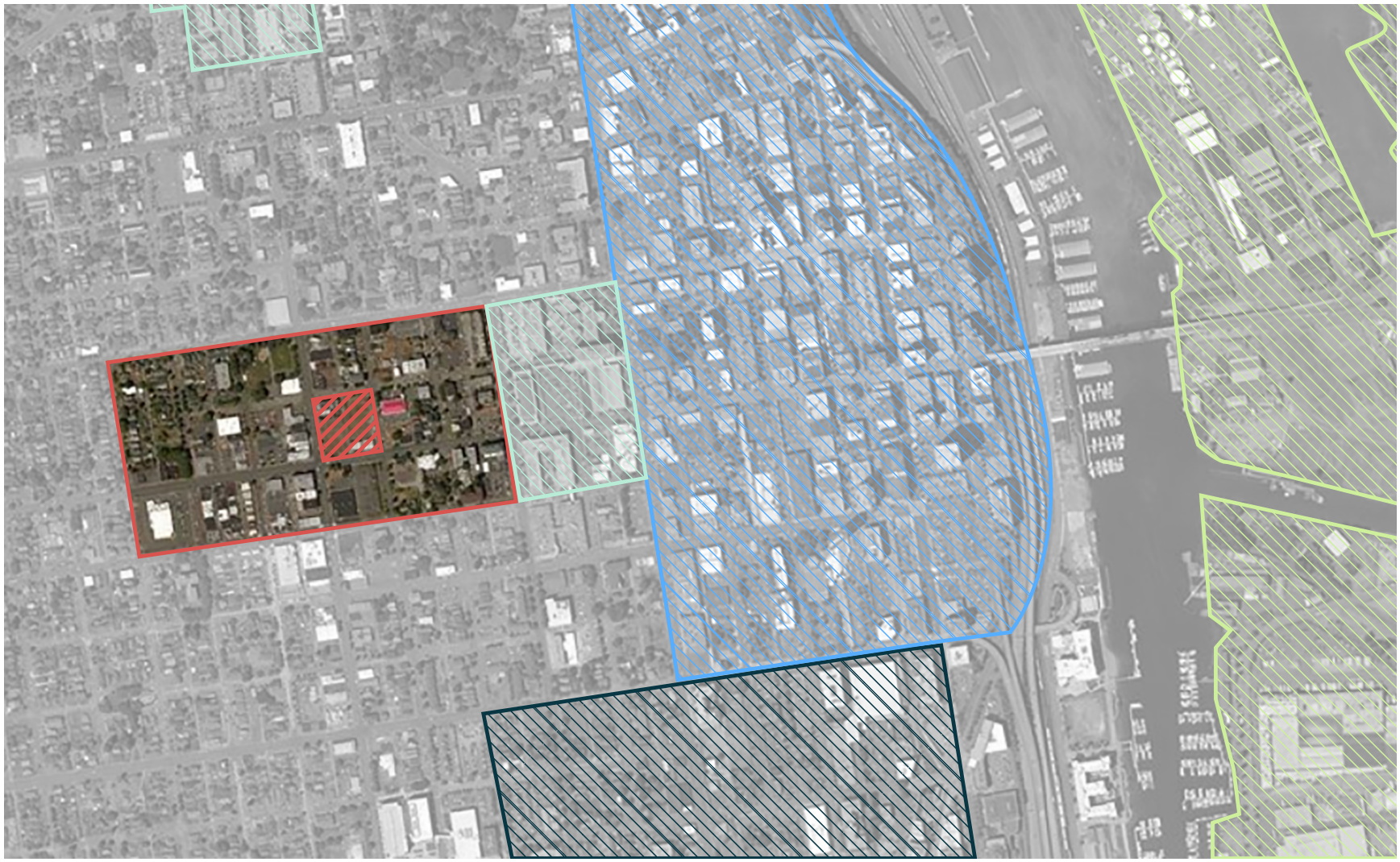
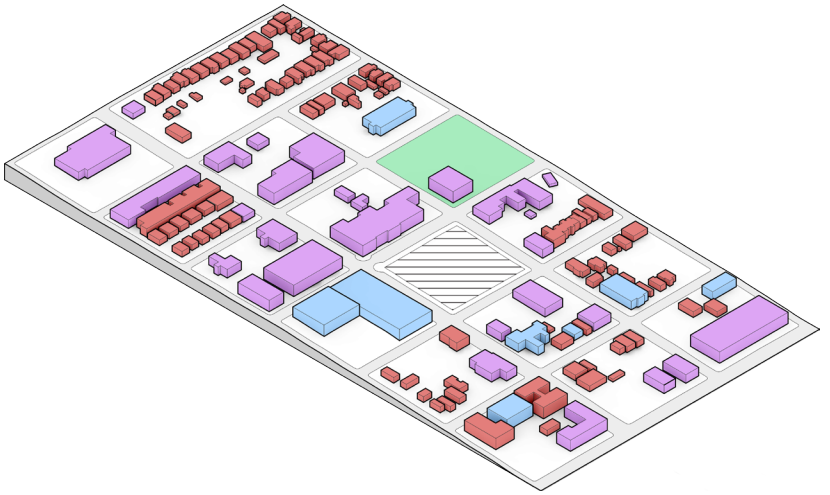


Fig. 59: *Neighborhood Context.* The site, in red hatch is immediately adjacent to several promenent Tacoma institutions. Hospitals are marked in light green, the port of Tacoma in electric green. University of Washington-Tacoma is dark blue, while the commercial core of Tacoma is designated in royal blue. Central location ensures the hub will have a consistent consumer base and promenent visibility.

Hilltop Site

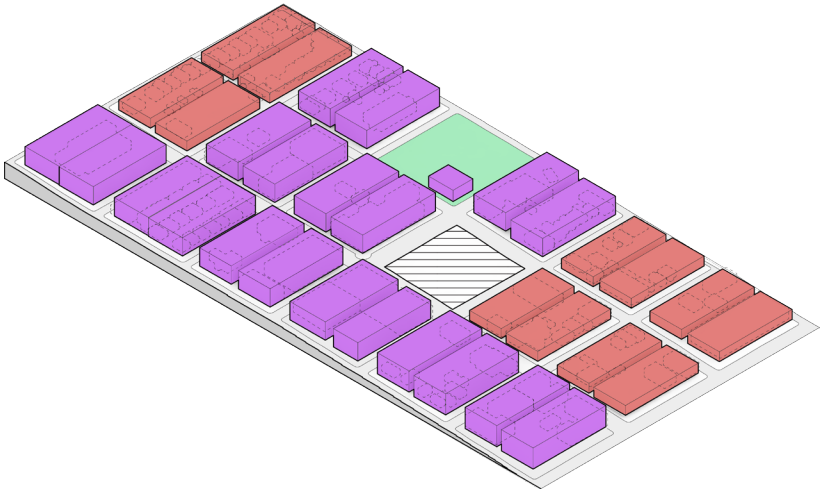
The site is currently a derelict lot in the Hilltop neighborhood of Tacoma. The site was chosen in accordance with the HIlltop Area Plan, and design exists within the planning framework established by the city of Tacoma. Specific value is placed by the plan on preserving the historic residential and commercial character of the Hilltop neighborhood. Empty lots should be the first to be developed, as they inevetiably will, while more historic structures will be retained.

The negative qualities associated with Tacoma: bad schools, food insecurity, nutritional health, poverty and unemployment are magnified in the urban core neighborhood of Hilltop. Hilltop is the former crime epicenter in the city, and until recently, was characterized by abandoned houses and empty commercial buildings. In the 1970s, the mayor of Tacoma referred to Hilltop as "Downtown Beirut," in a reference to the then ongoing civil war in Lebanon (Tacoma Sun 2013). Hilltop has traditionally been the poorest and most racially diverse neighborhood in Tacoma. The neighborhood's struggles are well documented.



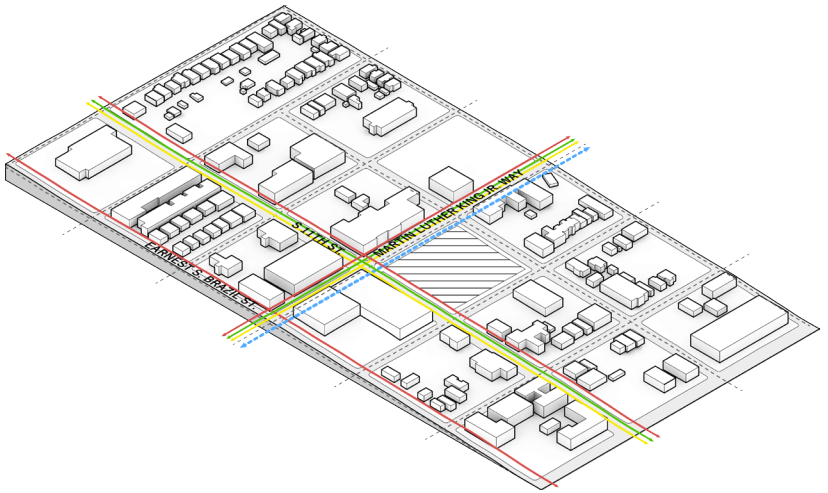
Above Fig. 60: *Site Context.* The site is hatched. Residential use is highlighted in red, commercial in purple, and institutional in blue.

Below Fig. 61: *Potential upzoning.* The site is hatched. Rezoned envelopes are shown. Purple indicates upzoning to seventy five feet, red indicates upzoning to thirty five feet mixed use.



The site sits in between Martin Luther King way and S 11th St. The site was chosen for multiple reasons including accessibility. The site lies adjacent to a proposed light rail station, and two bus lines, enabling service across the Tacoma metro area. The Tacoma walking tour also passes the site, as do two recently added bike routes. Additionally, the site is adjacent to downtown Tacoma, the University of Washington- Tacoma, and MLK commercial corridor, ensuring the project will be visible and viable beyond Hilltop.

Hilltop, along with adjacent downtown Tacoma, is marked to absorb much of the growth in the city prescribed by the WSGMA (Hilltop Subarea Plan) (Figure of Hilltop Demographics). Displacement and gentrification become worrisome issues, especially when the economic situation of Hilltop is examined. However, the neighborhood does have strong assets in the form of many minority population specific non-profits, higher education and social housing programs, and a strong history of community activism (Hilltop Subarea Plan). The neighborhood could benefit from an intervention which would provide additional space for entrepeneurs, a market which would provide badly needed food access, and accessable education.



Above Fig. 62: *Site Circulation.* The site is hatched. LINK rail is in dotted blue, bus in yellow, pedestrian in red, and bike in green. Car routes are dotted black and exist on all adjacent streets.

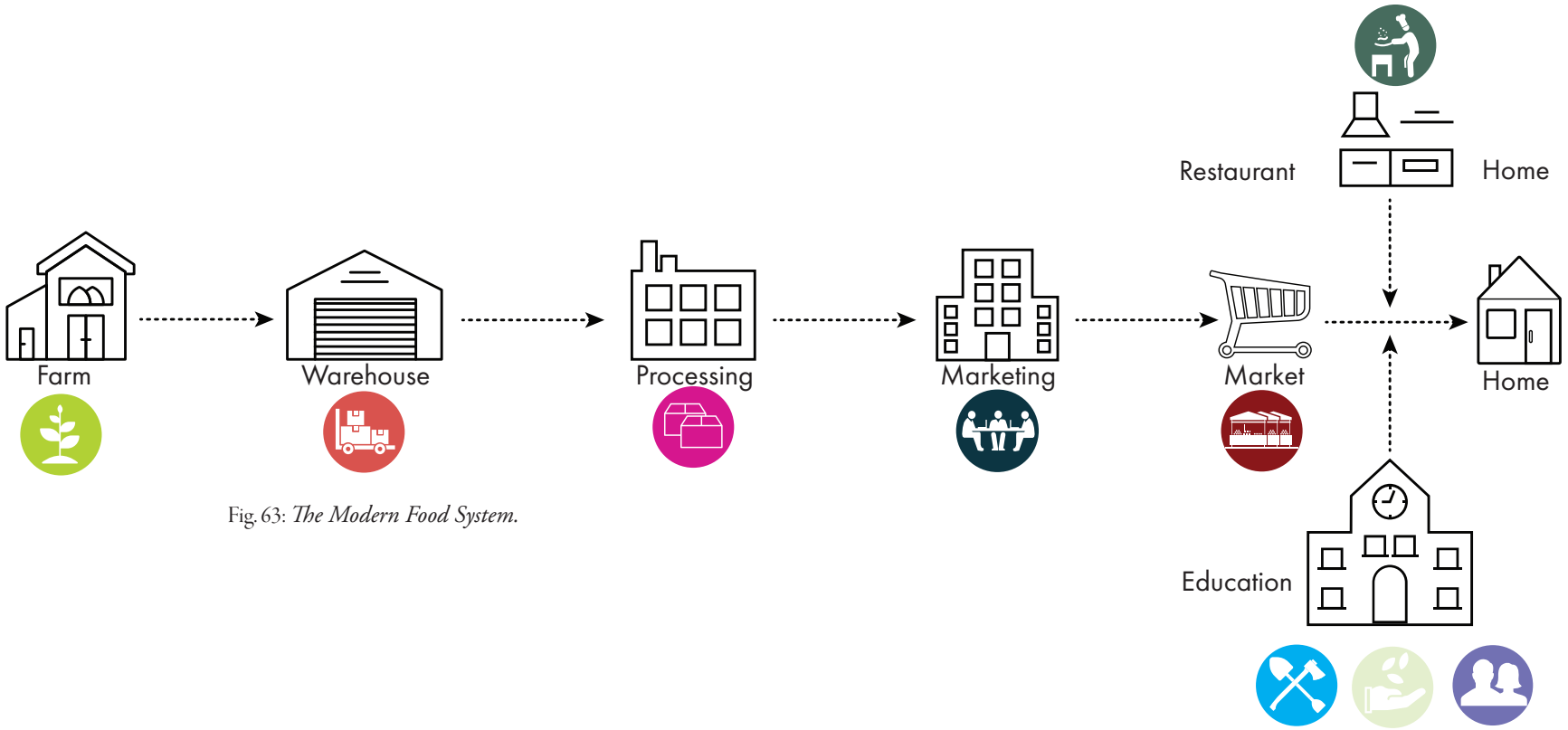


Fig. 63: *The Modern Food System.*

Grassroots and in-ground urban food systems have not engaged with the design profession in meaningful or significant ways since the garden city movement (Gorgolewski et al 2011). Certainly, how design and architecture can engage with a grassroots movement outside the scope of a building is a significant question. This thesis' stated goal is to present smalls farms as viable alternatives to lawns, and chose infrastructural support as the means.

Beyond planning open spaces for farming, the built and spatial aspects of the food system: aggregation, processing, distribution, and marketing, are areas where design can interact directly with the food network. Changing the assumptions of the physical layout of the food system, i.e. the relationship of many parts that exist thousands of miles apart, can act to change how the food system is visualized and engaged with, as well as reducing the food miles and carbon footprint of food.

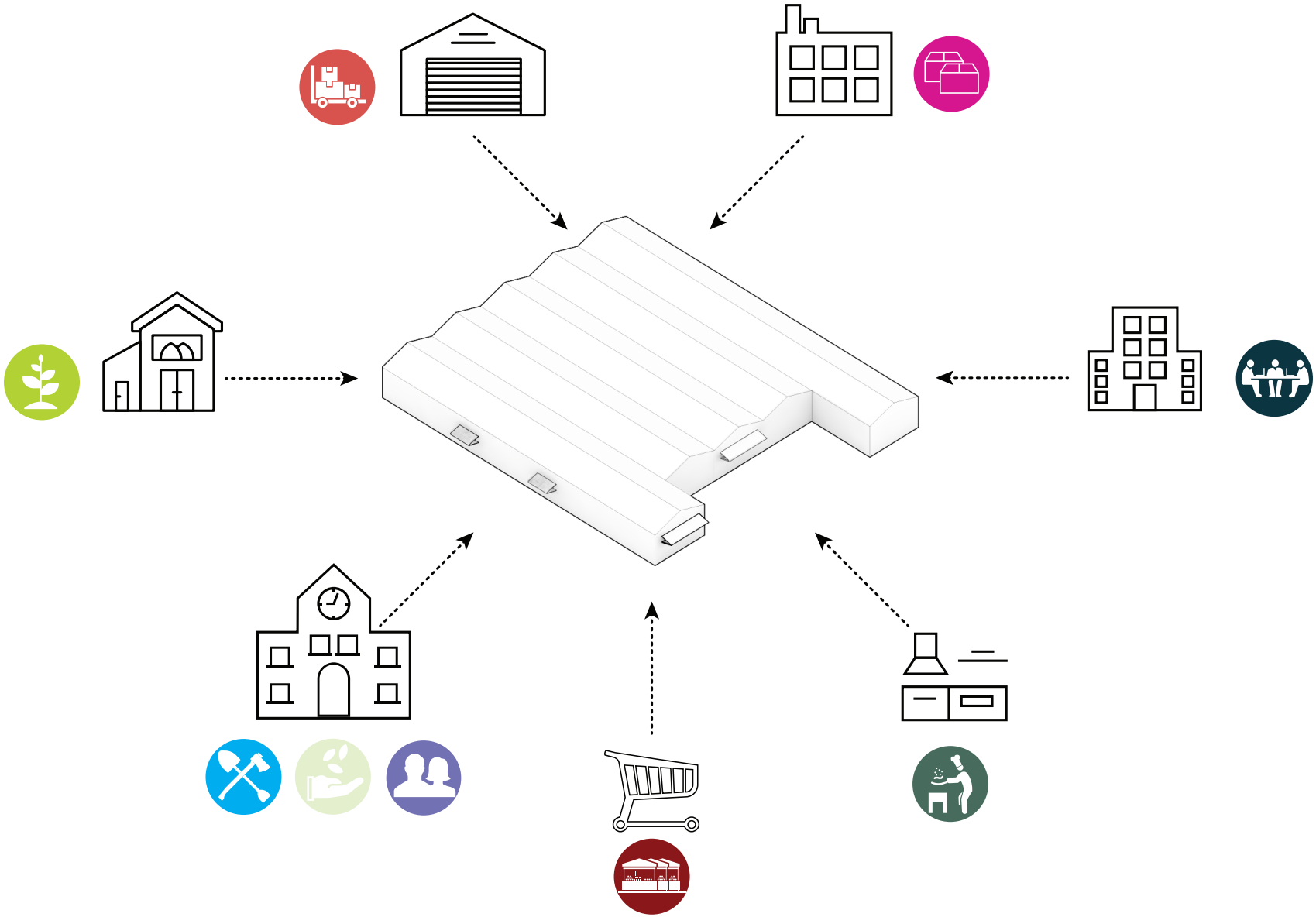


Fig. 64: *Building Concept Diagram.* Architectural components of the food system come together in a single building.

Fig. 65: *Ground Floor Plan.* See legend

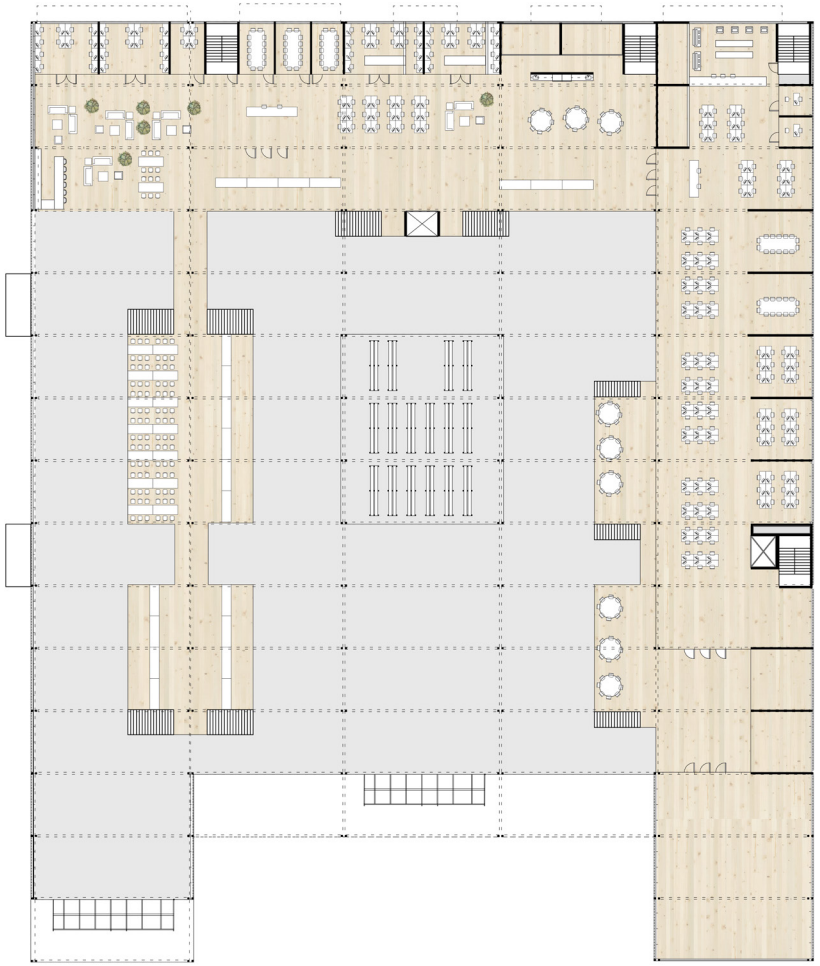


Fig. 66: *First Floor Plan. At 1.5x scale of ground floor plan.*

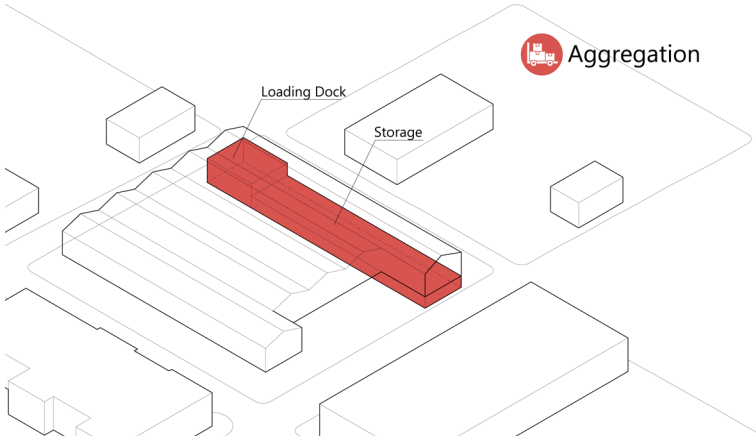


Fig. 67: *Aggregation.*

1. Aggregation

The least-public part of the hub. Food enters and leaves the building on the least used or accessed corner of the site. The generously sized loading dock allows for 4 vans to load and unload concurrently. Cold and dry storage is built into the slope of the hill.

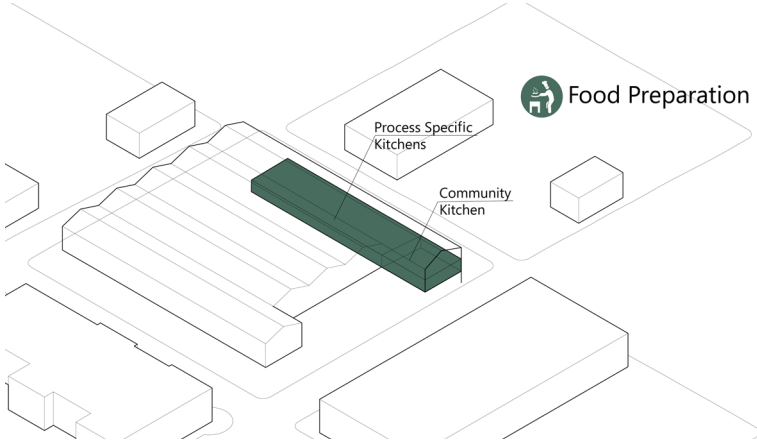


Fig. 68: *Preparation.*

2. Food Preparation

Process specific, and full kitchens provide local food entrapenurs access to value enhancing services - a vital part of growing a food system. Food Prep is accessable by food court restauranteers, network members, and as a rentable service.

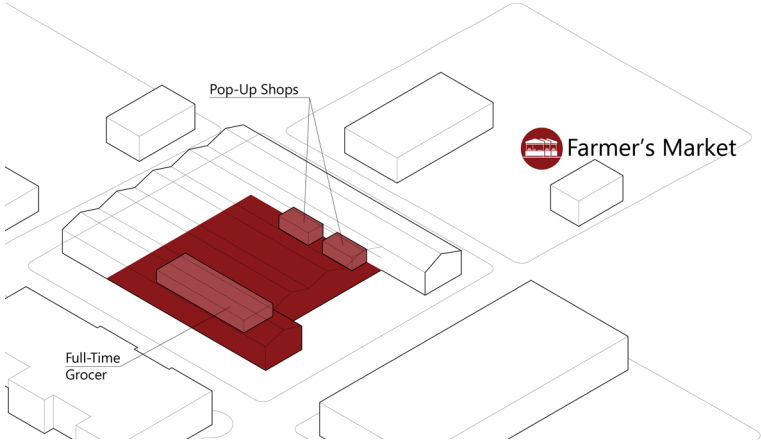


Fig. 69: *Market.*

3. Market Space

The farmers market expands and contracts seasonally. In winter months, the interior of the building is fully activated. A full-time grocer sells fresh local produce to community members throughout the year. Small shop retail space brings a diversity of economic activity into the hub, and pop-up space offers local entrepreneurs a growing space.

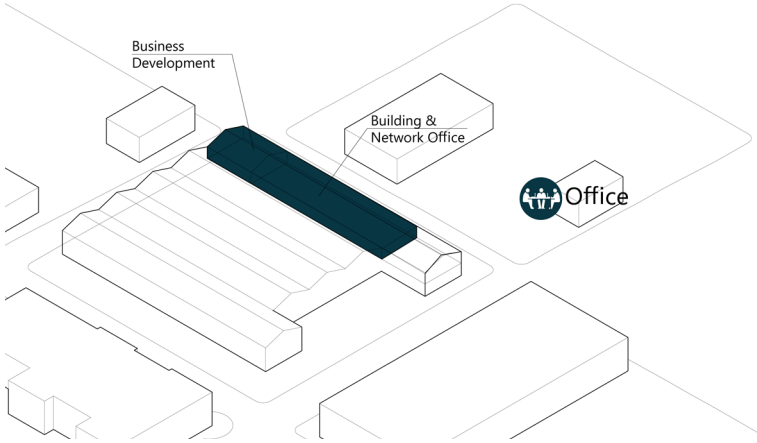


Fig. 70: *Office.*

4. Office

Managing a network of farms, sheds, and the central hub requires an office. Additionally, printing and business development offices exists to help farmers grow and brand themselves.

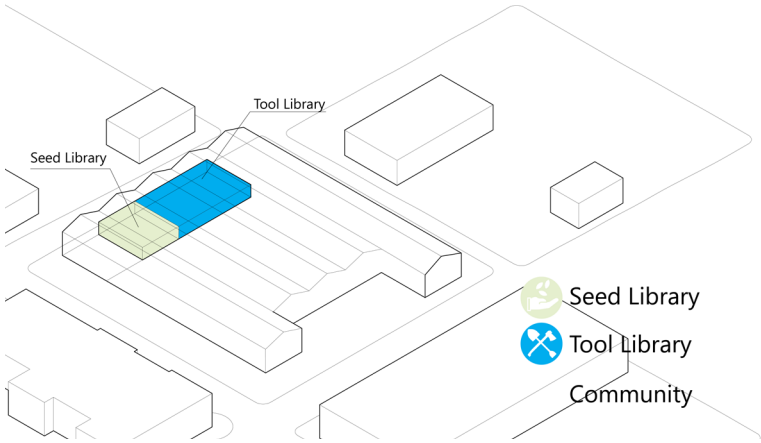


Fig. 71: *Community Libraries.*

5. Community Libraries

Community tool and seed libraries are a relatively new developments nationally, indicative of the growth of the sharing economy. At least sixty such libraries currently exist nationally, and the rapid expansion and subsequent integration into neighborhood associations points to success.

Tacoma has an existing tool library, established in March of 2016 in Hilltop, and has seen initial community support (Ponnekanti 2016). The existing tool library will move into the hub, tool libraries have often found success through integration with larger civic models, like library systems (Ponnekanti 2016).

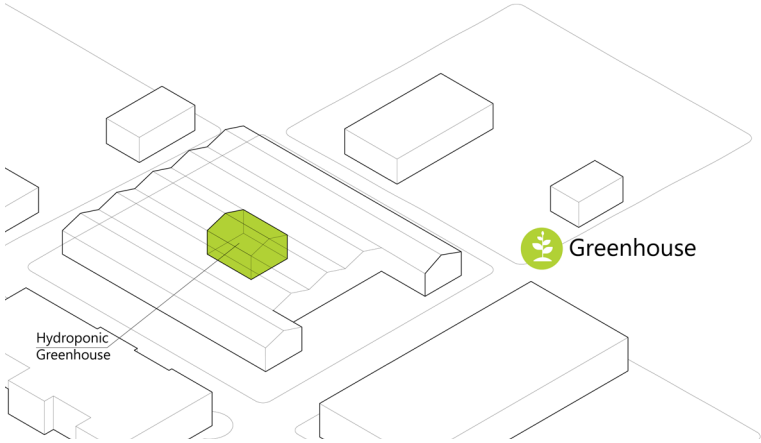


Fig. 72: *Greenhouse.*

6. Hydroponic Greenhouse

The hydroponic greenhouse increases the amount of avialable produce in the hub. Vertical, rotating beds offer a significant amount of growing space on a relatively small footprint. In addition to increasing avialable produce, the greenhouse offers visibility into an advanced farming system.

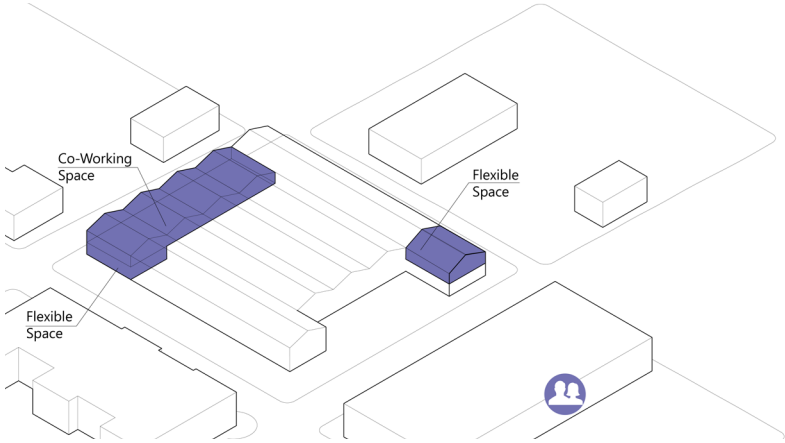


Fig. 73: *Flex Space.*

7. Community Oriented Flex Space

Flexible spaces bring the community into the building in unexpected ways. Adult classrooms, studios, and exersize rooms are consistently in demand, and would keep the public involved in the day to day of the hub.

Co-working space is a relatively new model of office space, where individuals or groups come together in a shared work environment. Co-working is an attractive model for start-ups, work-from-home professionals, and freelancers. Collaborate work space develops interesting synergy from individuals overlapping interests that may not be typically be exposed to each other. Open to the public office space will also bring the public into the hub on a day-to-day and out-of-market hours basis.

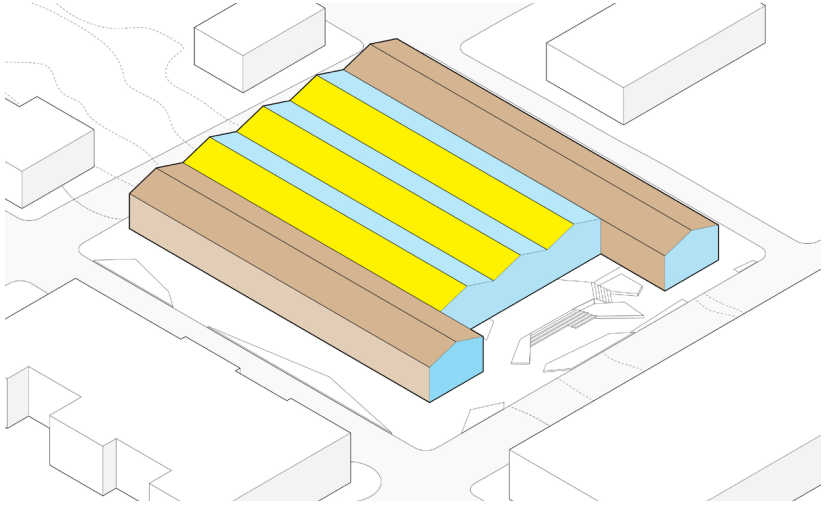


Fig. 74: *Transperancy Diagram.* Brown indicates wood slat, yellow indicates solid, and oppertunity for solar collection, blue indicates full transperancy.

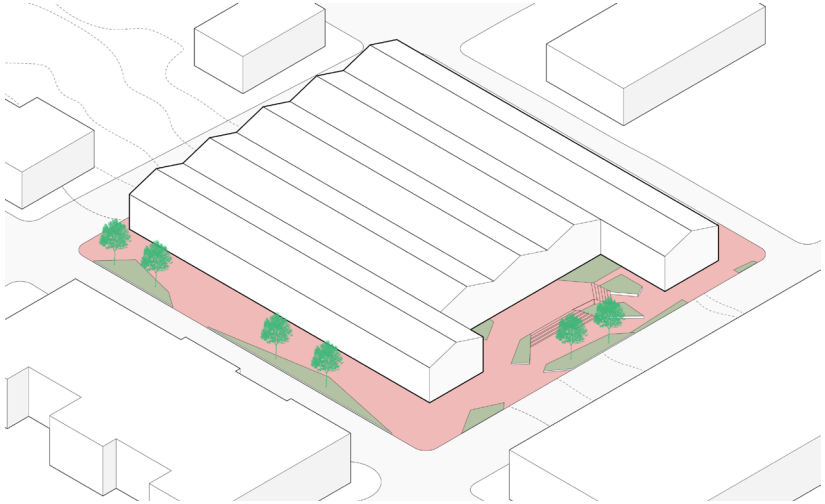


Fig. 76: *Public Plaza Diagram.* Red shows public space. The landscape was designed to push and pull people through the public plaza and towards the entrances of the hub.

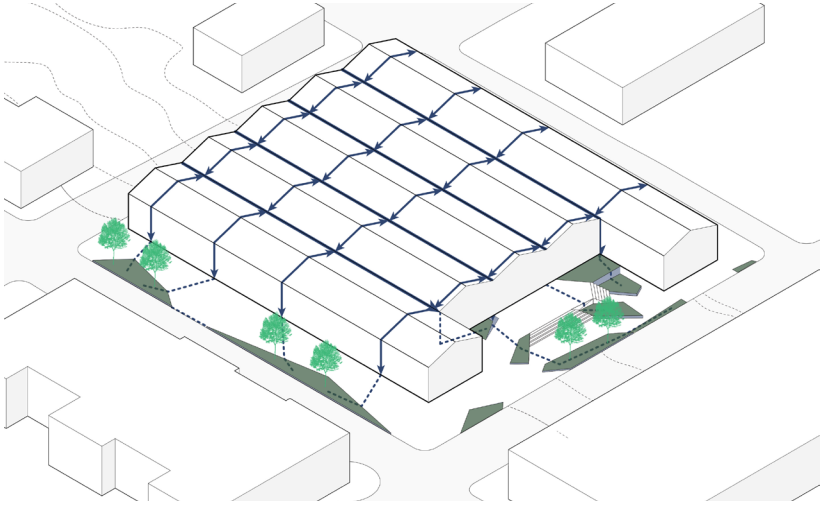


Fig. 75: *Rain Water Diagram.* The roof shape gave the building the oppertunity to manage the considerable rainwater that would fall on the site. Rain moves off roofs and into filtering rain gardens, that slow the water path and prevent storm drain overruns.

Public Considerations

Architecture has the responsibility to engage with the public sphere, especially at ground level. The hub, a project concerned with the environmental and social impact of public/private space, the need for engagement was especially considered. Significant space was given over to the public realm in the form of a plaza, which could act as a food truck court or ad hoc market. Environmental concerns - water management, and solar collection also helped guide the form of the roof. Rain gardens were introduced as an educational and functional design element.

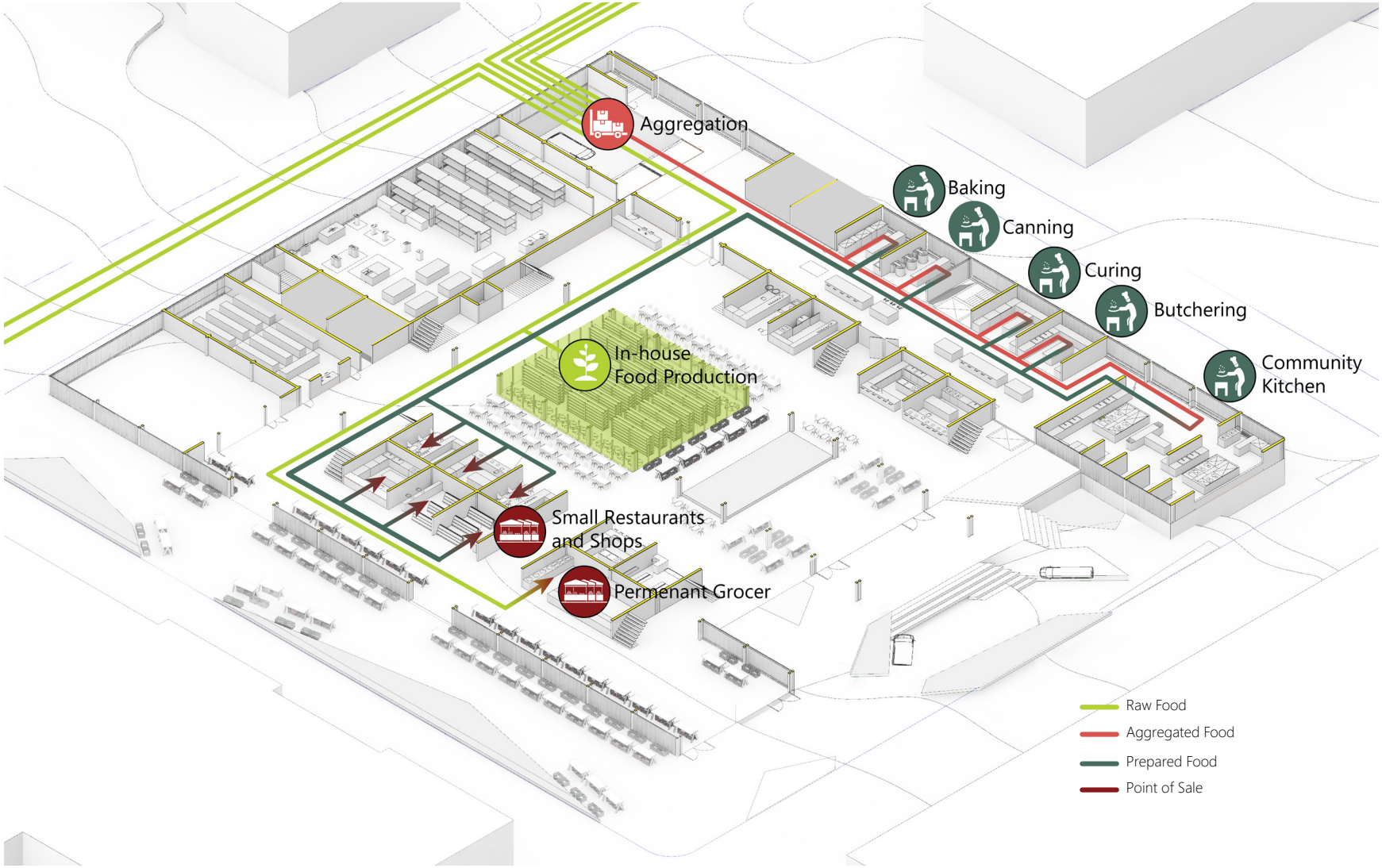


Fig. 77: *Food Path Diagram.* Produce is delivered to the hub by van through the loading dock. After it is aggregated and stored appropriately, it can be purchased and prepared by in house restaurants, or others renting the community kitchens. From preparation, food moves into the public market, where it is sold.

Fig. 78: *Seasonal Diagram - Summer.* The market expands into the public plaza during the more bountiful summer months. Pieces of the most public facade lift off and the building becomes experientially transparent. Curated rain gardens and deciduous trees help celebrate the seasonal transformation.

Fig. 79: *Seasonal Diagram - Winter.* The facade closes, and the market retracts along with the number of farmers and amount of produce available. The rain garden's texture and color changes and provides a different experience in the public space surrounding the market. Production in the in-house greenhouse is increased to suppliment crop avialability.

Fig. 80: *Experiential Perspective - Winter.* Public life moves inside the shed during the winter months. An interior stage hosts music as the local food court remains busy.

Fig. 81: *Experiential Perspective - Fall.* Colder weather doesn't stop local citizens from enjoying the harvest. Much of the market has started to shift inside, but the facade remains open.

Fig. 82: *Experiential Perspective - Spring.* The early harvest is bountiful. This view showcases the techtonic development of the hub. The roof structure embodies the idea of many parts coming together to form a cohesive network.

Conclusion

The most significant question that this thesis asks is: what the role of architect in the 21st century? I don't know that there is a definitive answer to that question, either in this thesis or any other. My project attempted to explore architectural design beyond what is strictly a building by imagining what a new food system could look like and how it might realistically be implemented. Because the architectural profession's influence and importance the field of construction and management will inevitably wane with the advent of parametric design and BIM, it is critical to ask what architecture as the built environment means. This includes considering public experience, large scale spatial relationships, designing for dignity and equity and rethinking how systems interact through and with architecture. My own professional inspiration has been Rem Koolhaas, an architect who has always pushed the profession to grasp new opportunity and meaning. Indeed, OMA attacks design at all scales, from publication to civic master plan.

This project was less about the tectonic architecture and was more concerned with systematic and programmatic reorganization, and with the social implications of that reorganization. That reorganization led to a three part design solution: Network, Shed and Hub. The multi-faceted solution reflects my own learning: the world is impossibly complex, global systems are beyond the scale or rationalization or understanding - day to day interactions and their effects are what matter to people. Urban food represents a sustainable future because it builds immediate physical connection to environment, community and health.

The purpose of this thesis was never to realize an immediate and absolute solution to the American urban form or the food system. Rather, my thinking was how a problem can present a unique opportunity. No other country in the world has lawns in the way that America has lawns; no other country posses the same optimistic potential for urban agriculture. This project's initial interest was in how architecture as a means of thinking, can interface with sustainability beyond "green" construction. I think that is a fine place to continue my education

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Figure List