This thesis is predicated around the critical question: how do we feed an exponentially growing world population? With 80% of the world population living in an urban context by the year 2050, it is crucial for us to explore the architectural potential of what city living can be like in combination with urban farming. Using the social typology of a kibbutz as a vehicle for investigation, this thesis analyzes the Israeli version of agricultural co-housing. Parallel to this analysis is a study on the technique of urban agriculture which can be applied to the site in the horizontal and vertical dimensions. The site, located in the cultural center of Jerusalem, Israel, is an underdeveloped parking lot adjacent to the famous shuk (farmers market), home to hundreds of vendors competitively selling their produce.

This thesis begins by researching and analyzing two different themes. The first theme focuses on various hydroponic techniques which would consist of a comprehensive study of the eco-design components of urban farming and its applications. The second theme will investigate the social characteristics of a kibbutz and how we can apply this collective community into an urban environment. The end result will be a synthesis of the two that will allow us to explore the potential of integrating collective living with urban agriculture. What would the product be like when people begin to take responsibility for the growing of their own food? Or when the separation between architecture and agriculture blends into a single entity?
Urban Kibbutz:
Integrating Vertical Farming and Collective Living in Jerusalem, Israel.

By

Daniel Scott Ankri

Thesis submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Master of Architecture
2010

Advisory Committee:
Peter Noonan: Professor of the Practice, Chair
Carl Bovill: Committee Member
Brian Kelly: Committee Member
Jeremy Kargon: Committee Advisor
David S. Ross: Committee Advisor
Preface

All satellite map images in this document are copyright-free screenshots from Google Earth and have been manipulated by the author.
Foreword

Throughout my lifetime I have been fortunate enough to travel to Israel many times; mostly with family, some on individual adventures. It’s a beautiful country- embedded in history, diverse in topography and rich in culture. Among the country’s diverse cities, Jerusalem has always stood out in my recollections as an international renowned city with deep-rooted traditions. I have a strong personal connection with Jerusalem having explored the historical and modern sectors by foot and moped at day and night. It is the city where my family grew up, my religion originated and my childhood memories reside.

In combination with having a location for my thesis, the decision to focus the content of the exploration around agriculture stems from a more recent chapter of my life. After happily marrying my wife, Mimi, in August 2008, I realized how obsessed she is with vegetables and, at the same time, realizing how much I am not. She constantly urges me to eat as much vegetables as possible often by placing a bag of them in my lunch every day, which was usually followed by a depressed look by me. Though I will admit that as the months progressed I began to appreciate this new healthy diet of mine and began to appreciate the richness in vegetables. Thus, as a topic for this thesis, I feel it is appropriate to explore the possibilities of the food that I grew up heavily disliking.
Dedication

To my wife, Mimi.
Acknowledgements

I would like to acknowledge my wife, parents and the rest of my family and friends for their ongoing support and encouragement throughout my life.
Table of Contents

Abstract
Foreword
Dedication
Preface
Acknowledgements
Table of Contents
List of Images

**Chapter 1: Introduction**
Statement of the Problem

**Chapter 2: Thesis Research & Analysis**
Site/Context/Place
02 Country
04 City
07 Neighborhood
10 Site
The Kibbutz
32 Social Dimension
34 History
36 Physical Manifestation
45 Precedent Analysis
Vertical Farming
48 Why Urban Agriculture?
49 Structure/Installation
50 Precedent Analysis
Crop Cultivation
53 Indoor Process
54 Hydroponic Systems
59 Crop Selection

**Chapter 3: Design Approach**
Conceptual Design Strategies
63 Access
64 Distribution
66 Enclosure
68 Entry
Parti Analyses
70 Site Planning
74 Schematic Design
78 Design Development
List of Figures

Fig.01: Kibbutz member working the field. [Source: www.zeek.net]
Fig.02: Satellite image of Mediterranean Sea. [Source: Google Earth]
Fig.03: Northern region of Israel. [Source: author, Google Earth]
Fig.04: Coastal region of Israel. [Source: author, Google Earth]
Fig.05: Central region of Israel. [Source: author, Google Earth]
Fig.06: Southern region of Israel. [Source: author, Google Earth]
Fig.07: Scale of New Jersey to Israel. [Source: author, www.depts.drew.edu]
Fig.08: Precipitation levels of Israel. [Source: skyscrapercity.com, weather.com]
Fig.09: Aerial map of Jerusalem. [Source: author, Google Earth]
Fig.10: Aerial map of Old City. [Source: author, wikitravel.com]
Fig.11: Historical plan and section of Old City. [Source: wikitravel.com]
Fig.12: Jerusalem Diagram- Ridge Line. [Source: author, Google Earth]
Fig.13: Jerusalem Diagram- City Centers. [Source: author, Google Earth]
Fig.14: Jerusalem Diagram- Major Nodes. [Source: author, Google Earth]
Fig.15: Jerusalem Diagram- Primary Streets. [Source: author, Google Earth]
Fig.16: Figure Ground of site’s neighborhood. [Source: author]
Fig.17: Neighborhood within Jerusalem. [Source: author]
Fig.18: Photo of outdoor shuk. [Source: author]
Fig.19: Photo of indoor shuk. [Source: author]
Fig.20: Figure Ground of site’s neighborhood. [Source: author]
Fig.21: Neighborhood Diagram- Street Hierarchy. [Source: author, Google Earth]
Fig.22: Neighborhood Diagram- Pedestrian Streets. [Source: author, Google Earth]
Fig.23: Neighborhood Diagram- Yafo Street. [Source: author, Google Earth]
Fig.24: Site within neighborhood. [Source: author]
Fig.25: Photo of mural painted on an apartment building. [Source: author]
Fig.26: Land uses. [Source: author]
Fig.27: Boundary of site. [Source: author]
Fig.28: Trees on site. [Source: author]
Fig.29: Topography of site. [Source: author]
Fig.30: Transportation around site. [Source: author]
Fig.31: Population densities around site. [Source: author]
Fig.32: Combined diagrams. [Source: author]
Fig.33: Architect’s proposed design of site. [Source: author]
Fig.34: Photo of rendered lightrail. [Source: author]
Fig.35: Plan of the large office building. [Source: author]
Fig.36: Parking entrance to office building. [Source: author]
Fig.37: Indoor retail photo of office building. [Source: author]
Fig.38: Exterior photo of office building. [Source: author]
Fig.39: Section cut through Yafo Street facing east. [Source: author]
Fig.40: Aerial panorama- wide lens. [Source: author]
Fig.41: Religious seminary. [Source: author]
Fig.42: K-5 school. [Source: author]
Fig.43: Police lounge. [Source: author]
Fig.44: Apartment building with retail on ground level. [Source: author]
Fig.45: Vending booth in shuk. [Source: author]
Fig.46: Vacant courtyard building. [Source: author]
Fig.47: Aerial panorama. [Source: author]
Fig.48: Section cut through site facing west. [Source: author]
Fig.49: Section cut through site facing north. [Source: author]
Fig.50: Context elevations facing away from the site. [Source: author]
Fig.51: Context elevations facing towards the site. [Source: author]
Fig.52: Sketch-Up model depicting major streets by the site. [Source: author]
Fig.53: Shadow studies. [Source: author]
Fig.54: Existing parking on site. [Source: author]
Fig.55: Pedestrian shortcut through site. [Source: author]
Fig.56: Major nodes along Yafo Street. [Source: author]
Fig.57: Important spaces in Jerusalem. [Source: author, Google Earth]
Fig.58: Street section cut through Yafo Street facing east. [Source: author]
Fig.59: Nighttime photos of site. [Source: author]
Fig.60: Photo of Kibbutz members. [Source: www.everyculture.com]
Fig.61: Kibbutz timeline. [Source: author]
Fig.62: Kibbutz locations throughout Israel. [Source: net-travel.org]
Fig.63: Kibbutz demographic chart. [Source: author]
Fig.64: Kibbutz Nitzanim- photo of entrance road. [Source: author]
Fig.65: Kibbutz Nitzanim- photo of dining hall. [Source: author]
Fig.66: Kibbutz Nitzanim- photo of a member’s home. [Source: author]
Fig.67: Kibbutz Nitzanim- photo of crops growing. [Source: author]
Fig.68: Kibbutz Nitzanim- photo processing warehouse. [Source: author]
Fig.69: Kibbutz programmatic pieces that exist near the site. [Source: author]
Fig.70: Logo of BARD. [Source: bard-isus.com]
Fig.71: BARD website. [Source: bard-isus.com]
Fig.72: Proposed program of the urban kibbutz. [Source: author]
Fig.73: Sketch-Up model of office building. [Source: author]
Fig.74: Photos of office building. [Source: author]
Fig.75: Photos of Jerusalem stone being used. [Source: author]
Fig.76: Aerial map of Kibbutz Nitzanim. [Source: author, Google Earth]
Fig.77: Diagram of typical Kibbutz layout. [Source: author]
Fig.78: Figure ground of Kibbutz Nitzanim. [Source: author, Google Earth]
Fig.79: Plan of La Tourette. [Source: greatbuildings.com]
Fig.80: Section montage of La Tourette. [Source: author, greatbuildings.com]
Fig.81: Nighttime image of earth. [Source: realfurture.org]
Fig.82: Photo of lettuce growing hydroponically. [Source: hydroponics.co.nz]
Fig.83: Diagram of the Center for Urban Agriculture. [Source: author]
Fig.84: Diagram of the Living Tower. [Source: author]
Fig.85: Diagram of the Eco Laboratory. [Source: author]
Fig.86: Diagram of the Harvest Green Project. [Source: author]
Fig.87: Germination process of a plant. [Source: www.infovisual.info]
Fig.88: Diagram of the Nutrient Film Technique. [Source: www.dbcourt.co.uk]
Fig.89: Diagram of the Wick System. [Source: www.dbcourt.co.uk]
Fig.90: Diagram of the Water Culture System. [Source: www.dbcourt.co.uk]
Fig.91: Diagram of the Ebb and Flow System. [Source: www.dbcourt.co.uk]
Fig.92: Diagram of the Drip Feed System. [Source: www.dbcourt.co.uk]
Fig.93: Diagram of yield comparison, matrix of crop types. [Source: author]
Fig.94: Photo of a falafel pita. [Source: lataco.com]
Fig.95: Photo of a falafel stand. [Source: flickr.com]
Fig.96: Drawings of the 5 chosen vegetables and their growing technique. [Source: author]
Fig.97: Sketch of access points. [Source: author]
Fig.98: Photo of existing closed access gate. [Source: author]
Fig.99: Sketch of distribution process. [Source: author]
Fig.100: Photo of shuk (farmer’s market). [Source: author]
Fig.101: Photo of shuk at nighttime. [Source: author]
Fig.102: Photo montage of vendor cubicle under renovation. [Source: author]
Fig.103: Sketch of piazza locations. [Source: author]
Fig.104: Photo of existing site (location for piazza option A). [Source: author]
Fig.105: Photo of existing site (location for piazza option B). [Source: author]
Fig.106: Photo of existing site (location for piazza option C). [Source: author]
Fig.107: Photo of existing site (location for entrance option A). [Source: author]
Fig.108: Sketch of possible entry location. [Source: author]
Fig.165: Detail plan of Private Courtyard with perspective above. [Source: author]
Fig.166: Detail sketch of Private Courtyard. [Source: author]
Fig.167: Detail plan of Communal Dining Hall with perspective above. [Source: author]
Fig.168: Detail sketch of Communal Dining Hall. [Source: author]
Fig.169: Detail plan of Water Tower with section elevation above. [Source: author]
Fig.170: Detail sketch of Water Tower. [Source: author]
Fig.171: Detail plan of Vertical Farms with perspective above. [Source: author]
Fig.172: Detail sketch of Vertical Farm finger. [Source: author]
Fig.173: Diagram of thesis process. [Source: author]
Fig.174: Diagram of the three thesis components. [Source: author]
Chapter 1: Introduction

Statement of the Problem

A kibbutz is a collective community in Israel that traditionally uses agriculture as its main source of income. The kibbutz was very successful from its initiation in 1910 as a socialist and Zionistic movement. All members appreciated the tranquility of being in the countryside, the convenience of all the children being raised in one house and the overarching equality ranging from standardized dress code to equivalent monetary income. However, there are flaws in the system which is making the Israeli people skeptical on the kibbutz’s future. Notably, the physical disconnection from large cities is not helping the image of the kibbutz, especially for the younger society. The young adults growing up in the kibbutz no longer want to continue the tradition that their parents and grandparents put in place and many are in search for a re-evaluation of the role of the kibbutz in Israeli society. Many are intrigued with the notion of developing kibbutzim in the fabric of urban cities. With that said, not all characteristic of the kibbutz should be changed, but there are certain values which can be rethought.¹

¹ Gavron, Daniel. The Kibbutz: Awakening from Utopia. Page 1
Chapter 2: Research & Analysis

Site/Context/Place

Country: Israel

The country for which this thesis will take place in is Israel, located along the eastern coast of the Mediterranean Sea (Fig.2). Dating back to biblical times, Israel has been considered the most sacred country for the Jewish nation. Since then, the country has endured countless battles over ownership between the Romans, Muslims and, currently, the Palestinians. Israel has, arguably, the most diverse geographical characteristics out of any country in the world—all within a few hours of driving. The country can be separated into four physical regions: the Galilee in the North (Fig.3), the coastal shores on the West (Fig.4), the Judean Hills in the center (Fig.5), and the Negev desert in the South (Fig.6). Roughly a third larger than the state of New Jersey (Fig.7), Israel can be driven from the northernmost city of Kiryat Shmone to the southernmost city of Eilat in roughly six hours.
Beginning in the North, the drive will begin high in the mountains of Mount Hermon, and then slowly descend through the rugged Judean Hills until one reaches the vast desert of the Negev with the warm Red Sea at its tip.

<table>
<thead>
<tr>
<th>Fig.03: Northern region of Israel.</th>
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<tr>
<td>Fig.04: Coastal region of Israel.</td>
</tr>
<tr>
<td>Fig.05: Central region of Israel.</td>
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<tr>
<td>Fig.06: Southern region of Israel.</td>
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</tbody>
</table>
City: Jerusalem

Jerusalem (Fig.9), a sacred city for several religions, can attribute its birth to the building of the Holy Temple on Mount Moriah by King Solomon (Fig.10-11). Jerusalem sits on a plateau within the Judean Hills in the central part of the country. At the heart of Jerusalem is the Old City whose walls were built to serve as a large enclosure for the Holy Temple. Since 1948, when Israel became a State, the Old City has been home to Jews, Muslims and Christians. Outside of these thick stone walls is modern Jerusalem whose population mostly consists of Israeli Jews.
Fig.10: Aerial map of Old City.

Fig.11: Historical plan and section of Old City.
Neighborhood: Machane Yehuda

The neighborhood where the thesis site resides is called Machane Yehuda (Fig.16), located in the cultural center of Jerusalem (Fig.17). This neighborhood is rich in diversity, in large part due to the shuk (outdoor farmers market) which occupies most of the neighborhood. The shuk (Fig.18-19) attracts thousands of locals and tourists combined, six days a week, excluding Saturday (religious observance), from when the sun rises in the morning until the sun sets in the evening. The shuk consists of two long, pedestrian streets running parallel to each other. Both streets run approximately 300 feet (the length of a football field) and range between 15-20 feet in width. Both of these pedestrian streets unconditioned space, though the eastern street has a translucent arch (Fig.19) awning while the second street is open to the sky (Fig.18). Connecting these two vibrant streets are four narrow walkways (roughly ten feet in width and 100 feet in length). Along these pedestrian streets are hundreds of vendors selling a large diversity of items including vegetables, spices, fish, bread and also various hand made textiles and clothing.
Fig. 18: Photo of outdoor shuk.

Fig. 19: Photo of outdoor shuk.

Fig. 20: Figure ground of site’s neighborhood.

Fig. 21: Neighborhood Diagram - Street Hierarchy. Red: Primary, Blue: Secondary, Yellow: Tertiary.
Fig. 22: Neighborhood Diagram- Pedestrian Streets.

Fig. 23: Neighborhood Diagram- Yafo Street.
Site:

1. Brief description and history of site and rationale for selection:

Adjacent to this east of the shuk is the location of the thesis site. Currently the site consists of several disconnected program pieces dispersed around a vast parking lot. Appearing as an object building on the site is an abandoned building which used to serve as a small education college for the surrounding area. This courtyard building is considered a historical landmark and must remain in the future scheme. In addition, there is a small K-5 school for orthodox children to the north of the site and several support buildings which are unsanitary and in very poor conditions. To the east of this school is a small police station which has been relocated so now this two-story building serves as a hangout for police officers. They come here during their breaks to eat lunch, smoke cigarettes and play backgammon (the most popular board game of Israel). Situated in the northeast corner of the site is a compact three story apartment building which is also in a very poor condition. Inhabited by four low-income families on the top two floors and retail on the ground floor, this mix-use building faces a busy and prominent intersection along Yafo Street. An additional positive attribute to this building is a locally
famous mural (Fig.25) which is painted on the west elevation depicting the glorious environment this parking lot used to have three decades ago - a beautiful outdoor park filled with vegetation and water fountains adjacent to the once busy college in the courtyard building. This park once served as an urban oasis for the neighborhood where students, tourists and locals can socialize together and relax from the busy Jerusalem.

Fig.25: Photo of mural painted on an apartment building.

Fig.26: Existing land uses.
2. Survey maps and plans of site and surrounding area (including: site boundaries, vegetation, topography, transportation patterns and population densities).

**Fig.27: Boundary of Site.**

The boundaries of the site are poorly defined. With the exception of a few buildings, most of the existing buildings do not relate to their context or to the street. Highlighted in red is the extent of the thesis scope with light demarcating adjacent properties that might be considered as well.

**Fig.28: Trees on Site.**

Trees are scarce on the site with the exception of the K-5 School where there exists clusters of 60 foot trees surrounding the buildings. Several large trees begin to define street edges to the east and to the south.
Fig. 29: Topography of Site.

The image to the left illustrates the one-foot interval contours that exist on the site and the surrounding neighborhood. There are no steep slopes on the site with the average gradient being .012 percent which is easily handicap accessible. To the northeast of the site, as seen in the image to the left, a 6 foot retaining wall begins to counter some of the existing topography.

Fig. 30: Transportation around Site.

The thesis site is located in a very busy transportation area of Jerusalem. Street widths are small in comparison to American standards. The four-lane Yafo Street (running from northwest to southeast) is filled with transportation buses and taxis. In addition, as seen with the yellow dotted line, the city is under construction for a two-lane light rail system which will transport people north and south from the Central Bus Terminal down to the Old City.
The thesis site is adjacent and to the west of the famous shuk (farmer’s market) called Machane Yehuda which is one of the major cultural landmarks of the city. Illustrated by the blue dots, the shuk is filled with local residents and tourists shopping for produce. The adjacent streets contain heavy pedestrian traffic as well but not to the magnitude of the shuk.

The image to the left takes the previous diagrams shown and overlays them into one diagram. By doing this, one begins to sense the layers of information and processes which occur at the thesis site in one cohesive illustration.
3. Prior planning or architectural studies, applicable to the site and project:

There are two projects that are currently being developed within the area. The first is the design proposal for the chosen site of the thesis. The proposal plans for a high-rise building containing luxury apartments and penthouses designed by local architect, Zeev Sheenberg.

The second development which is currently halfway through construction is the plan for an above-ground light rail system. This train will take up two of the existing four traffic lanes on Yafo Street and will transport hundreds of people a day from the central bus station down to the Old City.
In addition to these new projects that are underway, there is potential to adaptively reuse an under-utilized building located to the east of the thesis site for urban farming frameworks (Fig.35). Currently programmed in this 200 foot tall structure are 3 underground levels for parking (Fig.36), 3 levels for retail (Fig.37) and 14 levels for rentable space (Fig38).

\[Fig.35: \textit{Plan of the large office building.}\]

\[Fig.36,37,38: \textit{Photos of office building’s parking entrance, indoor retail and exterior.}\]
This section highlights several important characteristics of the thesis site. Firstly, is the 6 foot retaining wall on the right side of the image which elevates the existing parking lot and, unfortunately, creates an opaque barrier which offers nothing to the streetscape. Secondly, one can see the two lanes dedicated for the lightrail (under construction) and the two lanes dedicated for bus transportation. And, thirdly, on the left of the image is one-sided retail on very narrow sidewalks (8') for such a busy pedestrian area. The thesis will explore alternative uses such as commercial retail which will replace the 6 foot retaining wall and provide additional activity for the area.
Fig. 40: Aerial panorama of site- wide lens.

This aerial panorama is taken from the 14th floor of the office building located to the east of the thesis site. This montage view is pieced together in a wide-lens perspective showing the 3 story residential neighborhood to the south of the site (left in image) and the busier 6 story retail and residential neighborhood to the north of the site (right in image).
Fig. 41: Religious seminary. Building is underutilized and is much too large for its existing program. Currently, 15 members are associated with the seminary as opposed to the 100 members that once existed.

Fig. 42: K-5 school. Buildings are in very poor condition and not properly accessible from Yafo Street.
Fig. 43: Police lounge.
Building used to be a functioning police headquarters but when the program outgrew and relocated the building turned into a lounge for policeman to play backgammon and smoke hookah during their lunch breaks.

Fig. 44: Apartment building with retail on ground level.
Corner building is home to 3 families and remains in very poor condition. Famous mural painted on back wall.
Fig. 45: Vending booth in shuk. The shuk (farmer’s market) consists of hundreds of these vendor stalls. The one above in the image is undergoing renovations before it will be leased out to a new tenant.

Fig. 46: Vacant courtyard building. Under the Jerusalem Historic Landmark, this former education building cannot be demolished and will be adaptively re-used with a new program for the thesis.
Fig. 47: Aerial panorama.

This view focuses on the expansive parking lot that exists on the thesis site and is mainly filled by tourists who come to shop at the shuk. To the left of the parking lot, is the vacant courtyard building with the K-5 School surrounded by trees. The corner apartment building can be seen in the bottom right of the image.
Fig. 48: Section cut through site facing west.

On the right of the section is the four-lane Yafo Street with the two-lane Agrippas Street on the left of the section.

Fig. 49: Section cut through site facing north.

On the right side of the section is the 14-story office and retail building. In the middle of the section is the 3-story vacant courtyard building and on the left of the section is the farmer’s market pedestrian street.
Fig. 50: Context elevations facing away from the site.

With the exception of the 14 story office building, the thesis site is surrounded by 2-3 story apartment buildings with retail on the ground floor.
Fig. 51: Context elevations facing towards the site.

With the exception of the 14 story office building, the thesis site is surrounded by 2-3 story apartment buildings with retail on the ground floor.
Fig. 52: Sketch-Up model depicting major streets by the site.

Highlighted in red are the major streets that run adjacent to the thesis site. The three major streets are called Yafo, Ki’ach and Agrippas. Where applicable, the image above indicates the important landmark that the direction of the street is headed towards.
5. Site analysis identifying and documenting: problems and opportunities illustrated graphically as well as described verbally:

One of the first problems and opportunities someone would notice when arriving at the thesis site is the relatively large office building to the southeast. This high-rise building is 14 floors taller than the next tallest building in the site, resulting in large cast shadows onto the site—especially in the morning hours (see top row). With urban farming components in the program, the site offers one ideal location that receives east sun and south sun (see middle row). However, as an opportunity, one can use this tall structure to house the urban farming components minimizing the carbon footprint.

Fig. 53: Shadow studies.
The second problem is the parking that exists on the site, currently used for the marketplace. As an opportunity, the tall office building has three underground floors that do not nearly reach its full capacity so parking can be conveniently relocated to across the street.

An additional problem and opportunity for this site is the existing pedestrian corridor that serves as a shortcut to reach the *shuk* from the parking lot. If kept in the future design, as an opportunity, this unceremonious pedestrian link can be much more elegant and noticeable.

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*Fig.54: Existing parking on the site.*

*Fig.55: Pedestrian shortcut through the site.*
And lastly, as a third problem and opportunity is how the thesis site will respond in relationship to the other major nodes along Yafo Street. The site does not provide an 'urban wall' for the street so, as an opportunity, how will the design front Yafo Street along with the major intersection to the east (second node from upper left).

Fig.56: Major nodes along Yafo Street.
6. Siting precedents that help to clarify potential “solutions / opportunities.” What are the urban issues that this site can / should address?

The first urban issue which can be addressed is Jerusalem’s lack of a clear public space/piazza, especially along Yafo Street which stretches for several miles without an urban oasis. With a vibrant marketplace adjacent to the site along with a light rail route currently being built, the opportunity for a space which everyone shares will be a nice addition for the neighborhood.

Fig. 57: Important spaces in Jerusalem.
The second urban issue which can be raised is the long stretch of Yafo Street which lacks any retail program resulting in a sterile 5 minute walk. Especially at night, this area does not receive as much activity as other parts of Jerusalem, like Ben Yehuda, in large part due to the lack of commercial functions that is open after 6pm. In addition, at this stretch there is a stone retaining wall which butts up against the street in a fortress-like manner.
The Kibbutz

Social Dimensions

A kibbutz is a collective community in Israel that traditionally uses agriculture as its main source of income. Kibbutzim (plural) are unique rural settlements which are dedicated to mutual aid and social justice\(^2\). Based on the principle of joint ownership of property, the Kibbutz system is based on equality and cooperation production, consumption and education. One can think of a kibbutz as a large household shared by an entire community with a common purse making it a distinct socioeconomic entity. All monetary income the kibbutz makes from its exports goes into the kibbutz bank account which is then redistributed to the families depending on their job position. From each paycheck, a percentage (ranging from 10-20 percent) is subtracted and put into the community trust fund which is used for building new facilities, updating technology equipment or for social events.\(^3\)

The notion of consumption has significantly changed the past few years. Each kibbutz member has an enlarged freedom of choice and control over his/her budget. Furthermore,

\(^2\) [http://www.jewishvirtuallibrary.org/jsource/Society_&_Culture/kibbutz.html](http://www.jewishvirtuallibrary.org/jsource/Society_&_Culture/kibbutz.html)

\(^3\) Meeting with Avi Cohen (Kibbutz Nitzanim Coordinator). 6 July 2009
some kibbutzim offer measures of reward which diminish equality and generate economic stratification. Historically, each family would make the same amount of money, receive the same type of clothing and live in the same size home. Today, hierarchy has found its way into the system, where each family has different yearly earnings depending on their job description. In addition, each family has more choices as to what they want to wear, where they want to shop and where they want to eat.⁴

Eating is a major social category of the kibbutz movement. Traditionally, all the families in the kibbutz community would have their daily meals in the communal dining hall, cooked by the members who worked in the communal kitchen. However, in the contemporary era, most kibbutzim no longer mandate that all families must eat all meals together. Rather, each kibbutz experiments with the system where some communities will require dinner meals to be eaten with the rest of the families or, perhaps, just the Sabbath meals. There is a wide spectrum ranging from kibbutzim still requiring all the meals together, to the kibbutzim that only require a handful a week. These decisions are made by the community or the board members and are highly dependent on the kibbutz’s social agenda.⁵

⁴ Meeting with Avi Cohen (Kibbutz Nitzanim Coordinator). 6 July 2009
⁵ Meeting with Avi Cohen (Kibbutz Nitzanim Coordinator). 6 July 2009
History

The first kibbutz, Kibbutz Degania, was established in 1910 and was situated along the Kinneret, a natural lake within the northern Galilee Mountains. As the 1920’s approached, the idealistic community continued growing and became central to the Jewish labor movement. However, being that the traditional kibbutz was often segregated in rural environments, in the 1935 there was an argument in the kibbutz movement. On one end of the spectrum there were the radicals who wanted the entire State of Israel to become a countrywide commune, compared to the other side of the spectrum, who wanted single kibbutzim that would cooperate with the rest of Israeli society.  

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Fig. 61: Kibbutz timeline.

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Today, many kibbutzim attract exchange students who want to experience the Israeli lifestyle. They live on the kibbutz for several months volunteering in the fields, learning the native Hebrew language, and touring the country.

Here are some demographics for Kibbutzim through time:

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Kibbutzim</th>
<th>Kibbutz Population</th>
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</thead>
<tbody>
<tr>
<td>1910</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>1920</td>
<td>12</td>
<td>805</td>
</tr>
<tr>
<td>1930</td>
<td>29</td>
<td>3,900</td>
</tr>
<tr>
<td>1940</td>
<td>82</td>
<td>26,550</td>
</tr>
<tr>
<td>1950</td>
<td>214</td>
<td>67,550</td>
</tr>
<tr>
<td>1960</td>
<td>229</td>
<td>77,950</td>
</tr>
<tr>
<td>1970</td>
<td>229</td>
<td>85,100</td>
</tr>
<tr>
<td>1980</td>
<td>255</td>
<td>111,200</td>
</tr>
<tr>
<td>1990</td>
<td>270</td>
<td>125,100</td>
</tr>
<tr>
<td>2000</td>
<td>268</td>
<td>117,300</td>
</tr>
</tbody>
</table>
Physical Manifestation

These revolutionary social and communal beliefs are manifested into the physical construct of a typical kibbutz settlement. Being that no public roads run through a settlement, a kibbutz should not be mistaken for a village, rather, it is seen in legal terms as an entirely private domain. There is a single entrance road (Fig.64), usually for tourists and trucks, which lead to a gatehouse with a security officer. The gatehouse also offers campus maps and tourist information. After this checkpoint, at the center of the kibbutz, are all the communal programmatic pieces including the communal dining/kitchen hall (Fig.65), social hall, health center, library and merchandise store. One can treat these communal buildings as the nucleus of the kibbutz which holds the community together. In addition, one can usually find a large green space for the children to play or for outdoor social events. Branching from the center is a section where the dwelling takes place consisting of single family homes with front and back yards (Fig.66). Kibbutz sizes can range from 10 families (smallest) to the size of a town with 300 families (largest). Adjacent to the homes is a location for recreational activities such as a large outdoor swimming pool, extremely popular in the warmer months, and courts for basketball.
and/or tennis. Surrounding the entire built settlement are vast fields dedicated for agriculture and manufacturing. Here, depending on the kibbutz's agricultural focus, are several hundred acres for growing crops (Fig.67). Placed amongst the agricultural fields are manufacturing and administrative buildings housing field/processing equipment and offices (Fig.68).

Fig.67,68: Images of Kibbutz Nitzanim.
Pragmatic design objectives (goals) and approach. Special problems, issues and possible examples to help clarify:

Being that this thesis focuses on re-envisioning the typical rural kibbutz into an urban context, the program must therefore be reevaluated as well. In a rural kibbutz, where the closest city may be an hour drive, all the necessities for living must be provided by the kibbutz. However, when an urban kibbutz is established, the city where the kibbutz will reside offers the luxury of some of these pragmatic functions. Below are examples of functions that a rural kibbutz no longer needs if sited in an urban context:

Fig.69: Kibbutz programmatic pieces that exist near the site.

Recreational Activities

Shopping

Cafe/Bar

School

Wedding Hall

Medical Center
The type of members that will live and work in the proposed urban kibbutz will vary from those that exist in a rural kibbutz. In rural kibbutzim, the members mostly consist of middle aged men and woman 40 years or older. Many of them either have young children or their children have already moved out by their high school years. In reaction to this inevitable transition where young adults (in their 20’s) no longer want to live in a rural setting, the proposed urban kibbutz plans on targeting men and woman who finished their required 3 year military service after high school and wish to live together communally and contribute to the urban society.

In addition, the role of this urban kibbutz will change slightly in relationship to its historical tradition of outdoor farming. Being that the targeted audience for the thesis are individuals who are planning on entering the collegiate environment, the urban kibbutz will take a research oriented path in conjunction with the vertical farming component and informal educational work. Thus, members will be able to choose from a variety of disciplines in regards to their working responsibility.

As an example to help clarify what is meant by ‘research oriented’, there is a program in Israel known as BARD: Bi-national Agricultural Research and Development Fund (Fig.70). BARD is a competitive funding program for
mutually beneficial, mission-oriented, strategic and applied research of agricultural problems, jointly conducted by American and Israeli scientists, as said on the website (Fig.71). The plan is for the kibbutz members to be in dialogue with this research program. Furthermore, since BARD works with American students as well, there will be housing dedicated for visiting students traveling to Israel.

The goal is for this urban kibbutz, Kibbutz Yafo (named for the street it’s on) to have 100 permanent members, if possible, half men half women. Below is a typical weekday schedule for the Kibbutz Members, Sunday-Thursday (Fridays and Saturdays are off days in Israel).

**Daily Ritual**

<table>
<thead>
<tr>
<th>Daily Activity</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td>7:00am-8:00am</td>
</tr>
<tr>
<td>Morning Work</td>
<td>8:00am-12:00pm</td>
</tr>
<tr>
<td>Lunch/Siesta</td>
<td>12:00pm-2:00pm</td>
</tr>
<tr>
<td>Evening Work</td>
<td>2:00pm-6:00pm</td>
</tr>
<tr>
<td>Dinner (on your own)</td>
<td>6:00pm-7:00pm</td>
</tr>
<tr>
<td>Activities (optional)</td>
<td>not specified</td>
</tr>
</tbody>
</table>

**Notes:**

- **Meals** are offered by the Kibbutz throughout the week and on Shabbat/Holidays. One meal a day during the week (currently it is Dinner) and one Shabbat weekend a month, the Kibbutz members are free to eat wherever they please.
- **Work** can range from research, farming, processing/packaging, distributing, administration, kitchen staff, education and public outreach.
- **Activities** are organized by the Kibbutz and will take place in the Multi-Purpose Hall (also used as the Dining Hall). Activities can include billiards, happy hour, language classes, gaming, etc.
- **Visiting Students** who want to experience urban kibbutz life by volunteering in the farming/research programs or assisting in the education/public outreach programs can follow the same schedule as above and will join the Kibbutz members in the Dining Hall etc.
- However, these visiting students will have more flexible times throughout the week for traveling and other personal endeavors.
Space allocations and relationships indicated graphically. Program Tabulation:

### Kibbutz Yafo (100 Members)

#### Visitor Center
- Entry Vestibule: 200sf
- Main Lobby: 1,000sf
- Lounge: 1,000sf
- Tour Route: unknown

**Total for Visitor Center:** 2,200sf

#### Education
- Classrooms (4 x 600sf): 2,400sf
- Lecture Hall: 3,500sf
- Media Center/Library: 2,000sf

**Total for Education:** 7,900sf

#### Housing
- Permanent Residences (2 members per unit) (50 x 450sf): 22,500sf
- Visiting Students (2 students per unit) (20 x 200sf): 4,000sf

**Total for Housing:** 26,500sf

#### Communing
- Dining Hall: 3,000sf
- Kitchen: 1,000sf
- Administration Offices: 1,000sf
- Collaboration Rooms (2 x 500sf): 1,000sf

**Total for Communing:** 6,000sf

#### Outdoor Space(s)
- Urban Space: 20,000sf

**Total for Outdoor Space(s):** 20,000sf

#### Indoor Farming
- Growing Area (Naturally Lit) (three acres): 120,000sf
- Growing Area (Artificially Lit) (one acre): 40,000sf
- Packaging and Processing Area: 10,000sf

**Total for Indoor Farming:** 170,000sf

#### Research
- Main Labs (4 x 1,000sf): 4,000sf
- Research Offices (10 x 400sf): 4,000sf

**Total for Research:** 8,000sf

#### Services
- Loading Dock: 800sf
- Water Recapture: unknown
- Mechanical Systems: unknown
- Equipment Storage: 1,000sf

**Total for Services:** 1,800sf
Fig. 72: Proposed program of the urban kibbutz.
Structural and mechanical implications.

Sustainability goals or considerations.

Applicable building codes and their impact on the architecture:

It is under the assumption that many, if not all, of the proposed urban farming structures remain un-built due to the enormous investment along with its large initial carbon footprint. As was shown previously, the Indoor Farming component of the thesis far exceeds any other programmatic piece with 170,000 square feet (70% of the total 242,400 square feet). As one of the major sustainability goals for the thesis, the opportunity to re-purpose an existing tall structure would be of paramount importance.
Israeli building codes are currently unavailable at the present time though there is one parameter to keep in mind. According to municipal laws in Jerusalem, all buildings must be faced with local Jerusalem stone. This regulation began by the times of the British Mandate\textsuperscript{7}.

There are various rock types in the area that were quarried for different purposes. The variety of stone gives Jerusalem its unique nostalgic character. The setting sun reflected on the cream-colored limestone façade of both ancient and modern structures gives the buildings a golden hue hence the term “Jerusalem of Gold.” Below is the diverse list of lithologic types used in buildings:\textsuperscript{8}

1. White, coarse crystalline limestone originally referred to as “Meleke”, the stone of Kings.
2. Cream-colored micritic limestone known locally as “Mizzi Hilu” (sweet rock).
3. Red-colored limestone known as “Mizzi Ahmar” (red rock).
4. Gray crystalline dolomite known as “Mizzi Yehudi” (Jewish rock – modern times).
5. Flagstone of thin-layered limestone.

\textsuperscript{7} Eldar, Yishai. “Jerusalem Architecture Since 1948.” Jewish Virtual Library.
Precedent Analysis

Select relevant examples that offer meaningful formal, cultural, functional, typological or technological guidance.

Case Study 01

As a precedent, Kibbutz Nitzanim, located near the coast of Israel, offers an understanding of how a typical kibbutz might be programatically organized:

Fig.76: Aerial map of Kibbutz Nitzanim.

Fig.77: Diagram of typical Kibbutz layout.
Fig. 78: Figure ground of Kibbutz Nitzanim.
Case Study 02
Monasteries offer a similar genius loci to that of a kibbutz. Both are set in rural environments and tend to be disconnected from any urban settings. The living requirements are provided with what is necessary to function in everyday life and the focus is more inwardly than out. The monastery, La Tourette, designed by Le Corbusier, is a successful example of how to unite different programmatic elements into coherent masses:
Vertical Farming

Why Urban Agriculture?

Within the past decade, interest in urban agriculture has grown tremendously internationally. The major benefits for growing food in cities result in environmental, social and economic benefits. In terms of environmental benefits, urban agriculture preserves biodiversity, tackles waste and reduces the energy consumed from producing and distributing food. In addition, current traditional farming techniques in the countryside have harmful effects on biodiversity. With the runoff of fertilizers and pesticides from the fields, these hazardous chemicals pollute the waterways and destroy the ecosystem.9

Aside from the downside of chemical-enhanced crops, rural farming requires extreme amounts of energy for food transportation from country to city. This unsustainable pattern of growing is referred to as ‘food miles’ whose by-product is increased air pollution via greenhouse gases such as carbon dioxide and increased congestion. Urban agriculture provides an alternative framework where, instead of a monopoly of

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9 Viljoen, Andre. CPUL’s: Continuous Productive Urban Landscapes. Page 21
rural farming companies traveling thousands of miles, there can be a supply of local outlets throughout the cities of the world.\textsuperscript{10}

Furthermore, one of the many added benefits of urban agriculture is the potential for connecting the consumers with the food that is produced. With the existing model of rural farming, there is little knowledge from the urban population of the process that crops endure to reach the consumer’s dinner tables. By placing a farm in the cities, there is a great potential for educating the public on agriculture and enhancing their knowledge of food production. Thus, an urban farm can be an institution and a home for creative places of learning.

**Structure/Installation**

In order to implement an urban farm, where space is limited, the vast horizontal layer of a rural farm must be transformed into a series of smaller horizontal layers in the vertical dimension. The largest obstacle the plants are faced with is sun exposure. With floors now being stacked on top of each other, sun penetration becomes a critical issue.

\textsuperscript{10} Viljoen, Andre. *CPUL’s: Continuous Productive Urban Landscapes*. Page 41
Precedent Analysis

Professor Dickson Despommier, who researches environmental health sciences and microbiology at Columbia University, developed the idea of vertical farming in 1999 with his graduate students. Being that vertical farming is a relatively new typology, precedents are limited. In cities such as Inchon (South Korea), Abu Dhabi (United Arab Emirates) and Dongtan (China) have expressed serious interest from developers and local governments in establishing a vertical farm within their urban fabric. In addition, there have been many theoretical projects which explored the possibilities of vertical farming. Focusing on four un-built projects, one can begin to notice various ways vertical farms are expressed and the way different programmatic pieces can be organized:11

11 www.verticalfarm.com
Fig. 83: Diagram depicting construction process of container units.

Fig. 84: Diagram depicting circulation pattern of plants around building’s core.
Fig. 85: Diagram depicting how the natural ventilation works and how residential program and farming program can be placed on same floor.

Fig. 86: Diagram depicting the interior of one of the growing modules which uses circular containers to grow their food.
Crop Cultivation

Indoor Process

Crops go through a linear process in order to reach fruition. The first step in the cycle is called germination which is the “process in which a seed (produced by flowering plants) or spore (produced by non-flowering plants) emerges from a period of dormancy.” Being that this application takes place indoors via hydroponics; one can place several dozen of these seeds in a container relatively close to each other and light them through artificial lighting. This may occur for the initial four weeks of a crops life. Lighting is one of four components that crops need to survive. The other three include temperature, water and oxygen. All of these four components can be supplied to the seedlings even if grown in a small container. After this time has passed and the seedling sprouts a few inches from the soil, the next process takes place in which the seeds are now separated a bit further apart from each other. This second step can continue happening in the small container being lit via artificial lights, watered by a small .5” diameter pipe and fed oxygen through natural ventilation within the container. After another four weeks pass, the crops are ready to emerge from the container and be exposed to natural light by being spread out further.
apart from each other and closer to the southern glazing. They have reached the third step in the process where they will remain until their growing maturity has been reached and they will be harvested for consumption.\textsuperscript{12}

This is the basic yet intriguing process a seedling endures in order to reach fruition. The architectural implication of this process is to design the vertical floor plates in a way that there is a location for the crops to receive as much natural sunlight as possible towards the end of its cycle. At the same time, there may be locations that do not receive an immense amount of natural sunlight and this is where the germination process will begin. Each step along its life cycle, the crop moves closer and closer to the South glazing and at each step along its life cycle, the crops are spaced further and further apart from each other.\textsuperscript{13}

\textbf{Hydroponic Systems}

There are six main hydroponic systems which are used indoors to cultivate crops. Of course, there are many variations of these systems but all of them tend to fall into one of these six categories:

\textsuperscript{12} Meeting with David Ross (Professor in the Agriculture Department). 2 November 2009
\textsuperscript{13} Meeting with David Ross (Professor in the Agriculture Department). 16 November 2009
1] Nutrient Film Technique (NFT)

This method of hydroponics suspends the plants above a constantly flowing stream of nutrient solution, in which the solution usually 1-3mm deep. The plants are held suspended in a rock wool cube with a mesh container while the roots hang down from the container, dangling down into the nutrient solution. This system must be constantly checked to make sure that the roots do not overgrow and create a dam preventing the nutrient solution from flowing which will result in dead plants. As with all hydroponic systems, it is very important for the waste water to be filtered from root debris so blockages do not occur. In addition, this system requires a constant flow of electricity to create a constant source for the water pump.  

2] Wick System

This system is often referred to as the ‘simplest’ of the six hydroponic systems because there are no moving parts such as drippers or pumps which makes this system a ‘passive system’. The process works by connecting the bottom of each plant to the water reservoir below with a wick. The wick is suspended several inches into the water and draws up nutrient solution from the reservoir into the growing medium where the roots are.

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The disadvantage to this system is that since the nutrient solution is not moving or flowing, the solution may become deoxygenated or stagnant. Placing an air stone, which oxygenates the water, at the bottom of the reservoir may serve as a good remedy, though the air stone will not fit in a small reservoir. In addition, large plants may suffer in this system as they may draw more nutrient than the wick can supply, thus drying out the plants.\textsuperscript{15}

3] Water Culture
Similar to the Wick System, the Water Culture System is also a very simple technique where the plants are suspended in the nutrient solution, usually using a floating Styrofoam platform to hold it up. Sometimes the water is left still but can benefit from water circulating and aerated via an air stone. This system is scalable and can be easily used for on a very large scale to cultivate small, fast-growing leafy crops such as lettuce. Another advantage to this system is that the plant roots held up by the floating platform is constantly immersed in the nutrient solution regardless of the level. Therefore the plants are not at the mercy of an electricity supply such as in the NFT system where the plants would die if the electricity fails. Furthermore, this system is ill-
equipped to handle large plants or plants that take a long time to grow.\textsuperscript{16}

\textbf{4] Ebb and Flow System (Flood and Drain)}

Unlike a previous system, the Ebb and Flow System requires a pump therefore it is not a passive system. The plants are suspended in a fixed vessel where the roots are regularly subjected to a flood of water which covers the roots. Eventually, the water gradually drains away allowing the roots to oxygenate. On the downside, being that the water supply ascends and descends, this system is reliant on electricity so that a constant supply of water can be delivered. In a cold climate it is not much of a problem, but in a hot climate if the roots are not immersed in the water for a relatively short period of time then the young plant will die. To alleviate this threat, a water absorbing medium to support the plant can help which will provide moisture for the roots even if the water already drained. This system is good for large plants such as rhubarbs, tomatoes and even potatoes, while lettuce would not succeed as well in a system like this.\textsuperscript{17}

\textsuperscript{16} \url{http://www.dbcourt.co.uk/hydroponics/System%20_types.html} Accessed 5 November 2009

\textsuperscript{17} \url{http://www.dbcourt.co.uk/hydroponics/System%20_types.html} Accessed 5 November 2009
5] Drip Feed System

This is one of the most famous and widely used systems out of all the various hydroponic techniques. Nestled in a pot or vessel containing free draining mediums such as grow rocks or perlite, the plants are fed by an above head pipe that drips the nutrient solution onto the plant. The leftover nutrients which are not captured by the plant filters its way down the growing medium and are captured by a pipe which returns the nutrients back to a tank where it can be re-circulated to the plants. A constant supply of nutrients to the plants is not necessary thus the delivery can be controlled by a timer. The disadvantage to this system is that the above-head drippers need daily checking because they are prone to blockage which will prevent the nutrient supply. In addition, different plants along the drip line will absorb widely varying quantities of nutrient and can alter the pH level of the nutrient so daily checking of the levels is required.\(^\text{18}\)

6] Aeroponic System

In some ways, the Aeroponic System is the ideal system for hydroponic cultivation, but as most seemingly perfect systems it can be flawed. The system is quite simple where the plants are suspended above a vessel where the roots are hanging down into a chamber

\(^{18}\) [http://www.dbcourt.co.uk/hydroponics/System%20_types.html](http://www.dbcourt.co.uk/hydroponics/System%20_types.html) Accessed 5 November 2009
which releases a nutrient mist thus providing food for the plants and plenty of oxygen. This system is fully dependent on a reliable electric supply because the plants are at the mercy of a constant misting of nutrients. In addition, a larger obstacle is that if the constant mist solution contains salt then it will eventually condense on the jet and ultimately block it. Thus, regular (even hourly) inspection of the jets is required to make sure that the plant roots do not dry out quickly.\(^{19}\)

**Crop Selection**

The main parameter when choosing which crops can grow indoors is to analyze which crops can fit indoors. Due to limited height factors, crops which grow on trees like bananas, olives, avocados and nuts (to name a few) will be very difficult to cultivate indoors. However, there is opportunity to grow, in limited quantity, tree crops outdoors with space permitting. This leaves us with over three dozen vegetable varieties to choose from to grow hydroponically and indoors.

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\(^{19}\) [http://www.dbcourt.co.uk/hydroponics/System%20types.html](http://www.dbcourt.co.uk/hydroponics/System%20types.html) Accessed 5 November 2009

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**Fig. 93: Diagram of yield comparison, matrix of crop types.**
In attempt to pick a theme for the crop selection, as opposed to arbitrarily choosing roughly 4-8 crops for this thesis exploration, a study was done which analyzed the authentic dishes eaten in Israeli culture. One dish which stood out from the rest is, arguably, the most authentic Israeli/Middle Eastern dish of all time: the falafel pita (Fig.94). This fast food dish is served throughout all the regions of Israel and is eaten throughout all times of the day ranging from an early breakfast to a midnight snack. Within this delectable dish are five main vegetable ingredients: chickpeas, tomatoes, lettuce, cucumbers and parsley. The chickpeas are used to create the falafel balls (deep fried) and are the main ingredient in the famous sauce we know as hummus which is spread inside the falafel pita. The tomatoes, lettuce and cucumbers are finely chopped and placed as the salad appetizer within the pita. In conclusion, the vendor will spread some more hummus on top of the pita, sprinkle chopped parsley throughout the layers and then top off the sandwich with tahini sauce (made from olive oil and grounded sesame seeds). It is one of the goals of the thesis proposition to have a strong connection between what is grown in this Urban Kibbutz and its relationship to the

Fig.94: Photo of a falafel pita.

Fig.95: Photo of a falafel stand.
Israeli culture in which it is surrounded. Thus, the notion to grow the main ingredients for popular Israeli dishes is a concept that hopefully can be taken further.

Fig. 96: Drawings of the 5 chosen vegetables and their growing technique.
Chapter 3: Design Approach

Conceptual Design Strategies: Access

The existing site currently has a series of access points that are either open to the public or gated off. The diagram above indicates the access points which are accessible (marked in blue) and indicates, as well, the access points which have been closed off (marked in red). Unfortunately, a pedestrian who wishes to visit the site never has a clear understanding of where to enter the site. In addition, the existing site does not provide adequate street definition. As the design develops, a critical design strategy will be to clearly demonstrate to the public where access points occur and how edges will be defined.
Another component which must be taken into consideration before designing the site is how the process of food distribution will take place. Where will the food grow? Where will the food be processed and packaged? Where will the food be distributed to the adjacent farmer’s market? Though these questions have gone through a series of different solutions, the above diagram demonstrates the first attempt at answering these questions. In the beginning stages, the growing of the food was to take place in the 14 story office building located to the east of the site. After reaching maturity, the food was to be processed and packaged in the 3 story vacant courtyard building located in the middle of the site. After being placed in
crates for distribution, the food was to enter the farmer’s market every morning at a series of distribution points throughout the market. There is an ongoing ritual that takes place every day in the shuk (farmer’s market), from the food being brought via hand truck at 5:00am, to the shoppers arriving around 6:00am, and to the closing of the market at sunset. This thesis proposition is not planned to disrupt this process but rather to further develop it.
Most of the site consists of expansive parking lots with absolutely no sense of outdoor enclosure. Especially with a site adjacent to a highly populated landmark such as the shuk, one would expect a prominent urban space which the public could use for resting, eating or socializing. In comparison to cities such as Rome, which contains the prototypes of urban spaces, there are always hierarchical public piazzas adjacent to cultural landmarks. The above diagram begins to illustrate three different options for the location of a public urban space within the site.

Option (A): this space is enclosed on three sides and provides close proximity to the shuk and the major street (Yafo Street).
Fig. 105/106: Photo of existing site (location for piazza option B); Photo of existing site (location for piazza option C)

Option (B): this space is enclosed on two sides and faces the busy intersection of Yafo and Kiach Street. The site does not provide close proximity to the *shuk*.

Option (C): this space is enclosed on all four sides and provides close proximity to the *shuk*. This space, being located in the middle of the site and away from the major streets, will be less noisy in comparison to the other two options.
Conceptual Design Strategies: Entry

When beginning to design the planning of the site, different entry points were considered as the public face for the urban kibbutz. Being that the kibbutz was to use the entire site and be treated more like a campus rather than a building, it seemed necessary to provide a hierarchical entry point (blue arrow) for visitors along with the kibbutz residents.

Option (A): adaptively re-using an existing building as the main entrance for the kibbutz.

Fig.107/108: Photo of existing site (location for entrance option A); Sketch of possible entry location.
Option (B): creating a large circular atrium space adjacent to the major intersection to serve the hierarchical entrance.

Option (C): allowing the main entrance to be located off of the secondary street (Kiach Street).

Fig.109/110: Photo of existing site (location for entrance option B); Sketch of possible entry location.

Fig.111/112: Photo of existing site (location for entrance option C); Sketch of possible entry location.
Parti Analyses: Site Planning

While keeping in mind the conceptual design strategies listed previously, a series of site planning schemes began to emerge. The first step in the process was to determine which existing buildings on the site to keep/adaptively re-use and which buildings to demolish. Most of the buildings were underutilized and kept in poor condition. Any of the buildings which were to be demolished, either the K-5 school, police lounge, or the 3-unit apartment building would be relocated to a more ideal location and be built in better conditions. It is important to keep in mind that the courtyard building, located in the southern part of the site is under the Jerusalem Historical Landmark status and cannot be demolished. This building is currently vacant and will eventually house a new program established by the kibbutz. The initial site planning schemes that follow attempt different strategies at how to define street edges, create public urban space, establish public access and determine which buildings to keep:
**Fig. 114:** Sketch of parti design (Option A).

**Fig. 115:** Sketch of parti design (Option B).
Fig. 116: Sketch of parti design (Option C).

Fig. 117: Sketch of parti design (Option D).
Fig. 118: Sketch of parti design (Option E).

Fig. 119: Sketch of parti design (Option F).
Parti Analyses: Schematic Design

After completing the site planning schemes illustrated above, two schemes were chosen and combined to continue into the next stage of design:

These schemes were chosen because they achieved the most important goals of the thesis proposition. They clearly define urban edge conditions by providing 3-4 stories of building mass along the boundary of the site with a series of punctuations which provide access points for the pedestrian public. In addition, outdoor spaces were well defined providing a strong sense of enclosure. Instead of there being one major public space, there is a series of public and private courtyards varying in sizes and hierarchy. Furthermore, it was important for the site to provide pedestrian retail streets.
which lead to these public urban spaces. Similar to the ancient Roman layout of a town, there is a major public urban space located in the heart of the town and is connected by a major axis and a minor cross-axis. In both of the schemes above, the major public urban space is located in the middle of the site directly north of the courtyard building and is accessed by the north-south axis which bring people down from Yafo Street and the east-west axis which connect people from Kiach Street in the east to the shuk (farmer’s market) in the west. The public urban space, which will also be referred to as the public piazza, allows the courtyard building to sit adjacent to an hierarchical outdoor space which is not dissimilar to the churches of the medieval era which also sit adjacent to public spaces. One of the experiential intentions with these schemes, which can be found throughout the Mediterranean culture, is for the pedestrian to walk down one of these picturesque retail streets, away from the noisy vehicular streets, and eventually end up in a serene yet vibrant public piazza. These promenades occur in locations such as Jerusalem’s Old City or Italian towns such as Verona and Florence.

In addition to the public piazza located in the heart of the site, the two schemes illustrated earlier also provide a large private courtyard.
dedicated primarily for the kibbutz members located in the northeast of the site. Whereas the public piazza is oriented in the cardinal directions (north up), the private courtyard for the kibbutz members is oriented with the major streets which run parallel to the edges of the private courtyard. This private courtyard is intended to be a place where just the kibbutz members and invited guests can inhabit, and can provide a home for activities such as a bonfire, hookah smoking or personal meditation. With these activities in mind, the two chosen schematic designs shown earlier were integrated into the next stage of iterations:

Fig.123/124: Photo of Pedestrian Piazza in Florence Italy; Sketch of design parti (ground floor).
In these next schematic design versions, attempts were made to further refine the pedestrian retail street, public piazza, private courtyard and street edges. As seen in the figure to the left, programmatic zones begin to take place within the site. Colored in green are the vertical farm fingers, in purple are the kibbutz residential units, and in orange are the communal buildings such as the dining hall, lounge and offices. One of the biggest challenges in developing the site is that there are different geometries which converge and create weird angles and awkward moments.
Parti Analyses: Design Development

As the design continues to develop, the exploration begins to transfer from two dimensions to three dimensions, studying the massing of the buildings, how spaces are defined, and how edges are made. The design also begins to be studied in section and perspective where various programmatic pieces such as the kibbutz living units and private courtyard are raised above the ground level and where the vertical farm fingers are then raised above those living units.

Fig. 127/128: Roof plan; Aerial perspective.
Fig. 129: Section perspective cuts.
Fig. 130: Perspective views.

- View of kibbutz private courtyard (vertical farms above)
- View of pedestrian retail street
- View of dining hall facing public piazza
At this point in the process, the programmatic pieces have roughly found their place in the site. However, the moments where different geometries greet each other can still be further developed and refined. To best describe the thesis design at the current stage is to illustrate the essential ideas in the diagram below:

Beginning from the outer edge (hatched in red), is a continuous building mass that provides definition for the street edge. Located in the heart of the site is the historic landmark building (also hatched in red) and provides regulating lines for the rest of the site. Raised over the site are the vertical farm fingers (hatched in green) which face south and are spaced 30 feet apart providing direct natural sunlight for all the plants. Cutting through the vertical farm fingers are the major axis and cross-axis (lined in blue) which provides pedestrian connections to the public piazza (lightly circled in pencil).
As shown in the illustration to the left, the design plan took another step of refinement by shifting the pedestrian retail street (hatched in yellow) to the east. Originally, this 24 foot wide street which runs north-south was placed symmetrically with the courtyard building (which houses the kibbutz administration), but now, by shifting the pedestrian street to the east it creates a more picturesque approach to the public piazza. Using this piazza as its public face, four different buildings have their primary entrance off of the urban space: to the north is the entrance into the Vertical Farms; to the east is the entrance into the Kibbutz Visitor Center with Dining Hall above; to the south is the Kibbutz Administration Building and to the west is the entrance to the relocated K-5 School.

Fig. 132: Parti sketch.
As the focal point of the design, the public piazza acts as the connective tissue within this mix-used campus community. The piazza, which is intentionally removed from the noisy vehicular streets, provides an inwardly focused space that can serve as a getaway from the hustle-and-bustle of downtown Jerusalem. As shown in the illustration above, there is a ceremonial water fountain located in the center of the stone-surfaced piazza which provides a social gathering area along with evaporative cooling during the hot dry summers. In green, are the south-faced levels of the vertical farms allowing the public to witness the environment in which the plants are grown. And in the background, raised up a level, one can see the private kibbutz courtyard which is faced with the residential units along with the major communal program such as the dining hall and lounge. In addition, there is also the introduction of a tower which acts as an orientation device for people in the site.
When comparing the figure-grounds of the before and after, the sites feel drastically different. As seen in the image to the left, the existing site is not too dissimilar from other neighborhoods of Jerusalem where street edges are not defined and buildings do not relate to its context, resulting in an unfortunate amount of ambiguous spaces. The thesis proposition offers a precedent for the rest of the neighborhood illustrating how blocks and street edges can be better defined.
Final Design: Piazza Transformation

The procession of reaching the piazza has undergone a series of transformations throughout the thesis exploration. Components which have been transformed includes the width and location of the pedestrian street which brings one down into the piazza; the decision to create a smaller piazza at the head of the pedestrian street providing a threshold and a gateway for the site; and, of course, the piazza itself has been reshaped, manipulated...
and transformed to better accommodate the uses which look out onto the piazza.

In addition, by transforming the piazza procession, the diagram as a whole has become much more synthesized. As shown in the figure-ground above, lined in red are the building edges that now properly define the adjacent streets, colored in light red is the historic landmark building which was preserved and re-used into the kibbutz administration building, the yellow arrows highlight the pedestrian access points, and in green are the vertical farm fingers which are oriented to the southern exposure along with the geometry of the adjacent shuk (farmer’s market) to the west.

Furthermore, the diagrams to the top left demonstrates how the “bump out” of the dining hall onto the piazza provides a visual destination for the pedestrians walking south on the retail street. And in the diagram to the bottom left, there are a series of axes which begin to delineate façade alignments even in an asymmetrical layout.

Fig.137: Diagram sketches of Public Piazza (bump out as visual destination and axes).
Final Design: Realization

The integration of vertical farming and collective living provides unique opportunities for the future of sustainable communities. When the merging of these two programs occur in an urban environment it creates numerous and challenging opportunities for investigating what and how architecture can begin to solve the dilemmas we now face as a society. There is a rich and provocative potential when seemingly disparate operations [farming + urbanism + collective living] are synthesized into a seamless cohesiveness.

Fig.138: Hybrid aerial perspective.
Fig. 139: Ground floor.
Fig. 140: Typical floor.
This section demonstrates how the historic landmark building is adaptively re-used and framed by residential living units. The historic landmark building once was a popular city college but after the school ceased to continue, the building remained vacant. In attempt to repurpose the load-bearing structure, various program was proposed for the building ranging from the K-5 School, studio apartments or manufacturing plants for small products such as watches, belts etc. The thesis proposition converts the landmark building to be used at an administrative facility for the kibbutz, housing offices, conference rooms and gathering halls. On the basement level, which is half below grade and half above, the once-storage floor has been converted to a disco club for the kibbutz residents to throw a party and socialize during the weekends. On both sides of the administrative building are either market-rate apartments or studio apartments which are owned by the kibbutz enterprise and rented out to the public for additional kibbutz revenue.
Fig. 142: Section cuts.
This section is cut through several buildings in the urban kibbutz campus. Beginning on the right side (east) are the market-rate apartments above a level of retail. Moving to the left is the communal lounge for the kibbutz members where they can play pool, relax, study, read etc. Below the lounge is the kitchen, operated by the kibbutz, which provides meals throughout the week for all the kibbutz residents. Enhancing the idea of collective living, everyone is encouraged to eat together in the three-story communal dining hall which has a private terrace overlooking the public piazza. Below the dining hall is the kibbutz visitor center which provides tours for the general public and displays documentary films pertaining to the kibbutz. Cutting through the public piazza, the entrance to the vertical farms is clad in Jerusalem stone and is adjacent to the water tower which provides water for all the plants grown in the vertical farms. Lastly, at the west end of the piazza is the relocated K-5 school which has their own private courtyard for the children.
Fig. 144: Section cuts.
As we move north with the section cut, the thesis site widens. Beginning on the right (east) side are the market-rate apartments with the vehicular entrance into the two-story parking garage below. The garage is used by a variety of people such as the apartment tenants, kibbutz residents, or the general public who want to shop at the farmer’s market. The garage is owned and operated by the kibbutz. Above the parking garage is the private courtyard with kibbutz living units looking out onto the courtyard. This 100 foot wide outdoor space is dedicated primarily for the kibbutz members who can use the space for socializing, smoking hookah or nighttime bonfires. To the west of the courtyard is the atrium which is also lined with kibbutz living units. Some of these units look out onto the pedestrian retail street which is a common typology in Jerusalem and other Mediterranean cities. Also facing the pedestrian street are apartments for kibbutz families who have children and need additional space. In the inner courtyard are aquaculture tanks and the packaging plant where the food is prepared for distribution after being grown in the vertical farms.

**Fig.145: Section cut.**
Fig. 146: Section cuts.
Fig.147/148: Aerial perspective; Cutaway section cuts.
Final Design: Experiential

The series of perspectives that follow begin to capture how the urban kibbutz can be experienced from the vantage point of two different users: the visitor and the resident. The visitor may be someone who lives a few minutes away or it may be someone who has driven from a distant city to visit the area for shopping. Many of these visitors will be partaking in the public tour which takes a group of people on a behind-the-scenes tour of the urban kibbutz to locations such as the visitor center, administration building and the vertical farms growing and processing area. After the tour, people are free to visit the local vendors around the area or shop for produce in the adjacent farmer’s market. The second sets of three perspectives are views of what a kibbutz resident would experience throughout his or her day. These experiences can include the communal dining hall where all the residents eat their meals throughout the week, the private courtyard where members can relax in their own outdoor environment or the vertical farms where some of the members work growing and maintaining the plants.
Fig.149: Perspective of retail along Yafo Street. View also looks down Pedestrian Retail streets towards the Public Piazza with the water tower as a marking element.
Fig. 150: Perspective of Pedestrian Retail Street. View aiming towards Public Piazza with water tower serving as a marking element.
Fig. 151: Perspective of Public Piazza. Vertical Farm entrance to the left, Visitor Center straight ahead with Dining Hall terrace above on mezzanine level, Kibbutz Administration building to the right.
Fig.152: Perspective of Communal Dining Hall. With view up to communal lounge on second floor. Private Courtyard can be seen through curtain wall on the left.
Fig. 153: Perspective of Private Courtyard. With view into Dining Hall to the left through the curtain wall. Water tower can be seen as visual marking element.
Fig. 154: Perspective of Vertical Farm. Aquaculture tanks can be seen below on ground level with kibbutz family apartments on second and third floors sitting above retail. To the right is the main staircase kibbutz members take to get up to Vertical Farm fingers.
Kibbutz Rituals: Sleep

An important ritual which every human being does every day of their lives is sleep. People have different times they go to sleep and different times they wake up, but nonetheless it is a ritual which they perform day in and day out. Each member of the kibbutz is provided with their own personal living unit that either looks out onto the private courtyard or the pedestrian shopping street. Every two units share a bathroom which limits the amount of appliances needed and gives people the opportunity to adapt to each other and co-exist.
**Kibbutz Rituals: Work**

The ritual of working as a kibbutz member can take place in several locations. Either in the Vertical Farm as a farmer, the K-5 School as a teacher, the Visitor Center as a tour guide, the Dining Hall as a chef or the Administration Building as an office manager. These possible locations are highlighted in green below. Regardless of which location a kibbutz member chooses to work, everyone must enter the public piazza in order to reach their respective destinations resulting in a ritual which will promote the interaction between the kibbutz members and the general public.
Kibbutz Rituals: Commune

The ritual of communing is a critical chapter of this thesis for it is inherent within any kibbutz in Israel and any society that wishes to co-exist with one another. In the Urban Kibbutz, there are a series of opportunities where kibbutz members can commune (highlighted in orange below). Such places include the large communal dining hall, the lounge adjacent to the dining hall, the outdoor courtyard and several smaller, more intimate areas throughout the building. The idea of providing spaces for communing allows individuals from different cultures the opportunity to harmoniously live with one another.
Agricultural Processes: Water Collection

An important characteristic for any sustainable community is the act of collecting and re-using water that falls onto the site. Whether it falls on the ground floor or the roofs, it can be captured and distributed throughout the vertical farms. In addition to rainwater, the grey-water which comes from the showers can be filtered and used to feed the plants. The intention is for all the water to be funneled to an underground cistern in the center of the public piazza and then pumped and stored at the top of the water tower where it will eventually flow down and irrigate the plants via gravity.
Agricultural Processes: Food Growth

Focusing on the process of how food grows within each of the Vertical Farm fingers, the diagram below shows the two stages in which a plant will be placed in order to reach maturity. The first step in the life process of a plant is called germination where the seeds are placed on artificially lit shelves until they reach a certain height depending on the crop. Once the seeds have grown to a desired height, they are then transferred to the growing beds, which are naturally lit, until the crop reaches full maturity. As shown in Chapter 2: Hydroponic Systems, there are different techniques that can be used to grow food indoors.
Agricultural Processes: Distribution

Once the crops have reached full maturity they grow through a process for distribution. Labeled with orange arrows in the diagram below, at the end of every growing cycle the crops are transported from the hydroponic beds to the freight elevator where they are lowered to the processing and packaging floor below. It is at this level where the crops are cleaned, trimmed and excess materials are composted. Surplus crops can also be stored at this level in cold-storage units. Once packaged, the crops are either loaded onto a pickup truck for delivery or distributed to the local farmer’s market and produce vendors.
Programmatic Pieces: Gateway

The Gateway acts as the head of the pedestrian street that connects Yafo Street to the Public Piazza. The intimate outdoor space embraces pedestrians walking along Yafo Street and accommodates the five foot grade change. In doing so, the smaller piazza (which Italians would call *piazzetta*) consists of a series of theater-like steps allowing pedestrians to gradually ascend/descend and, in addition, provides seating for socializing and eating. There is also a handicap accessible ramp running along one of the retail facades that also allows vendors to easily transport their produce on hand trucks up and down.
Fig. 162: Detail sketch of Gateway piazza.
Programmatic Pieces: Public Piazza

As a visitor moves from the Gateway, down the pedestrian retail street they would enter into the Public Piazza. This vibrant space can also be accessed from the east and west sides via the cross-axis pedestrian street which connects Kiach Street to the *shuk* (farmer's market). This spaced can be used by kibbutz members heading to work, groups of people partaking in the Urban Kibbutz Tour Guide or local residents shopping for produce. With a fountain in the middle and terrace seating to the west of the Vertical Farm entry, this space is intended to provide a framework for a diversity of people to interact and socialize.

*Fig.163: Detail plan of Public Piazza with perspective above.*
Fig. 164: Detail sketch of Public Piazza.
Programmatic Pieces: Courtyard

This outdoor space is more meditative in nature in comparison to the Public Piazza. The stone-paved courtyard, with groves of olive trees providing shade, is framed by three facades of kibbutz living units, clad in Jerusalem stone, and a glass façade offering transparency into the communal dining hall. As seen in the perspective, the Jerusalem stone wall continues past the glass curtain wall and wraps around the dining hall before entering back into the courtyard. Activities such as communal bonfires, hookah smoking and lounging can take place in the courtyard.

Fig. 165: Detail plan of Private Courtyard with perspective above.
Fig. 166: Detail sketch of Private Courtyard.
Programmatic Pieces: Dining Hall

Centrally located in the site, the Dining Hall is the focal point of the Urban Kibbutz and the foundation for achieving a collective living environment. It is the one location in the thesis where all the kibbutz members gather for a period of time periodically throughout the day. Softly lit from east-faced skylights and a north-faced curtain wall, the three-story grand room can be flexibly used as a multi-purpose hall when the tables and chairs are stored away. As seen in the view to the left, the dining hall can be accessed from the communal lounge on the mezzanine level or from the grand staircase which connects into the spanning bridges.
Fig. 168: Detail sketch of Communal Dining Hall.
Programmatic Pieces: Water Tower

The water tower acts as a symbolic marking element for the public piazza and can be seen from several open locations in the site allowing occupants the opportunity to be reoriented. As the name suggests, this tower is a vessel for storing water that will eventually be distributed to irrigate the crops using gravity. The tower is capped by a cistern with an inverted four-sided pyramid which acts an emblematic funnel for the collection of water. As shown in the detail plan below, the Water Tower can be accessed from two levels of the Vertical Farm allowing people to enter within the thickened structural walls and receive views of the Public Piazza from an elevated level.
Fig. 170: Detail sketch of Water Tower.
Programmatic Pieces: Vertical Farm

Growing food vertically proposes several challenges and offers an enormous potential for the future of urbanism. Urban farming can be achieved at the micro scale of the residential backyard and rooftop or can be achieved at the macro scale of a 50 story skyscraper. The Urban Kibbutz proposes a model mediating these two by establishing a series of two-story fingers spaced enough to allow natural sunlight to penetrate the lowest level. As seen in the view to the left, each floor slab consists of a series of planting beds perpendicular to the south-face and levels of germination shelves on the north-face.
Fig. 172: Detail sketch of Vertical Farm finger.
Chapter 4: Conclusions

Reflections on Thesis

After ten months of thesis I can honestly say that I had a great time and a lot of fun working on it. There were definitely moments when the thesis took a pause for a couple weeks but with the help of my professors, advisors and classmates the project was able to push forward. During these ‘pause’ moments it was important for me to take a step back from the whole process and evaluate the direction I was headed. At these critical junctures, I laid out all the up-to-date work, stared at them for a couple of hours, sometimes days, and recalculated the path that the thesis was heading towards comparing where the thesis was then as opposed to several months prior. Was I staying true to my original intentions? Is the thesis solving the questions raised at the beginning of the process? These were important questions that had to be answered before being able to move forward.

Another important question that every student should ask themselves when completing a thesis is what did I learn from all of this? For starters, growing food in cities and vertically is not as easy as it sounds and requires a lot more space than expected. I'll admit that when
this thesis began I was under the impression that one can build a 50 story skyscraper, throw a lot of seeds under a lot of light bulbs and call it a day. That idea was not practical and leads me to another important lesson I learned from thesis: understanding the texture of the city/context where the thesis is taking place. The idea of placing a farming skyscraper in the middle of historic Jerusalem was a mistake from the get go and was a reality check for me that I had to delve deeper into understanding the culture and context of what makes Jerusalem special and an arbitrary skyscraper was not the answer. In fact, anything taller than 6 stories in my location seemed completely out of place. In addition to understanding context, culture is another important characteristic that I learned must be analyzed and diagramed before pushing forward with design. How people interact, commute and run their day in Jerusalem, Israel is a lot different than here in College Park, Maryland. Personal bubble space is half the size there than it is here meaning that people in Israel do not mind living closer together and do not need as much space either to function properly. This information and research was very helpful when laying out the program and would not have been possible if not for finding time to understand the importance of Place.
When reflecting back on the past ten months of thesis, the process did not go as originally planned, well what does? I set out goals for myself and expected to follow them to the point but, of course, detours occur so the process went something like this:

The pink horizontal bar represents the smooth ride that I hoped thesis would be and the squiggly line represents the actual way thesis went. The process was very cyclical in nature meaning that after pushing the design a bit forward I had to take another step back and cycle through the process again. These layers of reiteration are a necessity in the design process of a thesis.

**Fig.173: Diagram of thesis process.**
A New Hybrid

This thesis does not re-invent the architectural wheel and definitely does not discover any new typologies. Housing and the sense of shelter has been around since the beginning of mankind; modern office spaces has existed as a typology since the Industrial Revolution; retail existed long before America became a country; collective living or co-housing has been around for centuries; and vertical farming first hit the market wave in 1999, well over a decade ago. What this thesis does begin to investigate is the potential for a sustainable community that is a hybrid of all these existing typologies. With the demographics of the world’s population increasing exponentially, society needs to rethink how we make our communities in the macro scale and the micro scale. We need to start being more conscience of how we feed our population and where that food grows. Does it really make sense that people should eat food grown halfway across the earth? Though the scope of this thesis does not solve world hunger and was not designed at a scale appropriate for such, if this thesis was multiplied throughout our world and throughout our cities I would strongly argue that it can begin to address such issues. People, both in developed and undeveloped countries should
be given the tools necessary for accomplishing what this thesis proposes. In addition, the sense of collective living should not be ignored either as we develop our future communities. Many social issues that have occurred through time are caused by people not being able to co-exist. As architects, if we encouraged the sense of co-existing into our communities and provided spaces where people can learn how to commune with one another than we can begin to address current social inaccuracies. In conclusion, the Urban Kibbutz is not the solution but it is an opening for discourse where people from all disciplines should discuss the best ways that our built environment should push forward in the creation of a true mix-used community: a new hybrid.


3. Meeting with Avi Cohen (Kibbutz Nitzanim Coordinator). 6 July 2009


