Rooftop Gardens

A Green Solution to Los Angeles' Urban Problems

Noah Donnell-Kilmer
Urban and Environmental Policy
Occidental College
Senior Comprehensive Project

Executive Summary

My senior comprehensive project looks at rooftop gardens, specifically their application at affordable housing sites in Los Angeles. I partnered with Esperanza Community Housing Corporation to look into this topic, but also make useful suggestions for all affordable housing groups. Over the course of the initial research it became clear that the issue could not be addressed solely on an individual building level, but that a city-wide approach was also necessary. Thus, this report includes both a guide for affordable housing groups and a comparative case study of Seattle, Chicago, and Los Angeles' rooftop gardening policies.

The affordable housing section is a compilation of background research and interviews with local Los Angeles affordable housing organizations. Through this research I map out the challenges and benefits of rooftop gardening for affordable housing sites. From this information, suggestions are made for overcoming the challenges and maximizing the benefits. It is important to note that not all projects and housing sites are created the same, thus not all housing sites will find every piece of this report applicable. Moreover, this guide is not exhaustive and there are certainly more solutions if a groups is creative.

The case studies in this report focus on the incentive programs in Seattle and Chicago and how these programs started. Seattle's program focuses on storm-water runoff mitigation and the addition of green space in the city. Both the rooftop gardening culture and green culture in general are a result of Seattle's generally progressive population. In Chicago, the city government completed a study on the heat island effect and how rooftop gardens reduce this effect. Based on their study, the city government created a comprehensive incentives program for rooftop gardening, made possible by Mayor Daley. Finally, based on these two studies, I make recommendations for the City of Los Angeles as to how to best incorporate rooftop gardening into the city programs and codes.

Acknowledgements

I would like to thank Esperanza Community Housing Corporation for their help and direction with this study. I would also like to thank all those who were more than willing to share their knowledge on the subject. Finally, I would like to thank Professors Gottlieb and Shamasunder, without whom this would not have been possible.

Table of Contents

Executive Summary 2
Acknowledgements 3
Introduction 5
Methodology 6
Background 9
- History 9
- Benefits 11
- How to: The Parts of a Rooftop Garden 15
- Planting Media 16
- Plant Container 16
- Filter layer 17
- Drainage layer 17
- Protective layer 17
- Membrane 18
- Other Considerations 18

Affordable Housing and Rooftop Gardening 19
- Challenge: Funding 20
- Funding Options 22
- Challenge: Building Structure 23
- Challenge: Access and Security 26
- Resident Involvement 28
- Planting 30
- Benefits 32
- Analysis 34
- Recommendations 36
  - General Recommendations 36
  - Esperanza Specific Recommendations 39

City Incentive Program Comparative Case Studies 40
- Seattle, Washington 41
- Chicago, Illinois 46
- Los Angeles, California 51
- Analysis 56
- Recommendations 59

Conclusion 63
- Appendix A 64
- Appendix B 66
- Appendix C 71
- Appendix D 73

Bibliography 74

Introduction

Many may ask why I looked at rooftop gardening as opposed to traditional gardening, which is currently a more popular and viable gardening option. I wanted to study a relatively unexplored subject in the popular gardening world and try to understand where the movement is going. I partnered with Esperanza Community Housing Corporation in South L.A. to look into rooftop gardening best practices. From this research I created a guide for them to use while considering rooftop gardens at their affordable housing sites. As I researched rooftop gardening, I saw that in many cities the movement developed through support from the city governments. However, when I looked into Los Angeles' city government assistance with rooftop gardening projects, I found none. I felt like the question the question of how affordable housing sites can benefit from and build rooftop gardens could not be answered without also addressing how Los Angeles city government could incentivize and promote the process. I attempted to answer this question through background research, interviews with local and national rooftop gardening proponents, and a comparative case study of rooftop gardening codes in Seattle, Chicago, and Los Angeles.

In his book *Roof Gardens: History, Design, and Construction*, Theodore Osmundson defines a rooftop garden as, "A roof garden is any planted open space, intended to provide human enjoyment or environmental enhancement that is separated from the earth by a building or other structure. It may be below, level with, or above the ground."[1] For this study of rooftop gardens it is assumed that "rooftop garden" refers to above ground structures only. Rooftop gardens are gardens meant for people to directly enjoy and interact with. They are often modeled after the traditional on-the-ground garden but on a roof. I emphasize the use of rooftop gardens for food production, but they can be used for any type of gardening. Green roofs are another name for vegetated rooftop space, but there are two types of

1 Theodore Osmundson, *Roof gardens : history, design, and construction* (New York: W.W. Norton, 1999).

green roofs. An extensive green roof utilizes the increasingly popular thin rooftop cover of grasses, succulents, and other small plants. These are mainly used to reduce heat radiated by the roof, absorb rainwater, and insulate the building.[2] They require little maintenance and are usually used solely as roof cover. Intensive green roofs are the same as rooftop gardens; they are meant to function like traditional gardens. Intensive green roofs have a deeper growing media and are meant to grow larger plants. They can be used to grow vegetables, small shrubs, or even small trees.[3] Unless I specifically refer to extensive green roofs, the use of the term green roof in this report refers to intensive green roofs and is synonymous with rooftop garden.

Historically, rooftop gardens have been used to create green space in the built environment. Today, city planners and community members are using them to create green spaces, start urban micro-farms, teach students, provide relief for vulnerable populations, and develop "green" office buildings and "green" cities[4]. One group that can benefit from rooftop gardens are residents at affordable housing sites, because of the potential community space created by a rooftop garden. Rooftop gardens have been underutilized at affordable housing sites due to their cost and lack of information. Additionally, Los Angeles city government has not invested in rooftop gardening. In a city with 300 days of sunshine per year, and a Mediterranean climate, the potential for growing plants is under-utilized. The process of creating a rooftop garden is not easy and takes extensive planning. Although rooftop gardens can be costly, they present many benefits, which apply to the city as a whole, the individual building, and the residents. To begin the process of creating a rooftop garden it is important to look at rooftop gardening historically.

2 Ibid.

3 Rooftop Gardens Task Force of San Francisco Beautiful, *Rooftop gardens : from conception to construction* (San Francisco: San Francisco Beautiful, 1997).

4 *Green Roofs and Rooftop Gardens*, Brooklyn Botanic Garden Guides for a Greener Planet handbook #198 (Brooklyn, NY: Brooklyn Botanic Garden, 2012).

Methodology

To inform myself about the topic, I started my research by looking at the general history of rooftop gardens. I used journal and newspaper articles, books, and pamphlets to gather this information. From there I narrowed my searches to specifically focus on modern applications, Los Angeles, affordable housing sites, and Los Angeles and affordable housing sites. Most of my sources were books and gardening pamphlets. However, I also consulted journal articles, audio transcripts, and newspaper articles. Through this research, I noticed a gap in the scholarly information available about rooftop gardens at affordable housing sites, especially in Los Angeles where there is a lack of a program. Much of the information available specifically on Los Angeles was news articles about Skid Row Housing Trust's rooftop gardens.

This research led me to find literature on how to actually implement a rooftop garden. It is essential to understand exactly what implementing a rooftop garden entails if I am going to promote their development around Los Angeles and identify their benefits to affordable housing sites. These sources were mainly books and pamphlets from botanical societies detailing the steps for creating rooftop gardens. The information is available in the background section of this paper.

This study compares the three cities of Chicago, Seattle, and Los Angeles and how their governments address rooftops spaces. I chose Seattle and Chicago as my case studies, because, along with New York, they are known for their rooftop gardens and progressive policies in the field. I based this decision on background research, which shows that city leaders in Seattle and Chicago have become leaders in bringing about substantial change through their rooftop policies and incentives. I interviewed Laura Raymond of Seattle P-Patch, which is a branch of the Seattle Department of Neighborhoods and deals specifically with community gardening. I also consulted the city website, looking specifically at their storm-water runoff policies and green building ordinances. As the national leader in green roofs, Chicago has much documentation of their green roofs on both private and public

websites. I looked at both city incentives and city reports about green roofs. In Los Angeles, I spoke with Rene Rodriguez and Raeven Flores of Abode Community Housing, who have worked with rooftop gardening in Los Angeles. I also consulted a 2006 report by the now defunct Los Angeles City Environmental Affairs Department, which advocated for extensive green roofs in Los Angeles. Despite being three regionally, demographically, and physically different cities, I believe that Chicago and Seattle can provide valuable lessons and suggestions for Los Angeles.

As my research focuses on rooftop gardens at affordable housing sites, I am partnering my research with Esperanza Community Housing Corporation. This non-profit affordable housing group is looking into placing rooftop gardens on a few of their buildings. However, they are in the very first steps of the process. I worked with them to develop some criteria as a basis for my research and developed a survey for them to pass out to building residents to gauge resident interest. In addition, this report will help them determine if and how to move forward with a rooftop gardening project.

My final method is interviews with people connected to affordable housing and rooftop gardens in Los Angeles. My first interview was with Ernesto Espinoza of East Los Angeles Community Corporation. They considered rooftop gardening at two housing sites, but did not go through with the projects. After speaking with Ernesto, I met with Jayne Torres of Ur-Bin gardening. Ur-Bin partnered with Skid Row housing trust to build a garden at the Cobb apartment complex downtown. This was one of the few functioning rooftop gardens at an affordable housing site that I was able to find in Los Angeles. I would like to learn more about their process, benefits, and challenges on the project. Next I briefly interviewed Francesca de la Rosa, director of policy and strategic alliances at WORKS. WORKS researched putting a rooftop garden at one of their affordable housing sites, but ultimately did not follow through on the project. My final interview was with Rene Rodriguez and Raeven Flores, architects at Abode Communities. Abode develops and builds large affordable housing developments around Los Angeles, a number of which have rooftop gardens.

Background

History

Rooftop gardens' cultural significance stretches back for millennia starting with the Mesopotamians[5]. They built the most famous ancient example of a rooftop garden: The Hanging Gardens of Babylon. These early historical rooftop gardens were for kings and simulated nature. They were stand-alone buildings with multiple terraces containing the plants and trees. Rooftop gardens remained a luxury reserved for the wealthy throughout early history. Roman leaders adopted rooftop gardens as a way to bring nature into their cities and stay connected to their agrarian roots[6]. Examples can also be seen in medieval times, when churches were the only buildings structurally able to support the weight of a rooftop garden. Many large buildings from the Italian Renaissance placed gardens on rooftop piazzas to serve as an oasis and beautify their building[7].

However, Norwegians were the first to popularize the use of rooftop gardens. Homes in the countryside of Norway used sod to cover their roofs. They built a traditional roof, covered it with birch bark to waterproof it, placed a layer of twigs on this, and finally cover everything with sod.[8] Many of the benefits they gained from it, such as increased roof life, building insulation, and improved waterproofing, are the benefits associated with modern rooftop gardens. Norwegians brought this rooftop gardening practice to America. Many of them immigrated to the mid-West, where they continued to use their traditional sod covered roofs on their new houses. However, Germany championed the modern, urban interpretation of the ancient art of rooftop gardening to reduce urban

5 Osmundson, *Roof gardens*.
6 Ibid.
7 Ibid.
8 Hanson, *Breaking Through Concrete*.

heat and storm water runoff. Germany started by placing gardens on the roofs of most of their new buildings and they provide a model for cities around the world[9]. Although not the champion of rooftop gardens, America has had many successful examples of rooftop gardening.

Although short, America's rooftop gardening history provides some prime examples. One of the first examples of widespread rooftop garden use was in New York in the late 19th Century. Enterprising theater owners attempted to recreate Paris' outdoor garden theaters on the roofs of their buildings for summer use[10]. This was a lucrative businesses plan, until modern technology could cool indoor theaters so they could operate year round. Although it eventually failed due to advances in indoor cooling technology, the theaters were a start for rooftop gardens and got developers thinking about spaces above the buildings.

However, it was not until the mid-20th century when architects like Frank Lloyd Wright and Le Corbusier truly adopted the rooftop garden as a design technique[11]. Their designs attempted to put the traditional public garden complete with pathways, flowers, shrubs, water fixtures, and animals on rooftops. Presently, the rooftop garden has taken a more utilitarian approach. As the local food movement grows, enterprising groups are taking advantage of rooftop space to produce food in cities. Additionally, as cities attempt to become greener, many local governments utilize rooftop gardens because of their multiple benefits. Under Mayor Richard M. Daley, Chicago borrowed ideas from German cities to create a rooftop garden incentive program[12]. They created a rooftop garden on the roof of city hall and conducted studies with the U.S. Environmental Protection Agency to gauge the benefits, resulting in an incentive program[13]. Although many cities have been embracing the push for more rooftop gardens, the movement is still in the budding stages.

---

9 Ibid.
10 Osmundson, *Roof gardens*.
11 Ibid.
12 Margolin, “Design for a Sustainable World.”
13 “ANALYSIS.”

Los Angeles' history with rooftop gardens is still in its infancy. Recently, there has been a push by a few organizations to create more rooftop gardens in Los Angeles. One of these organizations is *Farmscape*, which is a California wide group that recently began operations in Los Angeles. Their famous project in Los Angeles is a rooftop garden at the California Club, with the produce grown in the garden going to the club's kitchen.[14] There have also been a few examples of individuals in Hollywood taking over the rooftops of their apartment buildings and creating their own urban oasis[15]. Finally, Skid Row Housing Trust created a rooftop garden at their Cobb Apartment building with the help of Ur-Bin[16]. The residents grow vegetables on the roof to supplement their diet. Rooftop gardens are beginning to catch on in Los Angeles, but they have a long way to go before LA can compare to other US cities, like Chicago, Seattle, Portland, and New York, boasting rooftop gardening programs.

Benefits

Creating a rooftop garden results in many benefit, both on the macro-citywide level and micro-building wide level. The benefits on a macro level are: reducing storm-water runoff, reducing the heat island effect, pollution particulate reduction, the potential for urban food ecology, and the return of wildlife to the city[17]. Rooftop gardens are naturally very private spaces. They cannot be seen from the streets and are usually only accessible by residents of the specific buildings. As a result, most of their benefits are building specific. These benefits are: reducing heating and cooling costs, extending roof surface life, not having to search for a new space (as is the case with traditional community gardens),

14 "From Rooftop To Fork: Downtown L.A. Club Grows Its Own Greens: LAist."
15 Bowen, "EMERALD CITY."
16 "A Roof Full of Vegetables at the Cobb Apartments on Skid Row."
17 NPR, "ANALYSIS: ENVIRONMENTAL PROTECTION AGENCY EXPERIMENTS WITH ROOFTOP GARDENS AND OTHER CHANGES TO TRY TO BRING DOWN THE TEMPERATURES IN CITIES," November 29, 1999, http://0-search.proquest.com.oasys.lib.oxy.edu/socialsciences/docview/189956062/1395F32CB4D453EB47E/1?accountid=12935; *Green Roofs and Rooftop Gardens*, Brooklyn Botanic Garden Guides for a Greener Planet handbook #198 (Brooklyn, NY: Brooklyn Botanic Garden, 2012).

serving as a social space for community members to gather, an outlet and hobby for residents, a cultural activity, and promoting healthy eating[18]. In addition, there are benefits specific to gardening on a rooftop, which are: fewer weeds growing and full sun[19]. There are many benefits to rooftop gardens, and as urban ground-level gardening space disappears under development, we should look rooftops for our green space.

Rooftop gardening proponents dream of one day flying over urban areas and seeing a patchwork of green rooftops[20]. Although we are very far away from realizing that dream, there are many reasons that we should strive for this goal. On a city wide level the benefits are clear. One of the primary benefits touted and researched by the EPA is the reduction of the heat island effect[21]. Currently most of the roofs in cities are flat and covered by waterproof tar sealant. Like asphalt roads, these roofs absorb the sun's heat and radiate it back into the surrounding atmosphere[22]. Studies have shown that this heat island effect can raise the temperature in a city by up to five degrees[23]. In a city like Los Angeles, where temperatures rise well into a hundred and above in late summer, decreasing this heating effect would be beneficial. Rooftop gardens cover up the tar and are constructed of materials that do not radiate heat. Plants add to the cooling factor by releasing water through a process called evapotranspiration. Additionally, plants provide the added benefit of reducing CO2 levels in cities[24]. Roofs can also create storm water run-off problems for cities. Water collects on the roofs and then spills down into storm drains, which is a problem because it wastes our rain water, floods the drains, and increases storm-water discharges.[25] Rooftop gardens absorb the rainwater, making the plants happy and reducing the need to water them, while also reducing the flow into the storm drains.

---

18 Ibid.; Rooftop Gardens Task Force of San Francisco Beautiful, *Rooftop gardens*; Hanson, *Breaking Through Concrete*.
19 Ibid.
20 "ANALYSIS."
21 Ibid.
22 Ibid.
23 Ibid.
24 Ibid.
25 *Green Roofs and Rooftop Gardens*.

In Los Angeles, where water is a critical resource, any projects that can help effectively utilize the little rainwater received, should be considered seriously. Los Angeles' storm-water discharge systems deal with rain poorly, so rooftop gardens could help change this problem. The above solutions to urban problems are concrete benefits to implementing rooftop gardens in cities, but there are also potential benefits that depend on how much a city is willing to put into a rooftop gardening program.

The long term benefits of intensive rooftop garden proliferation are very exciting in their potential for cities. One amazing potential benefit of intensive urban rooftop gardens is the creation of a comprehensive urban food system. Based on the current rooftop garden projects around the country, it is possible to create an expansive urban food system on rooftops. For example, the Brooklyn Grange is a large urban rooftop farm in New York City that sells produce to restaurants and markets, while boasting a CSA for community members[26]. The Grange is located on a 2.5 acre rooftop above apartments and a restaurant, yet it produces enough food to feed many community members. Imagine what a city full of roofs like this could produce. Granted there are logistical issues to work out, but there is potential to localize urban food through rooftop gardens. Another potential benefit of rooftop gardens in urban settings is the return of wildlife to the city[27]. Obviously these would not be deer or coyotes, but rather birds, bees, butterflies, and insects, along with any chickens, rabbits, or other animals that are raised[28]. While some are more beneficial than others, the return of wildlife to the city creates a pleasant atmosphere and is representative of a healthy city. Although these benefits are long term, the potential of rooftops gardens to revolutionize a city on a macro level is no less exciting.

On an individual level, buildings also reap many benefits through installing rooftop gardens. Like the reduction of the heat island effect, rooftop gardens also carry benefits for the insulation of

26 Hanson, *Breaking Through Concrete*.
27 *Green Roofs and Rooftop Gardens*.
28 Ibid.

buildings[29]. The extra layer on the top of a roof helps insulate the building, meaning lower heating and cooling costs, resulting in less energy use. In a city like Los Angeles where air conditioning is a major cost for building owners, it makes economic sense to add rooftop gardens. Adding a rooftop garden to the building extends the rooftop surface's life, which is counter intuitive, because it retains water longer keeping it near the surface[30]. The garden covers the surface of the roof, protecting it from sunlight, thus slowing down the deterioration of the roof. Additionally, the soil captures rain water, reducing the amount of standing water accumulating on the roof. Extensive water accumulation can lead to damage, and eventually leaks.[31] One of the greatest benefits of building on a roof is that the "land" is already owned. Thus, unlike a traditional community garden, there is no need to look for new open space. Also, if the rooftop garden is being created by the owners of the building, they have control over the space as opposed to traditional community gardens which are usually owned by outside parties. Even if the rooftop is not being created by the building owners, the space can be leased for the express cause of rooftop gardening. While the benefits for the building are financially enticing, it is the benefits to the residents of the building that are most important.

Rooftop gardens can be an oasis in a desert of concrete, whether they are for growing food or aesthetics. An example of an oasis is the Via Verde affordable apartments in the Bronx, New York. The residents planted a flower garden complete with foot paths and benches for people to sit on. Both residents and staff members at Via Verde use the space as an escape from busy city life.[32] Thus, their rooftop garden can serve as a pleasant space for community members to gather. Similarly, rooftop gardens can provide residents with a hobby, which can also be an escape. Many studies claim that

29 Osmundson, *Roof gardens*.
30 *Green Roofs and Rooftop Gardens*.
31 Ibid.
32 Ibid.

gardening is a therapeutic hobby, making it especially valuable at affordable housing sites[33]. Often low income residents face stressful situations, thus having a therapeutic hobby can help improve their lives. In a city like Los Angeles which is immigrant rich and culturally diverse, gardening can be a part of residents' cultural heritage[34]. By moving to an urban area, many people lose their ties to cultural activities, especially gardening. Providing residents with a space to garden can help keep cultural traditions alive and grow a sense of community. Finally, growing fruits and vegetables can promote healthy eating in the community[35]. In many areas of the city, fresh, affordable fruits and vegetables are not available, especially in low income communities. Growing fruits and vegetables not only provides residents with healthy food, but may also prompt them to demand healthy foods from local stores. Although rooftop gardens have many benefits for cities, the local benefits for residents of the buildings are the greatest argument in rooftop gardens' favor.

As always, there are many challenges to overcome before reaping the benefits of rooftop gardens. These challenges include the cost of the garden, which can be high or low based on the type of garden, quality of the garden, building structure, roof access, and materials used. However, one of the first challenges for most is understanding the process of building the garden and the components of a rooftop garden.

33 Hanson, *Breaking Through Concrete*.
34 Ibid.
35 Ibid.

How to: The Parts of a Rooftop Garden

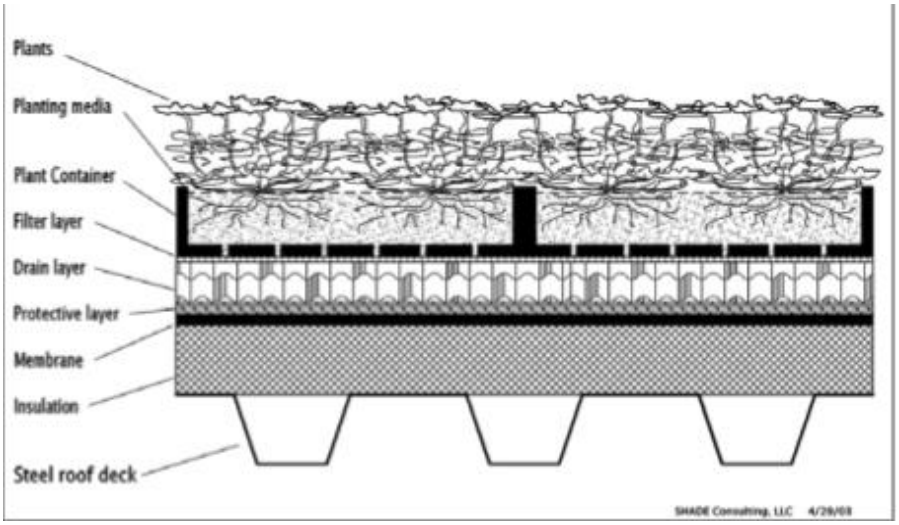

Figure 1. Extensive Garden Cross Section: This cross section depicts all of the layers needed for an extensive rooftop garden. The only change necessary for an intensive project is a deeper planting media of 6"-8". [36]

Planting Media

Planting media is another name for the soil used in the garden. This is the most important component of the garden, because healthy plants require good soil. However, it can also represent the greatest weight of the garden. Soils run on a spectrum between heavy clay soils and light sandy soils. Depending on garden location the loamy soil in the middle of the spectrum is usually best for growing.

36 Christopher Wark and Wendy Wark, "Green Roof Specifications and Standards: Establishing an Emerging Technology," *The Construction Specifier* 56, no. 8 (August 2003): 12.

Clay soils retain water very well making them very heavy over time, which can overwhelm plants. Sandy soils do not retain water and thus are poor for growing plants and also would not reduce storm-water runoff. For a rooftop garden where the weight needs to be kept to a minimum, a slightly sandy loam is desirable. This is a balance of a light soil with most of the nutritious, water-retaining properties of loams. Soil can weigh up to 100 pounds per square foot when wet, thus it is important to strike a balance of light, but nutritious soil.[37]

Plant Container

Plant containers are necessary to rooftop gardening, because the soil must be retained.Because the soil is an addition to the roof surface, it is above grade, unlike soil in a traditional ground garden. Without retention, soil will flow off the rooftop when it rains, drains will become blocked, and the garden will be ruined. The plant container of the rooftop garden is an aspect where creativity leads to solutions to weight issues. Many traditional materials used for raised beds or terrace retention can be heavy. This is not to say that raised beds are not a good option, but there are some easier ways to build the garden. One of the best ways to make plant containers is to repurpose other containers. Crates, barrels, buckets, and boxes are a few examples of possible containers, but the options are only limited by creativity.[38]

Filter layer

The filter layer is meant to retain the soil and plant particles, while letting the water permeate to drain. This layer is very important, because it retains the soil and keeps the drain unclogged. The filter is usually a special fabric made of strong materials, but still able to pass water easily. The filter layer must line the entire bottom of the bed and continue up the container wall at least 8 inches to prevent

37 Laura Raymond, Seattle P-Patch, February 27, 2013.
38 Jayne Torres, Skid Row Housing Trust and Ur-Bin, February 19, 2013.

soil from slipping through. The filter should be non-biodegradable and non-fabric. Common synthetic filters can be found in hardware stores at low cost.[39]

Drainage layer

The sole purpose of the drainage layer is to remove excess water from the roof. After water is filtered, it moves to the drainage layer. This layer is usually a series of channels under the filter level, angled at 1.5 degrees to transport excess water off the roof surface. If the roof slope is great enough, a drainage layer may not be necessary, but it is still highly encouraged because it removes water quickly.[40]

Protective layer

The protective layer of the rooftop garden protects the membrane from roots and is comprised of either copper sheeting or a thick polyester coating. As a garden grows, plants expand their root systems and if the roof membrane is not protected, they can damage the surface and cause leaks. To avoid this problem, gardeners should be careful when planting plants with large tap roots. Although the protective layer is not considered a requirement for a rooftop garden, it is recommended to avoid future roof problems.[41]

Membrane

The membrane is already a part of the roof surface, but should be replaced when the rooftop garden is built. This membrane, often made of asphalt on older buildings, is the waterproof layer of the roof. In terms of building structure, this is the most important as it prevents leaks into the units below. Technological advances have produced lighter, more affordable options to asphalt roofing.

---

39 Allan Wingfield, "Greenroofs101: Filter Fabric," 2013, http://www.greenroofs.com/Greenroofs101/filter_fabric.htm.
40 Allan Wingfield, "Greenroofs101: Drainage," 2013, http://www.greenroofs.com/Greenroofs101/drainage.htm.
41 Allan Wingfield, "Greenroofs101: Waterproofing," 2013, http://www.greenroofs.com/Greenroofs101/waterproofing.htm.

Traditionally, membranes should be replaced every 10-15 years, so coinciding replacement with rooftop garden creation saves time and money. Also, the new rooftop garden extends the membranes life to 20-30 years.[42]

Other Considerations

Above are just the components of a rooftop garden, but there are other considerations and steps that go into creating a successful rooftop garden. The primary consideration is the roof itself and its ability to hold a garden. Roofs are built to hold only a certain amount of weight, usually around 30-40 pounds per square foot[43]. Often rooftop gardens, and the foot traffic they bring, present a weight greater than this amount. Thus it is important to fully evaluate the roof's load bearing capacity before moving forward. Secondly, access is another concern, especially when attempting to grow food on a roof. Not all buildings have roof access, which is necessary for a rooftop garden. Building roof access can be costly, and thus is a major factor in the decision to build on the roof. Finally, safety is a major concern, as rooftops are dangerous places due to their height. Placing a fence or barrier around the roof's edge will make it secure, but can also take away from the aesthetics of the space[44]. Before creating a rooftop garden, it is important that an organization considers all of the factors, steps and commitments that go into cultivating a rooftop garden.

Affordable Housing and Rooftop Gardening

Rooftop gardening at affordable housing sites presents a number of unique challenges on top of the already challenging aspects of rooftop gardening, but there are also unique benefits. From a

42 Ibid.
43 Chicago Department of Environment, "A Guide to Rooftop Gardening" (The City of Chicago, 2003).
44 Rooftop Gardens Task Force of San Francisco Beautiful, *Rooftop gardens*.

development perspective, affordable housing developers have limited resources at their disposal. This does not mean their work is not valuable, rather compared to luxury developers they have less access to funds, desirable land, and often receive grants that constrain projects[45]. All of these aspects of affordable housing development make the already difficult rooftop gardening process even harder. However, a location in less desirable areas means that there is often less open space, less fresh food access, and park security issues[46]. All three of these issues can be addressed by rooftop gardening. Specifically looking at the areas around Esperanza's affordable housing sites, which are all located in the USC-South Downtown Los Angeles area, there is a distinct lack of open green space and a notable lack of healthy and fresh food options, and it represents one of the more dangerous areas of the city[47]. Thus, Esperanza residents could greatly benefit from rooftop gardening. However, before moving forward with a project, there are steps and specific issues that need to be assessed.

Challenge: Funding

The first challenge that a rooftop garden faces for any development is finding the funds for the project. Compared to a traditional black rooftop surface, the cost of a rooftop garden can be high, although costs will vary from site to site based on the attributes of the building. According to the Los Angeles Environmental Affairs Department's 2006 report, for a retrofit in Los Angeles the roof costs $15-$20 per square foot for a green roof, which lasts 35-40 years and $5-$15 for a conventional roof, which lasts 15-20 years. While a new roof in Los Angeles will cost $10-$15 for a green roof, which

45 Ernesto Espinoza, East Los Angeles Community Corporation, February 6, 2013.

46 Laura J. Lawson, *City Bountiful a Century of Community Gardening in America* (Berkeley: University of California Press, 2005), http://0-site.ebrary.com.oasys.lib.oxy.edu/lib/occidental/Doc?id=10076810.

47 "'Food Desert' Oases: Converting Corner Stores into Healthy Neighborhood Markets in South L.A. (Part I in a Series) | Streetsblog Los Angeles," accessed April 18, 2013, http://la.streetsblog.org/2012/07/27/food-desert-oases-converting-corner-stores-into-healthy-neighborhood-markets-in-south-l-a-part-i-in-a-series/; "Dear Santa: The 50 Parks Initiative Is Great, but Please Bring South L.A. Some Green Space for Christmas | Streetsblog Los Angeles," accessed April 18, 2013, http://la.streetsblog.org/2012/12/20/dear-santa-the-50-parks-initiative-is-great-but-please-bring-south-l-a-some-green-space-for-christmas/; "Violent Crime Ranking - Mapping L.A. - Los Angeles Times," accessed April 18, 2013, http://projects.latimes.com/mapping-la/neighborhoods/violent-crime/neighborhood/list/.

lasts 35-40 years and $3-$9 for a conventional roof, which lasts 15-20 years. Annualized, green roofs still cost much more than conventional roofs.[48] These include improving roof access, assessing load bearing capacity, adding sound proofing, stagnant water management, and duct placement. Some of these building aspects may need to be adjusted based on the specifics of the project and the building[49].

When asked about their approach, East Los Angeles Community Corporation property manager Ernesto Espinoza said that the cost of the projects ultimately outweighed the potential benefits[50]. They looked into both retrofitting an existing building and incorporating a garden into a new development, but decided against the project in both instances. With the retrofit, access to the roof was a major obstacle, as the project required adding to their existing elevator and staircase. The cost for these adjustments was too high for the project to move forward, along with other obstacles that will be discussed in later sections.[51] When asked about projects costs, Rene Rodriguez and Raeven Flores of Abode Communities said that many of the affordable housing groups they work with balk at the up-front cost of rooftop gardening, which are significantly greater than that of a normal roof surface. They emphasized the additional cost of hiring an engineer to examine the roof as a necessary step to determine whether a roof is able to bear the extra weight of a garden and where the weight can be placed.[52] There is potential for high up-front costs before even starting to build the garden infrastructure. However, based on the benefits cited in prior research, these costs are often recouped in rooftop membrane replacement, energy efficiency, and heat and air conditioning use over the lifetime of the roof.

There are also the infrastructure, tool, and plant costs of creating an actual garden. For intensive

48 Environmental Affairs Commission, "Green Roofs-Cooling Los Angeles: A Resource Guide" (City of Los Angeles, 2006).
49 Osmundson, *Roof gardens*.
50 Espinoza, East Los Angeles Community Corporation.
51 Ibid.
52 Raeven Flores and Rene Rodriguez, Abode Communities, March 5, 2013.

gardens it is better to use a container to restrain the soil, and keep the garden in designated areas.[53] Containers can range from traditional raised beds to repurposed materials. Containers are one-time costs for the start-up of the garden and contribute to sustainability. An often overlooked challenge and potential extra cost for rooftop gardening, especially in Los Angeles, is the need to irrigate the garden. I will touch on the options for irrigation in later sections, but it is important to recognize that unless there is already watering infrastructure available on the roof, improvements will need to be made. No matter how active residents will be in the garden, tools are necessary for the upkeep of any rooftop garden. The same tools required for gardening on the ground apply for gardens on the roof. Although not cheap, tools, if taken care of properly, can be a long-term investment for the garden.

Jayne Torres, who works with Ur-Bin gardening in downtown Los Angeles and helped create the rooftop garden at Skid Row housing trust's Cobb Apartments, said gardening organizations were willing to donate soil, seeds, and starts. Additionally, she applied for small grants from hardware stores, like Lowes and Home Depot, to receive the necessary gardening tools. She also received a soil donation from Whole Foods.[54] Clearly people are willing to help a project that goes towards a good cause, but it is important to be smart about the use of materials on a project. In speaking with Laura Raymond of Seattle P-Patch, she said that at Seattle's UpGarden, due to weight constraints on their roof, they had to be creative about their set up of the garden. This creativity led to lower costs on the project overall. One of her recommendations was to reuse materials that might already be containers, like old barrels or boxes, or repurpose materials to create containers.[55]

Funding Options

As an affordable housing group, it is important that Esperanza weigh the costs and potential benefits of a rooftop gardening project before moving forward. It is challenging for an affordable

53 Rooftop Gardens Task Force of San Francisco Beautiful, *Rooftop gardens*.
54 Torres, Skid Row Housing Trust and Ur-Bin.
55 Raymond, Seattle P-Patch.

housing group to have the necessary funds upfront, but there are ways in which these groups can access funding and plan into the future. As outlined later in my recommendations to the city of Los Angeles, there is potential for the city to incentivize the process, making it more affordable for affordable housing groups. These incentives could be tax deductions, partnerships with other governmental organizations for rebates, or zoning relaxations, among other possibilities. Los Angeles could give businesses and housing developers special tax breaks based on meeting certain rooftop gardening requirements. One possible partnership is with the DWP to reduce storm-water runoff as there are fees in place that could be rebated. Possible zoning relaxations could be allowing developers to add an extra floor to the plans or relax parking requirements. There are many ways the city of Los Angeles can help mitigate the costs of rooftop garden development, but they have yet to be fully explored.

There are also grants available both on a national level and in the state of California for green projects [56]. Some national grants include: Enterprise Green Communities grant which is specifically meant for affordable housing groups to green their communities; and Home Depot Building Healthy Communities that is given to nonprofits three times a year to improve their communities[57]. In California, grant opportunities include: low interest loans from the California Energy Efficiency Financing though slightly a stretch, for the energy efficiency benefits of rooftop gardens[58]. The Strategic Growth Council of California offers Urban Greening Grants which provide large grants to all types of greening projects around California[59]. Additionally, there are a number of government databases available to the public online, that detail grants, both government and foundation based, from

56 The Strategic Growth Council, "Strategic Growth Council - Urban Greening Grants (Round 2)," April 11, 2013, http://www.sgc.ca.gov/urban_greening_grants.html.

57 "Funding Opportunities | Green Building |US EPA," accessed April 17, 2013, http://www.epa.gov/greenbuilding/tools/funding.htm#state.

58 Extensive green roofs have energy efficiency benefits because they cover the whole roof, while rooftop gardens often do not cover the entire surface.

59 The California Energy Commission, "Energy Efficiency Financing," accessed April 17, 2013, http://www.energy.ca.gov/efficiency/financing/index.html; The Strategic Growth Council, "Strategic Growth Council - Urban Greening Grants (Round 2)."

the local to national level. Links to these resources can be found in Appendix A. I found these grant opportunities through a limited search and there are likely others out there. If an organization is committed to a rooftop gardening project, some effort should be devoted towards looking into grants and applying for them.

Challenge: Building Structure

After funding considerations, the next determining factor for a rooftop gardening project is the structure of the building. A rooftop garden adds a large amount of weight to a building, as there are both live and dead loads that could be involved. Buildings roofs have a certain load bearing capacity based on their original construction, and some are not well suited to hold a rooftop garden. Therefore, the structure of a building is a determining factor in the rooftop gardening process. Not all buildings are created equal, as building codes vary from region to region. Additionally, different materials have been used over time in buildings, resulting in differences in load bearing capacity based on location. If the load bearing capacity of a roof is ignored and extra weight is placed on a roof, the result is cave-ins and costly damage, especially at a residential site.

To determine the ability of a roof to hold a rooftop garden, one must look at the building's original plans. The plans have information regarding the load bearing capacity of a roof. However, reading plans and determining the necessary information requires a professional. Both Rene and Raeven from Abode Communities and Jayne from Ur-Bin recommended working with a structural engineer to determine if a building's roof is suitable for a garden[60]. Although this is another added cost, it negates any potential liability for building a garden on an unsound roof and also ensures the job is done properly. Additionally, an engineer can tell where the roof might be stronger or weaker, based on

60 Flores and Rodriguez, Abode Communities; Torres, Skid Row Housing Trust and Ur-Bin.

the materials used to construct the roof and where the rafters are located. Engineers can also recommend how to deal with ducts, sound proofing, and material use.[61] The materials used on a rooftop garden are very important because selecting wisely can reduce the amount of weight on the roof.

While dirt may seem like a light and airy substance, when concentrated in beds it can represent a significant amount of weight. According to studies, one square foot of wet soil weighs 100 pounds. If there are just four 6x4 raised beds on a roof covering 96 square feet, there is an added 9600 pound dead load when the soil is wet. Additionally, because the soil retains water better than a conventional roof, this weight is concentrated on the roof surface for a longer period of time. In general, a conventional roof is rated to hold between 30-40 pounds per square foot.[62] Despite this being significantly less than the 100 pounds for wet soil, strategies to offset this disparity can be found in the planting media section of this report.

If a rooftop garden is a space for the community to gather and garden, live loads must be considered along with dead loads when looking at the structure. Adding people to a rooftop space adds another dimension of difficulty to the project, because people's size is variable. With extensive green roofs, it is easy to have a low maintenance garden that requires fewer people be on the roof less often[63]. However, if this is the case, these spaces cannot be gathering places or intensive gardens. Most roof surfaces are not meant to bear frequent heavy foot traffic aside from occasional surface maintenance. Increased foot traffic leads to roof degradation, resulting in leaks and costly repairs[64]. Thus changes to the roof surface must be made for a rooftop garden. Like many of these changes, creative solutions can help lower these costs. An additional, and often overlooked, structural challenge associated with rooftop gardening is the sound proofing requirements for a roof. These are especially important for

61 Flores and Rodriguez, Abode Communities.
62 Chicago Department of Environment, "A Guide to Rooftop Gardening."
63 Wark and Wark, "Green Roof Specifications and Standards: Establishing an Emerging Technology."
64 Environmental Affairs Commission, "Green Roofs-Cooling Los Angeles: A Resource Guide."

residential buildings where there will be people living directly below the roof.[65] Finally, there are code requirements that deal with access to the roof based on the structure of the building. These will be discussed in the section about roof access.

Solutions to all of these problems are available, unless the roof is deemed unable to hold a live load at all. Intensive vegetable gardens require much more maintenance than extensive cover gardens. However, some strategies used to decrease maintenance can also be used on intensive gardens. One of these strategies is to use an automatic drip irrigation system to water the plants[66]. This negates the need for people to be on the roof daily. Coupled with a drip irrigation system, setting up designated gardening days and setting a roster of residents with access to the roof can reduce the number of people on the roof, and thus the live load. A possible solution for roof degradation from increased foot traffic is to create some type of barrier or pathway system for people to step on when working on the roof. At Abode Communities housing development in Glassell Park, Abode used a light weight cement platform to hold their garden, thus negating direct contact with the roof[67]. This extra layer also dealt with the issues surrounding the need for increased sound proofing as it kept gardeners from directly walking on the roof and absorbed the sound of their steps. Another possible solution for the sound proofing issue is to add more insulation to the roof, which will deafen the added steps on the roof. Increasing insulation has the added benefit of keeping the building cooler in the summer and warmer in the winter.[68]

Challenge: Access and Security

One of the greatest challenges for a rooftop garden is access and security. A rooftop garden is meant to be a community asset, but can be a major liability because of the dangerous height of

65 Flores and Rodriguez, Abode Communities.
66 M. J. Darnall, *Roof Gardening on a Grand Scale*, 1991.
67 Flores and Rodriguez, Abode Communities.
68 Wark and Wark, "Green Roof Specifications and Standards: Establishing an Emerging Technology."

rooftops. Thus, a balance must be struck between the accessibility of a rooftop garden and the security measures needed to keep residents safe. Access also has issues due to fire codes and costs. Safety can be a limiting factor because the proper measures can take away from the aesthetics of the garden and even reduce resident. These two issues are extremely important to affordable housing groups and have been dealt with in different ways by different groups.

Roof access is both a concrete and abstract issue when considering a rooftop garden, especially for a retrofit. The primary concern for roof access is simply if the roof is accessible at all. There are probably stairs or another means of accessing the roof, but this might not be adequate for the type of space desired for a rooftop garden. According to Los Angeles Municipal Code, which is used by the Fire Department, the maximum occupancy for a space before it requires two entrances is 49 occupants[69]. This is good news for a small housing development with a small garden, because it is rare that a small community garden will get 49 people working on it. However, if more than 49 people are expected to be using the space, a second exit is required. That requirement, as discussed earlier, is costly to build if not already available. When looking to build a rooftop garden, ELACC encountered problems with Fire Department requirements requesting they have two exits. Their garden was going to be more of a community gathering space, so there could possibly be more people on the roof.[70]

Equity is another issue to consider when determining rooftop garden access. There may be elderly or handicapped residents in the building who would enjoy and benefit from working in the garden but are restricted by inadequate access. For this reason, it is helpful to have access by elevator, but depending on desired accessibility it is not essential. Additionally, access to a rooftop might be only available by ladder or another difficult means, in which case this will not be up to Municipal Code and stairs will need to be extended. A more general issue to think about when working with rooftop gardens

69 Department of Building and Safety, "Los Angeles Municipal Code" (City of Los Angeles, n.d.).
70 Espinoza, East Los Angeles Community Corporation.

is who will have access to the garden and when will the space be open to residents. At Skid Row Housing Trust's Cobb Apartments, the rooftop, along with the garden, is open to all residents of the building at all times[71]. As this is also a security issue, I think that the amount of access available to residents is a subjective matter to be determined on a building to building basis.

The potential liability of an insecure rooftop garden can be very high, meaning potential high costs for a building owner. The roof of a building is the most dangerous place on a building because it is so far off the ground and is generally insecure. If a roof is not secure there is a high possibility that accidents might occur, especially when there are many people doing work on the rooftop. Sadly, there is a distinct possibility of people throwing themselves off the roof if given the chance.[72] For both of these reasons, rooftop security is a chief concern for building developers. There are a number of strategies available to address the security issue for a rooftop garden. One option is to limit who can access the building's roof, which creates accountability for who will be on the roof. This will keep people from both accidentally and intentionally falling off the roof. It also negates the possibility of vandalism and theft from the garden, as those with access will be the gardeners themselves.[73] However, if a rooftop garden is meant to be a community space, limiting who has access to the roof limits the communal aspect of the space. It is important to determine whether the purpose of the rooftop garden is for the whole community or for gardeners only before setting up security measures. A traditional security method at most rooftop gardens is creating a fencing barrier around the perimeter of the garden. Ernesto Espinoza of ELACC mentioned that placing a fencing border around a rooftop garden can "make a warm, community space feel more like a cage[74]." This is a major concern, because if the space is not inviting, people are less likely to use it. There are fencing options that create a better space

71 Torres, Skid Row Housing Trust and Ur-Bin.
72 Espinoza, East Los Angeles Community Corporation.
73 Darnall, *Roof Gardening on a Grand Scale*.
74 Espinoza, East Los Angeles Community Corporation.

and can actually contribute to the aesthetics. In building their Glassell Park rooftop garden, Abode chose fencing that would not block the beautiful views from the rooftop, but that could also support vines and creepers[75]. To create an additional barrier, Abode placed their beds directly adjacent to the fence, reducing access to the fence itself. Although these are simple measures, they can, if executed properly, go a long way toward creating a sense of security as well as one of community if executed properly.

Resident Involvement

Unlike rooftop gardens at other types of developments, rooftop gardens at affordable housing sites are strictly for the residents of the building. Many rooftop gardens are built on top of commercial buildings, with outside groups hired by building management to maintain the space[76]. Another popular use of rooftop gardens is for restaurants that grow salad greens and herbs for use in their dishes[77]. However, these uses are very different from those at an affordable housing site. A rooftop garden at an affordable housing site is like a private community garden meant only for the residents of the building. As a result, these rooftop gardens carry similar characteristics to community gardens, but also bring both added challenges and benefits. This type of gardening produces a tight knit community, reducing the amount of theft from the garden. However, there is a smaller pool of potential gardeners, which can make a project difficult to start and maintain. For this reason, it is important to gauge and garner resident support for the project before engaging in the process. An affordable group can spend lots of money on a beautiful rooftop garden, but unless there is people power behind the garden it will most likely fail.

75 Flores and Rodriguez, Abode Communities.
76 Rachel, Farmscape, February 7, 2013.
77 Shannon L. Bowen, "EMERALD CITY," *Hollywood Reporter -- International Edition* 405, no. 32 (July 11, 2008): 32–33.

Resident involvement is a tricky issue for rooftop gardening at an affordable housing site, but if it is the express goal of having a garden at the site, it is essential. It is important that before building a rooftop garden, the potential resident involvement is assessed. As part of such an assessment, I created a survey for Esperanza residents asking questions about their interest in gardening and how involved they could be. This survey can be found in Appendix B. A resident survey at buildings is a start, but will not necessarily provide accurate numbers of the residents who will be involved. Some residents may not receive or understand the survey and the survey may represent only a partial representation of resident opinion; thus, the results will likely be incomplete. Often, a project like this falls into the "chicken or the egg" argument; that is, will interest in the project generate more involvement or will the garden itself generate the interest. Skid Row Housing Trust's Cobb Apartments is a prime example of the latter category of resident involvement[78]. Their building was built with a green roof, which became neglected. It wasn't until Ur-Bin gardening volunteers looking for gardening space downtown became involved that the space was revitalized. Through community meetings and door-knocking, Ur-Bin found residents to help with the gardening. As the garden grows, more and more residents have join the ranks of gardeners. Additionally, because they are working with vulnerable and often transient people, Jayne Torres noted that there is greater participation at certain times of the month than others.[79] Although this will not be the case at most affordable housing sites, it is important to remember that residents are often extremely busy with work and other commitments. As a result, rooftop gardening might not be very high on their list of priorities. Thus, it might be beneficial, similar to Skid Row Housing Trust, to bring an outside group in on the project to keep it running.

Bringing in an outside group to be part of a rooftop garden changes the project a bit, but can be very beneficial. The project is no longer strictly an internal affair and the politics and ideas of the

78 Mary MacVean, "A Roof Full of Vegetables at the Cobb Apartments on Skid Row," October 14, 2011, http://latimesblogs.latimes.com/home_blog/2011/10/charles-cobb-apartments-rooftop-garden.html.
79 Torres, Skid Row Housing Trust and Ur-Bin.

parties involved must be considered in all decisions. This shifts decision making away from an exclusive role for the residents and the affordable housing group. This type of partnership can bring extensive knowledge to a project and be mutually beneficial. Clearly, the relationship between Skid Row and Ur-Bin is mutually beneficial, as Skid Row now has access to gardening resources previously unavailable and Ur-Bin has access to rare gardening space in downtown Los Angeles. Laura Raymond from Seattle P-Patch recommended that gardening groups seek out partnerships with other groups that might have similar interests.[80] Often, the relationships between two groups might not be immediately apparent, but the goals of the two groups might be similar. For example, the Health Department might be interested in healthy eating programs, and could be willing to supporting local produce grown at rooftop gardens. Exploring the potential partnerships for a rooftop garden can be very useful for an affordable housing group, especially if the organization has no gardening background.

Planting

Planting on the roof can be quite different from planting on the ground due to the nature of the space. There are environmental factors that increase on the roof. Most noticeable is the lack of shade on most rooftops (unless surrounded by taller buildings), resulting in direct sunlight for the whole day. Many green roofs facing this problem utilize drought tolerant plants on the roof.[81] However, for a vegetable rooftop garden, many of the desirable plants are not drought tolerant and suffer in direct sun light. Planting sun-loving plants, like tomatoes, is a possibility, but limits the variety of plants available to the garden. One option is inter-planting tall, shade providing plants interspaced with shade-loving plants, so they can work together. Another option is building shade structures over the plants, which double as small hoop houses in colder months.

80 Raymond, Seattle P-Patch.
81 Rooftop Gardens Task Force of San Francisco Beautiful, *Rooftop gardens*.

A second environmental factor that must be considered is that there is little on rooftops to block wind from sweeping over the garden. Often, small breezes on the ground are amplified when higher up on the roof. High winds can be very damaging to plants especially tall and creeping ones. Avoiding tall plants is one possibility, but limits the amount of plants available to the garden. Another option sometimes used in windy areas is to use the security barrier as a wind shield. This requires using a solid barrier, which can be more expensive than fencing. However, this solid barrier is not only secure and wind stopping, but, if clear, it preserves the view from the rooftop.[82] Planting in a garden is a very personal matter, and the variety of plants and solutions to address environmental difficulties will vary from site to site.

It is important that planting in the garden is a communal experience, as the space is meant for those working in the garden and not just individuals. It is easy to have one person dictate what to plant, but it is a greater experience if everyone contributes to the garden decisions. Jayne Torres mentioned that many Cobb residents gardened in their childhoods and had fond memories of those experiences. Often these residents had certain cultural foods they missed, and used the garden space to grow the necessary ingredients. Restaurants have found success growing greens and herbs, which are easy to maintain and in the case of herbs, can be dried and stored.[83] This is an area where it is beneficial to partner with a gardening group or master gardener. They have knowledge of how to grow fruits and vegetables and can help plan the planting process. Again, as with the whole rooftop gardening process, planting is only limited by how creative a group is willing to be with the process.

Benefits

The benefits of green roofs have been well documented and used to promote the greening of

82 Osmundson, *Roof gardens*.
83 Torres, Skid Row Housing Trust and Ur-Bin.

roofs. Intensive rooftop gardens can be similar to extensive green roofs, but due to the structural differences between intensive rooftop gardens and extensive gardens, the benefits are different. This report focuses on intensive rooftop gardens; thus the focus is on the benefits of this gardening style. The benefits for extensive green roofs can be found in the backgrounds section. Although not well documented, the benefits of rooftop gardens are very similar to those of on-the-ground community gardens. Additionally, there are benefits that are specific to affordable housing and low income communities.

The primary benefit of rooftop gardens, creating community space, is also usually the express goal of the project. Opening up the rooftop to residents for gardening makes it another space for them to gather and form a community. Ernesto Espinoza said that this is the reason ELACC looked to the rooftop as a place to gather[84]. People find the roof to be a very pleasant place, because it is very open, is far above the bustle of the streets, and provides a unique vantage point. The view from a rooftop garden by nature is usually not impeded by other buildings, with the only real barriers being the security fencing surrounding the garden. If built tastefully, this fencing can add to the beauty of the project. Ernesto mentioned that one of the benefits ELACC saw in these projects was that they were public-private spaces[85]. This means that the spaces are public to building residents but private to outsiders. Unlike an on-the-ground garden, where passersby can see what is happening in the garden, a rooftop garden is a space apart for building residents. Also, as a space physically away from the street, a rooftop garden can psychologically provide an escape from the worries associated with the streets surrounding an affordable housing site. A small added benefit along these lines is the unique vantage point of a roof for looking out on the city. Adding a community space in the form of a rooftop garden is a very utilitarian way of expanding a development.

84 Espinoza, East Los Angeles Community Corporation.
85 Ibid.

Unlike green roofs, rooftop gardens are meant for people to use like a traditional gardening space and can be used for growing whatever residents wish. However, one of the great benefits of a rooftop garden is that it can be used to grow edible plants. Food is a great way to bring a community together, especially by growing food that can then be enjoyed by the community.[86] Many times, affordable housing sites are found in areas where there is a lack of access to fresh fruits and vegetables. Thus, residents of a development with a rooftop garden can supplement their diets with fresh produce from the garden. The value and benefits of having healthy, fresh fruits and vegetables for a community cannot be over emphasized. This is what many residents look for most in a rooftop garden project, as they often have some connection to gardening or growing food in their past. Thus, the garden can provide a cultural connection for residents to foods they love but don't have easy access to. Jayne Torres said that many of Cobb's residents had very fond childhood memories of regional foods like okra and chili peppers and really enjoyed growing these. Culturally isolated residents can enjoy access to "their" foods.[87]

Studies have shown that gardening can be a therapeutic activity[88]. Rooftop gardening is no exception to this evaluated benefit. Jayne noticed that many volatile residents of the Cobb Apartments calmed down after gardening and their general demeanor changed dramatically[89]. For populations under high stress or with many external concerns, gardening provides an escape from these problems and helps relieve stress. Everyone, not just affordable housing residents, can greatly benefit from the de-stressing powers of gardening. Finally, a potential benefit that Jayne expressed was that of financial gain. Growing and selling food can be a valuable enterprise for a community if enough is grown. This could be in the form of raw produce or even hot sauces or salsas made from grown ingredients. With

86 Lawson, *City Bountiful a Century of Community Gardening in America*.
87 Torres, Skid Row Housing Trust and Ur-Bin.
88 Elizabeth N. Austin, Yvonne A. M. Johnston, and Lindsay Lake Morgan, "Community Gardening in a Senior Center: A Therapeutic Intervention to Improve the Health of Older Adults," *Therapeutic Recreation Journal* 40, no. 1 (January 24, 2006), http://js.sagamorepub.com/trj/article/view/965.
89 Torres, Skid Row Housing Trust and Ur-Bin.

the passage of The Cottage Foods Act in California this is a very viable option for a group of gardeners wishing to make some money from the food they grow.[90] Even just a little supplemental income for a low income family can help them. There are many benefits that are unique to rooftop gardening, most pertain to direct improvements to the lives of residents.

Analysis

Rooftop gardening is a much more complicated endeavor than an extensive green roof project. The first determination for a rooftop garden, load bearing capacity, can be minimized on an extensive green roof. Thus, where a rooftop garden can be stymied, an extensive green roof project can be viable. Additionally, because fewer adjustments need to be made to a building's structure for an extensive green roof, they often cost less than a rooftop garden. Funding should not be a determining factor for the creation of a rooftop garden, but it is very influential on the decision making process. Through creativity the costs of garden start up can be lowered. Moreover, there are a surprising number of people willing to help a low income constituency-related garden get started; it's just a matter of being connected to the gardening community. Finally, there are many greening grant sources from the local to national level, some even available to only affordable housing groups. Thus if there is a will for the garden there is a way to make it happen (structure permitting)[91]. The addition of people to a rooftop seems to be the greatest complication. While an extensive green roof can survive with minimal maintenance, rooftop gardens require people to maintain them. Almost all challenges, security, access, building structure, planting, and resident involvement, are a result of adding people to the mix. However, this is the point of a rooftop garden; for people to enjoy and use as a space to relax and

90 Ibid.

91 The structural components of a building determine the load bearing capacity of the building, which is necessary to know when placing a garden on the roof. Changing the building structure is difficult because it requires major building renovation.

cultivate a garden.

It may seem like an extensive green roof is a simpler, better alternative to a rooftop garden, but for a housing site where good community is desired, there is nothing better than a rooftop garden. An extensive green roof is a non-interactive roof covering and while it has its benefits, they are not directly for people to be engaged with it. Most of the benefits affect the surrounding environment, which, while a good cause, is not the place where many affordable housing groups want to be spending their relatively small budgets. An extensive green roof can be a gathering place, but if it can support a live load of people, why not turn the space into a useful area for growing vegetables. I have already lauded the benefits of rooftop gardens and believe that they cannot be overstated. People need open community space where they can feel safe and a rooftop garden provides just that.

As urban open space disappears, rooftops could be the next place where open space can be developed. The building's roof is an extension of land already owned, meaning that the often tenuous battles over open space for community gardening will not occur. The surface is already generally level, rock and root free, no weeds, and there is great sunlight. It is a gardener's dream aside from having to climb stairs to reach it. Additionally, rooftops are a whole floor of the building that is not being used. From an efficiency stand point, it makes sense to use the building's whole space. Although there might be somewhat high start-up costs for the projects, I did not encounter one group who had gone through with a project and regretted the decision.

Recommendations

General Recommendations

Funding is a major consideration for most affordable housing groups and can be the determining factor for a project. This was the case for ELACC, so they looked for other options. Although it might

seem contrary to this report, my first recommendation is to look for on-the-ground options if cost is a factor. Rooftop gardens are invariably more expensive than traditional gardens, so if cost is a factor, an on-the-ground garden might be better. Unfortunately, the technology and policies are not in place yet for rooftop gardens to be an option for all buildings. However, I believe they are the future for urban spaces as land continues to disappear under development. As money is an issue, I recommend finding someone in the organization to apply for grants for the project if a project is to be pursued in earnest. Some may be grant programs for major funding from national and statewide greening programs and some may be small grants for tools and supplies. For examples, see Appendix A. Either way, applying for a grant provides one way to lower costs even just a little, and has the potential to pay for a project in full. Despite being a potentially costly venture, rooftop gardens have a variety of unique benefits, with strategies for lowering their cost.

There are many structural considerations that go into creating a rooftop garden. Figuring out how these work with city building codes and zoning codes can be difficult. Additionally, original building plans may not be accessible and even when available, and they are very difficult for a non-professional to read and understand. Although it is a major added cost to the project, I recommend hiring a structural engineer to oversee the beginning of the project. They will know both the zoning codes and building specifications. Ultimately, they will determine if a roof is able to hold the live and dead loads of a garden, which can make or break a project. If the original structural engineer who worked on the building is available, they would be the best person to work with, because they are familiar with the building already. One tip that Rene at Abode Communities gave me is that if considering multiple buildings for a project, have the structural engineer look at the group's entire portfolio. This will cover all possibilities and also cost only a little more than inspecting one building. Another essential partnership is with local gardeners and organizations. Urban gardeners are always looking for more space in the city and willing to help out on a project for a good cause. There are

groups around Los Angeles, like Green Grounds, that organize volunteers to help start gardens, so they would be a good resource. See Appendix C for a complete list of urban agriculture organizations in Los Angeles provided by the Los Angeles Food Policy Council.[92] Additionally, Laura Raymond from Seattle P-Patch mentioned partnering with city departments and city government to promote the project. There are a variety of departments that might be interested in a rooftop garden, like the Los Angeles County Public Health Department or DWP. This requires promoting the project to these groups, which could lead to a partnership or grant from them.

If a rooftop garden is to be truly successful, there must be high resident involvement. While involving outside groups is a key factor, they should not dictate what happens in the garden. A rooftop garden is first and foremost a community space for residents of a building, and should be governed by residents. However, this cannot happen unless resident support and involvement is generated. Although the impetus for the project may come from an organization, the project should involve residents from the beginning. I recommend using community meetings and surveys as the stepping stones for a project. Through these outlets, residents can voice their opinions and show their support for the project. Once established, I recommend having regular work days and set work hours for working in the garden along with workshops. Having a set schedule allows residents to plan when they will be at the garden, while holding workshops keeps the garden work fresh and new. Although it is ultimately up to the residents to put in work at a rooftop garden, an outside organization can help it stay fresh and engaging. The initial set up of a garden can go a long way in making it an inviting space for residents. One of the problems ELACC faced was that their potential garden would resemble a fenced-in corridor[93]. Creating an appealing space means residents will be more excited to spend time in and work in the garden. The roof can be a dangerous place, especially for families with young children. Creating a safe space for

92 "Urban Agriculture | Los Angeles Food Policy Council," accessed April 18, 2013, http://goodfoodla.org/resources/local-good-food-organizations/urban-agriculture/.
93 Espinoza, East Los Angeles Community Corporation.

people working in the garden is the first step in making it inviting for residents. The primary way of making it safe is building a barrier around the edge to prevent people from falling off. However, padding sharp corners of ducts and beds, regularly cleaning the space, and training people to be safe are all other ways to ensure safety on the roof. While safety is a concern, avoiding the cage-like structure ELACC ended up with is essential to make people feel welcome on the roof. If the space is not welcoming, residents will not want to use it. Finally, ease of access is essential for a rooftop garden. If residents cannot easily get to a rooftop garden, they will not go to the roof often. Thus, if an elevator or staircase to the roof is not already built, they must be created for a garden to work. Building this new infrastructure is a major cost for a project, but if the funds are available and the garden project is serious, staircase or elevator extensions are necessary.

Although residents should dictate the scope of the project, I highly recommend having the garden be a fruit and vegetable garden. Flowers are beautiful, but they are not useful in the way that fruits and vegetables are. I have lauded the benefits of vegetables for a community already, and the reasons for recommending vegetable growing follow these. They promote healthy eating, care and cultivation for plants, cultural connection, and potential for economic benefits. Often residents will choose to grow vegetables in a garden, so requiring it will not be a problem. Again, in this case it is recommended that residents partner with a master gardener as this will help the garden grow and prosper. Finally, being creative is essential for a garden to be successful. Creativity can come at all stages of the rooftop gardening process, from the initial prospecting of roofs to building the garden beds to partnering with outside groups. These recommendations are not exhaustive, but will help start and further a rooftop gardening project.

Esperanza Specific Recommendations

The recommendations in the above section are very applicable to Esperanza's Housing site, especially those about resident support and involvement. Also, Abode recommended using their services to look at the buildings' ability to support a rooftop garden[94]. Granted their opinion is biased, but they are both familiar with Esperanza's portfolio and understand working with affordable housing groups, . Although I recommend rooftop gardens, there are four exceptions for Esperanza's housing portfolio. The Allegria, Amistad, Estrella, and Senderos developments are located extremely close to an oil drilling station, which has been causing major health problems in the neighborhood. The EPA study of green roofs in Chicago showed a decrease in particulate matter and an increase in air quality in areas where there are extensive green roofs[95]. However, when rooftop gardens are located near pollution sources, the particulate matter and bad air can settle in the soil and vegetables, causing further health problems[96]. For these reasons, I think that these four sites might benefit more from an extensive green roof or growing flowers as opposed to a rooftop garden. Also, the cost for the green roof installation could potentially be paid for by the oil company as a part of a community benefits agreement.

Another building to look at for the rooftop gardening project is the Mercado La Paloma[97]. This building is already owned by Esperanza, there is potential for this property to be part of the organization's rooftop gardening program. Primarily, the Mercado has a very large roof, and should be included in the portfolio reviewed by the structural engineer. A larger roof means that there is more space for gardening. One drawback to gardening at the Mercado is that it is not located at a building

94 Flores and Rodriguez, Abode Communities.
95 Northwestern University, "EPA Urban Heat Island Pilot Project City Profile: Chicago" (Environmental Protection Agency, 2001).
96 Robert Kuttner, "Building Green," April 2006, http://0-search.proquest.com.oasys.lib.oxy.edu/socialsciences/docview/201128645/1395F34499A453EB47E/3?accountid=12935.
97 Flores and Rodriguez, Abode Communities.

and would need to be available to multiple different communities. While not necessarily a bad aspect, it makes project coordination difficult. Another possibility for the Mercado to be of use for the project is a possible partnership with vendors or a vending opportunity for residents. As mentioned in the benefits section, rooftop gardeners could eventually sell the crops grown on the roof. It would probably take a number of years before the garden is established well enough to sell the produce, but there is already a potential market for the gardeners. Additionally, there might be groups at the Mercado who would be knowledgeable and willing to help with starting the garden at an Esperanza residence. Finally, if the cost of retrofitting an existing building is too high, I recommend including the infrastructure for a rooftop garden in any future building plans. Not only will building a rooftop garden at a new development cost less, it will make the building greener and be at the forefront of development.

City Incentive Program Comparative Case Studies

Although individual groups \initiate rooftop gardening projects, city governments can incentivize the process to make it more available for groups. City governments control the zoning and building codes within their jurisdiction, with this power they can change these codes to favor rooftop gardening. A number of cities around the country and abroad made green roofs a part of their municipal codes, resulting in an increasing number of projects in these cities. This report focuses on two, Seattle and Chicago, looking at how their city government promotes extensive green roofs and rooftop gardening through progressive incentives and codes, coupled with a strong grassroots gardening cultures. I compare these two cities to the current political and grassroots climate in Los Angeles to determine what lessons can be learned and what policies can be adapted from these cities. Although it seem easy to pick and choose the best programs from other cities, the correct political and activist climate is necessary for change to occur.

Seattle, Washington

Seattle has a rich and storied history of gardening- after all they are called the Emerald city. Gardening and green space are woven into the fabric of the city and the lives of the people who call it home. A majority of the rooftop gardening is actually dedicated to extensive green roof infrastructure. A 2009 study conducted by the Department of Public Planning, Seattle Public Utilities, and the University of Washington, reports that the city of Seattle has 363,006 square feet of green roof space, placing them third in the country in terms of square footage just behind Chicago and Washington DC. Of the 363,006 square feet, 148,069 square feet is dedicated to intensive rooftop gardening. However, just 2.5% of this intensive gardening space is used for food production.[98] This is an unfortunately small percentage of food production for such a large area of gardens. Seattle still has the resources to develop on-the-ground community gardens for food production, so rooftop food production is nota main focus. It is important to note that this report was commissioned by the Department of Public Planning and Public Utilities. Home to a very progressive population, Seattle city departments work for the citizens of the city. Rene Rodriguez of Abode Communities remarked at the differences between Seattle and Los Angeles experienced by his wife while she worked with the two cities on a development project. In Los Angeles, she experienced a bureaucratic disconnect between her work and the city government. There was never one specific person for her to talk to and the work always involved multiple departments who would refer her to other departments. In Seattle, the process of working with the city was less complicated as she had a single contact at the correct city department who helped guide her through the process, making it a smooth interaction.[99] Granted, Seattle is a smaller city than Los

98 Annika McIntosh, "Green Roofs in Seattle: A Survey of Vegetated Roofs and Rooftop Gardens" (City of Seattle, August 2010).

99 Flores and Rodriguez, Abode Communities.

Angeles, but there could be lessons learned from the helpfulness of Seattle city departments.

One such lesson is that of Seattle P-Patch, part of the Department of Neighborhoods, and whose sole purpose is to cultivate community gardens around Seattle. The Department of Neighborhoods is similar to the Los Angeles Department of Neighborhood Empowerment. It is their job to promote neighborhood culture, improve community, and serve as a link to city government. As a part of this department, P-Patch partners with neighborhood residents to build community gardens. Unlike the process in Los Angeles, where community gardeners are forced to find private land or lobby to public agencies, P-Patch is a part of the city government and is thus connected to other departments. In an interview Laura Raymond, a Project Coordinator for P-Patch, said that as a city department, they can work with other departments to obtain land for their gardening projects. They receive public funds to support their work with communities, a result of public support for community gardening. Because they receive public funds, P-Patch is required to address specific neighborhoods that might not otherwise build community gardens. Often these are mixed neighborhoods with lower incomes. This mandate could be seen as detrimental to community gardening as it takes funds and support away from neighborhoods that might have a population already involved in gardening. However, I think concentrating on areas lacking green space is a strong way to green the whole city. In an area where there is already support, they will create green space without help from the city, while an area where green space may not seem conceivable, benefits even more from the work of P-Patch. However, P-Patch gardens are public, so they are accessible to all residents.[100] P-Patch is a great community gardening agency, whose model should be studied and used in more cities around the country.

Most examples of rooftop gardening in Seattle are restaurants growing food on their roofs to use in their dishes. However, there is a rooftop community garden called the UpGarden, which was started through P-Patch. The garden is located on the top level of a parking garage on the site of the 1962

100 Raymond, Seattle P-Patch.

World's Fair. Located close to the famous Space Needle, this garage is a 30,000 square foot gardening space.[101] There was a willingness from both the managers of the parking garage at the World's Fair grounds and the surrounding community to have a rooftop garden on site. The garage was not heavily used, so the managers of the space were to repurpose the garage around the 50 year anniversary of the fair[102]. Through community meetings they worked out the design process, but there were challenges along the way, the first of which was actually tied to the structure of the building. One would assume that a parking garage could hold the weight of a garden. However, cars, per square foot, weigh less than wet soil. To account for this complication, the community adjusted the design of the project to lessen the weight per square foot by spacing long terraced raised beds far apart and creating slightly curved pathways. Aside from the structural hiccup, the rest of the project went smoothly with some creative thinking from community members. They repurposed an old Airstream trailer to serve as a shed and received tools donated from other gardens.[103] One comical aspect of the garden is that the community members wanted a lawn space, so they laid down sod in a section of the garden. Often, gardens replace lawns. However, due to the lack of open space in the surrounding neighborhood, the local residents wanted a place to relax on the ground. All told, the project cost a small amount of money, $150,000, compared to some rooftop gardening projects.[104] This is a direct result of the intergovernmental connections, community input, and creativity generated by the Seattle P-Patch system creates.

Seattle is located in the Pacific Northwest, directly on the Puget Sound. According to the National Weather Service, this area receives the highest levels of precipitation in the continental United States[105]. This rain makes it an easy place for gardening- t because, unlike Los Angeles, water does not

101 Sarah Deweerdt, "A 30,000-Square-Foot Community Garden, in a Parking Garage," May 29, 2012, 0, http://www.theatlanticcities.com/neighborhoods/2012/05/30000-square-foot-community-garden-parking-garage/2102/.
102 Raymond, Seattle P-Patch.
103 Deweerdt, "A 30,000-Square-Foot Community Garden, in a Parking Garage," 0.
104 Raymond, Seattle P-Patch.
105 National Weather Service Corporate Image Web Team, "National Weather Service - NWS Seattle," accessed April 17, 2013, http://www.nws.noaa.gov/climate/index.php?wfo=sew.

have to be moved to the area via aqueduct. Additionally, high precipitation means that gardens do not have to be watered as often, reducing the amount of maintenance necessary. However, high levels of precipitation in urban centers lead to damage of the environment. When new buildings and roads are built, they replace open spaces once covered with dirt. These new developments create impervious surfaces, leading to storm-water accumulation and eventually storm-water runoff. Runoff is a major problem in urban areas, because it causes flooding of drainage systems, and due to the concentration of pollution in cities, lead to water pollution. The contaminated runoff enters local aquifers, streams, and oceans, causing disruptions in the natural life.[106] In a city with is high precipitation, like Seattle, reducing the number of permeable surfaces through development has adverse effects on the environment. However, the Seattle city government, along with private groups and citizens, found ways to increase the number of permeable surfaces in the city. One of their strategies is to use green roofs on their buildings.

Seattle has a number of different incentive programs with requirements satisfied by the installation of a green roof. These programs are run by multiple city departments, and while some programs are not green roof specific, satisfying the requirements through green roofs is popular due to their multiple benefits and attractive nature. In this instance, extensive green roofs are more applicable, because they cover the entire roof surface, whereas rooftop gardens are localized on a roof surface. By covering the entire roof, an extensive green roof ensures that all storm-water is filtered and absorbs some before entering the drainage system. On the other hand, a rooftop garden covering only a portion of the roof's surface area only captures a small amount of rainwater which allows the rain to flow directly into the drainage system. However, as seen at the UpGarden, it is possible to cover a whole roof with a rooftop garden and reap the benefits of both intensive and extensive green roofing.

106 Seattle Public Utilities, "Storm Water Manual Vol. 3 Stormwater Flow Control & Water Quality Treatment Technical Requirements Manual," November 2009.

However, because of their extreme amounts of precipitation, most programs in Seattle focus on how rain water can be managed through extensive green roofs.

One incentive program is flow control requirements meant to reduce the amount of runoff entering the drainage system. Seattle requires all buildings control the flow of runoff in some way and one way to satisfy this requirement is to build a green roof. There are specific requirements that the garden must meet, which include: 2" of mulch, 8" of loamy soil, 90% plant cover in two years, erosion barriers, and no use of fertilizers or pesticides. Additional measures flow control might be necessary, but this can be determined after the garden is evaluated. Extensive, intensive, and container gardens can satisfy at least part of the requirements for flow control. Although there is no direct monetary incentive for flow control through a green roof, rooftop gardens receive a 1 to 1 credit, meaning that a rooftop garden receives the flow control credit even if there is just partial roof resurfacing. Green roofs are also a part of the impervious surface crediting system. Seattle has recognized that the urbanization of the Puget Sound area has replaced absorbent ground cover with impervious surfaces which hastens storm-water runoff and leads to flooding. Green roofs are one way developers can earn credit for replacing impervious surfaces. There are certain standards for impervious surface crediting and green roofs only receive partial credit based on their type and percent coverage of the roof.[107]

The city's other incentive program is their green building requirements called Seattle Green Factor. The program requires a certain area of a new development be dedicated to green space, to increase the total amount of green space in Seattle. The program requires new developments to reach a certain score based on the type of development. Developments score points based on the type and scope of their green development. Options for scoring points include green roofs and bonus points are awarded for food cultivation on site. Meeting certain scores in this program allows developers to fast-track their permitting process and relax certain building requirements. This is a progressive program for

107 Ibid.

a city to require, as it places somewhat cumbersome requirements on powerful developers. However, the city government also has green building requirements. All public buildings in Seattle are required to be LEED certified. Through this, city government is leading by example and placing stricter policies on themselves. Green roofs count for just one point in the LEED system, and while not significant in terms of the LEED system, it is another added benefit for installing a green roof.[108]

In Seattle, much of the green roof proliferation can be attributed to the proactive steps taken by the city to promote the practice. Through their incentive and green building programs and studies of green roof technology, city government made a point to explore this relatively new practice in urban greening. As their studies show, there is a dramatic upward trend in the amount of green roof space created each year in Seattle. When speaking with Laura Raymond, she attributed this trend to the creative partnerships between agencies in Seattle. Agencies like P-Patch, Seattle Public Utilities, the Public Health Department, the Office of Sustainability and Environment, and many private groups have partnered to make the city greener, often through green roofs[109]. As cities conduct studies, technologies improve, and the benefits of green roofs gain public attention, the already upward trend in green roofing experienced by Seattle will only increase.

Chicago, Illinois

Aside from being known as the Windy City, Chicago is the green roof capital of America. Based on 2008 numbers, Chicago's 534,507 total square feet of green roof space exceeded second place Washington DC by 33,465 square feet and greatly exceeded all other US cities[110]. Not only does Chicago have the largest coverage of green roofs, but they also have a rich history of green roofs. The

108 Seattle Department of Planning and Development, "DPD -- Green Factor: Overview," 2010, http://www.seattle.gov/dpd/Permits/GreenFactor/Overview/.
109 Raymond, Seattle P-Patch.
110 McIntosh, "Green Roofs in Seattle: A Survey of Vegetated Roofs and Rooftop Gardens."

major thrust for green roof coverage started with former Mayor Richard M. Daley and the city hall rooftop garden. Mayor Daley visited Germany, the worldwide green roofing leader, in 1997 and caught the rooftop gardening bug. The first major project was a 20,000 square foot extensive garden atop city hall.[111] The location of this project is indicative of where the drive for green roofs in Chicago comes from. Through incentives and requirements, Chicago, under Mayor Daley's direction, turned the city into the green roof capital of America. There has been some criticism of Daley's tactics and controversy over what classifies a green roof. However, there is no denying that Chicago is a visionary city in terms of American green roofing.

Located on the shores of Lake Michigan, Chicago's climate makes it an interesting location to be the green roof capital of America. Not only does the area experience extreme winds, but there are also harsh winters which make it difficult to grow plants. Because the area experiences this weather, cultivating plants during nearly half the year is impossible. This means that rooftop space used for active gardening is restricted to those months that are more temperate, whereas rooftops meant just to house plants and not people are not as affected by the seasons. Although wintery temperatures greatly affect the gardening in Chicago, it is not the only city to experience the winter season.

One weather pattern unique to Chicago is the abnormally high winds experienced by the city. High winds are a problem for rooftop gardens, because the effects of wind are felt to a greater extent higher up a building. Additionally, rooftops are exposed to the elements and rarely have any type of wind shield. Wind is a problem for rooftop gardens for a number of reasons. Primarily, if winds are strong enough, they can tear the plants from the soil or rip leaves and flowers from plants[112]. This problem is compounded when growing taller, leafier plants, because they give the wind more to take hold of. Thus, in Chicago rooftop gardens, plants are more low to the ground rather than stalky or

111 The School of the Art Institute of Chicago, "Chicago Green Roofs," 2006, http://www.artic.edu/webspaces/greeninitiatives/greenroofs/main.htm.

112 Darnall, *Roof Gardening on a Grand Scale*.

vines. Another problem associated with high winds is greater erosion of soil, especially loose topsoil. High winds moving across open beds whip loose soil into the air, contributing to erosion. One way to combat this is to build wind shields into the original design, which can be costly; however, the other option, constantly replacing topsoil, can cost even more over time.[113] Finally, winds dry out rooftop garden beds faster still than air and sun[114]. Drying out the beds means that plants will not have enough water unless watering increases. Clearly, there are obstacles to rooftop gardening in Chicago, but these also have solutions. The challenges do not outweighed the benefits of rooftop gardening in Chicago, which is the reason green roofs have flourished there.

In 1999, The Environmental Protection Agency and researchers from Northwestern University conducted a study of Chicago's heat island effect. The heat island effect occurs when the built environment replaces previously pervious and vegetated areas with impervious and heat reflecting surfaces. Roads and traditional roofs absorb the sun's heat and reflect it back into the atmosphere, causing a spike in temperatures in these areas. Increased temperatures associated with the heat island effect increase the use of energy to cool buildings, resulting in increased fossil fuel use, increased storm-water runoff temperatures leading to changes in water temperature of the bodies the water drains to. Higher temperatures can cause heat stroke, heat exhaustion, heat cramps, and breathing difficulties.[115] In the summer, roof surface temperatures can be up to 50-90 degrees warmer than air temperatures[116]. Although this will not heat the air to these levels, it does have a major effect on the areas immediately surrounding the surface. In densely developed areas, this effect is compounded by the high number of buildings reflecting heat in close proximity. In Chicago, the researchers found that

113 Osmundson, *Roof gardens*.
114 *Green Roofs and Rooftop Gardens*.
115 Northwestern University, "EPA Urban Heat Island Pilot Project City Profile: Chicago."
116 NPR, "ANALYSIS: ENVIRONMENTAL PROTECTION AGENCY EXPERIMENTS WITH ROOFTOP GARDENS AND OTHER CHANGES TO TRY TO BRING DOWN THE TEMPERATURES IN CITIES," November 29, 1999, http://0-search.proquest.com.oasys.lib.oxy.edu/socialsciences/docview/189956062/1395F32CB4D453EB47E/1?accountid=12935.

suburban development outside of the downtown area experienced the greatest heat island effects. They attributed this to the cooling influence of Lake Michigan on the downtown area. The study highlights a number of strategies Chicago used to lessen the heat island effect, one of these being rooftop gardening.[117] However, due to the less dense, highly residential nature of the suburbs, rooftop gardening was restricted to the downtown area where roofs are flat and larger.

The EPA study's evaluation of rooftop gardening focused primarily on the garden on top of City Hall. The garden covers 20,000 square feet, with part of a study comparing it to the conventional roof on the nearby Cook County building. Based on this comparison, the researchers tested for the cooling load of the building, energy savings, water savings, and air quality and extrapolated their findings to the city as a whole. Based on the comparison of the two buildings, they found that the green roof on City Hall; saved 9,272 kilowatt-hours of electricity per year, 7.372 therms of natural gas heating per year, and achieved 730% of levels needed to eliminate the cooling load of the roof, which is the amount of conditioned air needed to cool a surface. Extrapolated to the entire city, meaning if all buildings in Chicago had green roofs, they would save 720 megawatts, reduce the storm-water runoff load by 70%, and remove particulates from the atmosphere.[118] Based on this data, there were very clear benefits for the City of Chicago to implement a green roof program into city planning.

The City of Chicago created its own policies for green roofs, calling it the Sustainable Development Policy[119]. The policies pertain to residential, institutional, industrial, commercial, and existing buildings. They offer both financial and non-financial assistance for all types of buildings based on meeting certain green roofing criteria. Top tier financial assistance includes; RFP/Negotiated sale w/ Land Write down, meaning developers may request to buy land at a lower than market rate

117 Northwestern University, "EPA Urban Heat Island Pilot Project City Profile: Chicago."
118 Ibid.
119 City of Chicago, "City of Chicago Sustainable Development Policy," 2007.

cost[120]. Another is Empowerment Zone Grants, which are federal funds awarded to cities for distribution to certain zones of the city in need of improvement[121]. One is TIF or Tax Increment Financing, which are funds generated by a special tax and used through public-private partnerships to improve the city[122]. Finally, there is DHED Housing Assistance, are funds awarded by the Department of Housing and Economic Development for housing development[123]. Obviously some of these programs, like the Empowerment Zone Grants and DHED Housing Assistance, are only available to certain groups who qualify, but these are not the only incentives available.

The second tier of incentives has less stringent requirements. One incentive is Industrial Dev. Rev. Bonds, which are tax free city bond available to industrial developers to pay for fixed resources[124]. Secondly are Enterprise Zone Fac. Bonds, which are available to Enterprise Zone businesses located in certain areas of the city to make improvements to their facilities[125]. Another is Bank Participation Loans, which are loans where multiple banks take on the risk of lending the money for the project. One option is Class L, a tax incentive for landmark buildings in Chicago, their tax rates are reduced for 12 years as long as half of the savings from the reduction are used towards restoration or improvements[126]. Finally, Class 6B is a tax incentive for industrial development which assesses tax levels at 10% market rate for the first year, 15% market rate for the second year, and 20% market rate for the third year, as opposed to being assessed at 25%[127]. All of these incentives apply to non-residential developments, but

120 Ibid.
121 Department of Planning & Development, "Empowerment Zone Program" (City of Chicago, 1998).
122 "City of Chicago :: Tax Increment Financing (TIF)," accessed April 17, 2013, http://www.cityofchicago.org/city/en/depts/dcd/provdrs/tif.html.
123 "City of Chicago :: Housing and Economic Development," accessed April 17, 2013, http://www.cityofchicago.org/city/en/depts/dcd.html.
124 "Chicago Industrial Development Revenue Bonds (IDBs) | World Business Chicago | Economic Development, Chicago, Illinois," accessed April 17, 2013, http://www.worldbusinesschicago.com/site-selector/chicago-industrial-development-revenue-bonds-idbs.
125 "City of Chicago :: Enterprise Zone Program," accessed April 17, 2013, http://www.cityofchicago.org/city/en/depts/dcd/supp_info/enterprise_zone_program.html.
126 "City of Chicago :: Class L Property Tax Incentive," accessed April 17, 2013, https://www.cityofchicago.org/city/en/depts/dcd/provdrs/hist/svcs/class_l_propertytaxincentive.html.
127 Development Incentives Office, "Class 6B Eligibility Requirements" (Office of the Cook County Assessor, n.d.).

are significant incentives for businesses looking to build for less in Chicago.

Finally, there are non-financial assistance options available to developments based on meeting certain building criteria. Planned Development projects go through extensive planning to ensure they are reviewed and fit into the surrounding neighborhood, economy, and natural surroundings[128]. The other is Lakefront Protection Ordinance Developments, which applies to projects within a certain proximity to Lake Michigan and must conform to Lakefront Protection measures[129]. To receive incentives, a building cannot just have a green roof, but other criteria must be met. Often, the green roof is coupled with LEED certification to receive incentives, ensuring that a building is truly sustainable. The city produced a handy chart to find the criteria needed for the incentives based on business type.[130] The chart is found in Appendix D. Through this incentive program, the city of Chicago makes it very attractive and worthwhile for developers to explore the option of a green roof.

Los Angeles, California

Unlike Chicago and Seattle, the green roof movement in Los Angeles has been a grassroots movement, as opposed to one fueled by the city government. This is a major reason that the green roof movement hasn't yet blossomed in Los Angeles. Without incentives or assistance from the city, developers are less likely to include green roofs in their projects. This is not to say that Los Angeles city has not attempted to create city government based initiatives for green roofs. In 2006, the now defunct Department of Environmental Affairs released a report about the potential for extensive green

128 "City of Chicago :: Planned Development Designations," accessed April 17, 2013, http://www.cityofchicago.org/city/en/depts/dcd/provdrs/planning_and_policydivision/svcs/planned_developmentdesignations.html.

129 "City of Chicago :: Lakefront Protection Application," accessed April 17, 2013, https://www.cityofchicago.org/city/en/depts/dcd/provdrs/planning_and_policydivision/svcs/lakefront_protectionapplication.html.

130 City of Chicago, "City of Chicago Sustainable Development Policy."

roofs in Los Angeles and how to realize this potential[131]. Additionally, in 2007, The City of Los Angeles produced a similar guide for developing rooftop gardens. However, this was through the now terminated Flex Your Power California initiative to reduce energy use statewide[132]. There is potential for Los Angeles to explore both storm-water runoff and heat island reduction through green roofs like Seattle and Chicago did. There is already community and developer excitement about green roofs in Los Angeles, and hopefully this can translate to public action.

There have been a number of instances of private developers using rooftop gardens in Los Angeles for the benefit of their buildings and residents. Many of these produce food, whether for a restaurant or for building residents[133]. Despite the number of success stories around Los Angeles, it is still very difficult for developers to build rooftop gardens. They are costly compared to traditional roofs and often developers find alternatives to rooftop gardening[134]. It is difficult to know the steps for rooftop gardening in Los Angeles as there is little precedent in the city to work with. However, all of the people I interviewed who worked with successful rooftop gardens in Los Angeles loved the space and said it was worth the costs. Clearly there is great support for rooftop gardens once they are complete. This endorsement should not be overlooked by the city, because it is proof of how beloved rooftop gardens could be. The city of Los Angeles has a great opportunity to start a program that will help rooftop gardens gain even more popularity, but the benefits must be publicized first.

The 2006 report produced by the City's Environmental Affairs Department looked at extensive green roof systems, but ignored intensive options. The report references Chicago's work with the EPA studying the heat island reduction effects of rooftop gardens. Based on the Chicago-EPA study and a study by the Lawrence Berkeley National Laboratory, the report concluded that by converting just 15%

131 Environmental Affairs Commission, "Green Roofs-Cooling Los Angeles: A Resource Guide."
132 Ibid.
133 Lauren Lloyd, "From Rooftop To Fork: Downtown L.A. Club Grows Its Own Greens: LAist," January 31, 2012, http://laist.com/2012/01/31/from_rooftop_to_fork.php#photo-1.
134 Environmental Affairs Commission, "Green Roofs-Cooling Los Angeles: A Resource Guide."

of possible roof spaces in Los Angeles, summer temperatures downtown could be reduced by 6 degrees. Additionally, this would save 1 gigawatt in peak electricity use per year. Though not well researched scientifically, t the report claimed that reductions in particulate matter could be attributed to greening roofs. The Department of Environmental Affairs also lauded the benefits of green roofs in terms of storm-water runoff reduction. According to the report, "10 billion gallons of water flows off the rooftops and streets of L.A. County" and "a typical green roof with just three inches of growing media can be designed to reduce annual runoff by more than 50 percent".[135] On March 12th 2013, the Los Angeles County Board of Supervisors tabled a property owner tax that would go towards dealing with polluted storm-water in the city and county[136]. New state regulations require Los Angeles improve storm-water treatment methods[137]. This presents a perfect opportunity for the city and county to implement policy regarding green roofs.

Currently, there are no direct incentives for green roofs in Los Angeles. In 2002, all future city building projects were required to achieve LEED certified status. Again the LEED program awards just one point for a green roof, which is a small reward for a major addition to a project. A similar program to Seattle's could be beneficial, as Los Angeles already has storm-water runoff fees.[138] Using green roofs to combat storm-water runoff woes in the city depends on the purpose of the fees. If the fees are solely for revenue, creating an incentive program where fees can be replaced by green roofs does not make sense for the city. However, if the program is actually meant to reduce storm-water runoff, replacing fees with green roofs is a fantastic program. Similarly, in the California Green Codes, there

135 Ibid.

136 Abby Sewell, "L.A. County to Revise Proposed Parcel Tax to Fight Polluted Runoff," *Los Angeles Times*, March 12, 2013, http://articles.latimes.com/2013/mar/12/local/la-me-stormwater-20130313.

137 Department of Building and Safety, "Greywater Systems for Residential Buildings" (City of Los Angeles, November 5, 2012).

138 Environmental Affairs Commission, "Green Roofs-Cooling Los Angeles: A Resource Guide"; Sewell, "L.A. County to Revise Proposed Parcel Tax to Fight Polluted Runoff"; Department of Building and Safety, "Greywater Systems for Residential Buildings."

are sections requiring adding permeable paving and cool roofs to developments[139]. Granted these sections are voluntary codes, so they are not necessary for a project to meet code. Also, there is no mention of green roofs as a way to satisfy the conditions of the code. There is a section at the end of each section stating, "Innovative concepts and local environmental conditions. The provisions of this code are not intended to prevent the use of any alternate material, appliance, installation, device, arrangement, method, design, or method of construction not specifically prescribed by this code. This code does not limit the authority of city, county, or city and county government to make necessary changes to the provisions contained in this code"[140]. Thus, the City of Los Angeles has the ability to determine that green roofs satisfy the requirements of certain sections of the Cal State Green code. Until city government recognizes green roofs as a viable option to alleviate the city's woes, rooftop gardening in Los Angeles will remain a privately driven fringe strategy used by green developers and builders.

Los Angeles city government's lack of support for rooftop gardens is more complex than just unwillingness or neglect. The pressure on Los Angeles politicians to create rooftop gardening policies is not present. Angelenos have greater concerns driving their political motivations, like public safety and reforming LAUSD schools, to consider rooftop gardens as an important issue[141]. This situation is a result of a lack of awareness of the potential benefits of rooftop gardens. As a relatively young movement in America, it is understandable that rooftop gardening has not moved to the forefront of public policy making. However, I believe development is moving towards more green roofs, and any city creating green roofing policies now, will have an easier time gardening in the future. The next mayor of Los Angeles enters office facing a difficult fiscal situation with little wiggle room for new

139 California Buildings Standards Commission, "2010 California Green Building Standards Code California Code of Regulations, Title 24, Part 11," January 1, 2011.

140 Ibid.

141 Michael Finnegan, "In L.A.'s Mayoral Race, Battleground Areas Have Common Concerns," *Los Angeles Times*, February 16, 2013, http://articles.latimes.com/2013/feb/16/local/la-me-mayor-groundup-voters-20130217.

policies. A comprehensive green roof policy includes financial incentives like those found in Chicago and Seattle. These financial incentives require either city funds or a reduction in tax and fee revenue. Both of these types of incentives are difficult to find political support for when a city is in dire fiscal straights. Creating green roof policies, even when there is strong political will, is a tall order due to the power of private interests.

The history of Los Angeles is full of powerful private development interests controlling the structure of the city. From Mulholland to Chandler, individuals and private interests traditionally held an unequal sway in public matters in Los Angeles. Although less extreme today, developers still exercise an amazing amount of power in Los Angeles. This is a problem for introducing comprehensive green roof policy in the city, because such a policy would "negatively" affect developers. Every person I interviewed about rooftop gardening in Los Angeles told me that the best way for the city to promote rooftop gardening would be to require gardens at all future developments. This would be best, but because of the power of private developers it faces enormous challenges at this point. Many private developers, especially luxury housing developers, feel they should not be required to include anything extraneous at their developments that might take away from their profits[142]. Unfortunately, unlike Seattle where rooftop gardens are a selling to potential clients, rooftop gardens do not have the same allure in Los Angeles. Additionally, the structure of the city could be a potential limiting factor for creating a green roofs policy in Los Angeles. The city covers a massive area that is confusing when compared to other American cities. The downtown area is only a tiny part of the city's area, which extends from the Westside to the San Fernando Valley and San Pedro. This patchwork of regions means there are many different people and a diversity of development in the city. Due to this diversity of development, it is very difficult to create a comprehensive rooftop gardening policy for the city. One option is to create different policies for different areas of the city, but this will just add to an already

142 Environmental Affairs Commission, "Green Roofs-Cooling Los Angeles: A Resource Guide."

complicated zoning code for Los Angeles[143]. Navigating the truly complex private power and physical city structures of Los Angeles will be a difficult aspect of creating sound green roof policy for Los Angeles.

Not long ago, Los Angeles was a series of verdant valleys, orange groves, and was the highest producing agricultural county in the country[144]. This abundance has disappeared under extended sprawl and mismanaged land use policies. Although the city developed past the point of no return for this agricultural production, there are options. Rooftop gardens are a middle ground as they create a green space in the midst of the built environment. Los Angeles suffers from increasing temperatures, high smog levels, and polluted storm-water runoff. Although maybe not the issues on the forefront of Angelenos concerns, if no action is taken they will only get worse. Through comprehensive green roof policies, Los Angeles city government can take control of these problems. However, there are major obstacles for this to happen. The current political climate is not conducive for a financial incentive program for an unsupported industry. Moreover, there is little support from the development community as a whole, because of the high costs of rooftop gardens at developments. Los Angeles should learn from cities around the country who successfully overcame negative political climates and fashioned strong rooftop gardening policies to create cleaner, greener cities.

Analysis

The comparison of these three cities is imperfect, because all three cities are extremely different from one another. The cities all have different physical structures based on where they are located. Seattle is the smallest, least dense city of the three, covering just 83 square miles with 7,000 residents

143 Department of Building and Safety, "City of Los Angeles Zoning Code: Manual and Commentary Fourth Addition" (City of Los Angeles, 2005).
144 Lawson, *City Bountiful a Century of Community Gardening in America*.

per square mile[145]. The size of the city can be attributed to the city's location, as it juts out into the Puget Sound and is surrounded by water on three sides. At 230 square miles and 12,000 residents per square mile, Chicago is the second largest, but most dense of the three cities. Chicago abuts Lake Michigan on one side, with suburbs sprawling out from a dense urban core[146]. Los Angeles occupies an area more than twice the size of Chicago at 500 square miles, but has a density, 8,000 residents per square mile, just greater than Seattle's[147]. An extensive history of annexation has led to Los Angeles' sprawling structure and low density. Although they may seem disconnected, the size of a city can have an effect on how a city conducts governmental affairs. Due to its massive size, Los Angeles city government must balance the wishes of a wide array of interests. This makes it difficult to appease all interests and make unilateral decisions without kickback.

Location also plays a major part in a city's ability to support rooftop gardening. Located in the Pacific Northwest, Seattle receives enough rainfall annually to support gardens with only supplemental watering in the summer months[148]. This, along with a large amount of support from residents, led to the proliferation of gardening in Seattle. Additionally, rain water can pool and stand on flat roofs, adding a large amount of weight to the surface. Because of this, buildings in Seattle must have stronger roofs than most areas. As urban spaces for gardening disappear and rooftop gardens become the next option, Seattle will already have the political will and rainfall necessary for rooftop gardening. Located on the shores of Lake Michigan, Chicago weather is heavily influenced by the lake. Chicago's median snow fall levels over the past century are 33 inches per year[149]. Snowfall forms drifts on roofs, adding weight to the roof surface. Like in Seattle, this requires buildings to have stronger roofs. Thus, because of these two city's elements, they are already equipped for rooftop gardening. Los Angeles does not have

145 McIntosh, "Green Roofs in Seattle: A Survey of Vegetated Roofs and Rooftop Gardens."
146 Chicago Department of Environment, "A Guide to Rooftop Gardening."
147 Raphael Sonenshein, *Los Angeles: Structure of City Government* (League of Women Voters of Los Angeles, 2006).
148 Raymond, Seattle P-Patch.
149 Chicago Department of Environment, "A Guide to Rooftop Gardening."

this built in need for stronger rooftops, which is why it will take policy requirements to make rooftops stronger.

Incentive and city wide gardening programs are a part of public policy and are affected by local politics and the political climate. Seattle has a liberal local political climate, which is open to urban greening programs. P-Patch created the UpGarden rooftop garden with the help of city fundraised from a tax increase, which Seattle residents voted in favor of. This is evidence of the political willingness to fund local gardening and greening programs.[150] In Chicago, the will for rooftop gardening came directly from the mayor's office, an example of the historical strength of politicians in Chicago. Mayor Richard M. Daley's father, Richard J. Daley, is the preeminent example of boss politics and a mayor ruling a city with an iron hand. Critics of Richard M. Daley claim that he took a page out of his father's boss politics book when creating the Chicago green roof incentive program.[151] Unfortunately, these claims have the potential to overshadow a program that has resulted in the largest coverage of rooftop gardens in America. These are two contrasting ways of conducting local politics to start incentive programs. The Seattle method is a democratic program, but the Chicago method produces the desired results. Both however, require particular political climates. Seattle's democratic way requires a strong public desire to create a rooftop gardening program, whereas Chicago's way requires a strong mayor's office willing to create a rooftop garden program. Currently, Los Angeles has neither of these situations, so it will be difficult to create comprehensive green roof policy until one of them comes about[152]. As Los Angeles elects a new mayor, it will be interesting to see how the new mayor controls their power and how they deal with greening the city. Additionally, as the green movement continues to grow in Los Angeles, it will be interesting to see how the movement manifests itself in public policies.

150 Raymond, Seattle P-Patch.

151 "Cityscapes: Ten Years of Green Roofs in Chicago: Mayor Daley's Green Thumb and Iron Fist Have Produced Impressive Gains, but the Movement Remains in Its Infancy," accessed April 17, 2013, http://featuresblogs.chicagotribune.com/theskyline/2010/04/theres-been-so-much-hype-about-green-roofs-in-chicago-that-i-went-to-the-willis-tower-sky-deck-last-week-expecting-to-see.html.

152 Finnegan, "In L.A.'s Mayoral Race, Battleground Areas Have Common Concerns."

Creating a comprehensive financial incentive program is the easiest way to get previously uninterested private developers to support green roofs. Developers often think with their checkbooks first so making green roof cost less will lead to their support. However, just the extent of support the developers get from the city depends on the ability of the city to support the program. Due to the lack of funds, it will be difficult for Los Angeles to offer comprehensive financial incentives to developers. Unfortunately, Los Angeles is in a fiscal crisis and thus unable to take on an incentive program[153]. The success of the incentive programs in Seattle and Chicago can be attributed to their use of multiple strategies. In Seattle, one of their incentives for rooftop gardens is reduction of storm-water runoff, but it is not the only way to satisfying storm-water runoff mitigation requirements. Seattle has certain requirements for replacing impervious surfaces, but there are more options for meeting these requirements than just green roofs.[154] Also, green roofs satisfy part of the city's Green Factor program, thus two requirements can be met by a rooftop garden. Chicago has more specific parameters for satisfying the requirements of their incentive program. However, this often means that the building as a whole is green, as opposed to just the roof. Also, Chicago has specific policies for specific industries, giving them a goal to strive for in making their building green.[155] Finally, Chicago offers a very comprehensive array of assistance options, both financial and non-financial. Choosing from, loans, tax incentives, zoning relaxation, and grants for project developers allows for the developers to choose the option that will help them best create a green building. Chicago created customizable approach to incentivizing green roofs for developers. Incentives are essential for a city to jump start green roof projects.

153 Ibid.
154 Seattle Public Utilities, "Storm Water Manual Vol. 3 Stormwater Flow Control & Water Quality Treatment Technical Requirements Manual."
155 City of Chicago, "City of Chicago Sustainable Development Policy."

Recommendations

Before Los Angeles adopts a strategy for rooftop gardening, the potential for the city to support large scale rooftop gardening should be reviewed. It will be a major undertaking, but there should be a review of existing buildings to see if the building's current structure can support rooftop gardening. At the very least, city government should show initiative around the issue and review public buildings for retrofitting. The potential benefits for Los Angeles from just one type of project, adding green spaces, increasing local produce, storm-water runoff reduction and filtration, heat island mitigation, air quality improvement, and energy savings, are so great that they cannot be ignored. As America's two other major cities Chicago and New York continue to progressively promote rooftop gardens, Los Angeles lags behind. I recommend that Los Angeles be strategic about the initial implementation of a city government supported incentive program. Use the study of city building structures recommended above to make an informed decision about which neighborhoods to target first and then expand the program to the city as a whole. The incentive program should be included in the updated neighborhood plans for the areas that will benefit most.

As the County Board of Supervisors reviews increasing storm-water runoff fees, it is a perfect time for Los Angeles to make rooftop gardens a relevant tool for the city and developers[156]. Though the fees are currently tabled for review, eventually the Supervisors will have to institute some fee or policy to meet California state runoff standards. I highly recommend including rooftop gardens in this eventual legislature as an option to replace the fees. Currently, the city of Los Angeles also has a minimal $24 fee assessed on building owners for storm-water runoff[157]. Issues surrounding runoff in the city and the surrounding beaches and aquifers continue to increase, making action necessary. Unless

156 Sewell, “L.A. County to Revise Proposed Parcel Tax to Fight Polluted Runoff.”
157 Environmental Affairs Commission, “Green Roofs-Cooling Los Angeles: A Resource Guide.”

the fees assessed actually go towards storm-water runoff reduction, rooftop gardens are a much better option.

At a recent Climate Resolve summit about cool roofs in Los Angeles, there was no mention of the potential for green roofs to also be cool roofs. This is unfortunate, because green roofs achieve better cooling standards than the other cool roof options[158]. In a climate already experiencing extreme temperatures, Los Angeles can't afford to have the easily solvable heat island problem hanging over our heads. Obviously there are other, less costly ways of reducing the heat island effect than rooftop gardening. However, because rooftop gardens have other benefits they have a greater upside than other cool roofs. I recommend that the city of Los Angeles adopt goals for heat island effect reductions and that they include incentives in these goals for developments using rooftop gardens.

The reason Chicago is the rooftop garden leader of America is because they offer financial incentives. If Los Angeles is going to create comprehensive rooftop garden policies, they cannot be watered down and must include financial incentives. The easiest way to do this is to offer some type of tax incentive for the developers, like a rate reduction. Although this will reduce the city's revenue, the potential benefits of rooftop gardens on a city-wide scale are very great. At this time, grants would be difficult to give away, but a low interest lending program might be easier. I recommend this practice because the loans can be available to all developers. It is fair that city funds be used for such a program, because the benefits of a rooftop garden extend beyond the building and improve the environment of the city as a whole.

Currently, the Cal Green Codes do not include any requirements satisfied by rooftop gardening[159]. There are multiple sections of the codes where rooftop gardens could serve as a substitute for the solutions. However, the code allows for local government to interpret what can serve as a

158 NPR, "ANALYSIS."

159 California Buildings Standards Commission, "2010 California Green Building Standards Code California Code of Regulations, Title 24, Part 11."

substitute for the current solutions. Thus, Los Angeles city government has the power to determine that the Green Codes can be satisfied by a rooftop garden. Before this can happen, Los Angeles must change the city green building codes to include rooftop gardens. Currently there is no mention of rooftop gardening in the codes, despite roof cooling and storm-water runoff mitigation being a part of them.[160] Before Los Angeles challenges statewide green codes, the city must make a stronger commitment to improving its own codes.

A preliminary step to improve the green program in Los Angeles is to start a program similar to that of P-Patch in Seattle. P-Patch works with neighborhoods and local groups to set up community gardens[161]. Eventually the community gardens could move to the rooftops, but as stated previously, traditional on-the-ground gardens are the place to start. P-Patch is a great example of the city government working personally with neighborhoods to improve them. Based on the city's less than perfect past aiding community gardens (see South Central Farms), and as community gardening gains popularity, it would be smart to start supporting community gardening. Rooftop gardening has great potential to be a previously unavailable source of local food in the city. I recommend adding incentives for food production on site, as it negates food miles and contributes to a healthier diet and a healthier city.

For too long, the interests of private developers have been able to determine public policy in Los Angeles. In order to save a few dollars, they are willing to jeopardize the well-being of city residents. A prime example is the way developers squashed mandatory inclusionary zoning, because they claimed it was a burden on their developments.[162] Unfortunately, unless the city government takes a stand, rooftop gardens could meet the same fate. I recommend that as a show of power, the city

160 City of Los Angeles, "Los Angeles Green Building Code Ordinence," December 15, 2010.

161 Raymond, Seattle P-Patch.

162 "Real Estate, Land Use and Environmental Law Blog : Real Estate, Land Use and Environmental Law Lawyer & Attorney : Sheppard Mullin Law Firm : Supreme Court Refuses to Hear *Palmer* Case - Are Inclusionary Zoning Practices Due for Change?," accessed April 17, 2013, http://www.realestatelanduseandenvironmentallaw.com/land-use-and-entitlements-supreme-court-refuses-to-hear-palmer-case-are-inclusionary-zoning-practices-due-for-change.html.

requires that all new developments have the capacity to hold a rooftop garden. This means that they do not have to build the garden at the beginning of development, but the roof should be accessible, secure, and able to hold the live and dead loads associated with rooftop gardens. This is a way to ensure that in the future, when rooftop gardening is the next big way to green cities; Los Angeles is able to demonstrate its commitment in this area. At the very least, Los Angeles should require green roofs on all future public buildings and look into retrofitting existing public buildings with green roofs. The upfront cost may be high, but the benefits over time are even greater.

Conclusion

Although rooftop gardens face major challenges in both building and setting up a policy program, they are well worth the effort. Rooftop gardens are not one dimensional projects. They are multifaceted solutions to multiple urban problems. I cannot stress how great the benefits can be for reducing the problems increased urbanization has created. Depending on the needs of the group building the garden, these benefits and the garden's structure can be adjusted to meet those needs. Rooftop garden advocates for years dreamt about flying over cities in the future and seeing a green patchwork. I dream of flying over cities in the future and seeing a patchwork of vegetables growing on the roofs. These dreams cannot be met, unless action is taken. Groups must start taking risks in order to receive the rewards of rooftop gardening. If city government will not act first, unfortunately the burden of starting the rooftop gardening revolution in Los Angeles falls to private developers. However, the city government should act to support the practice of rooftop gardening, because despite having private benefits, most of the benefits from rooftop gardens are felt by the public. The first step in this process is to actually recognize the potential that rooftop gardens have to fix this city's problems. From this support, moving to action, rooftop gardens will be able to blossom, localizing diets and greening Los Angeles.

Appendix A

Potential Grant Sources

National:
EPA

http://www.epa.gov/greenbuilding/tools/funding.htm

Enterprise Community

http://www.enterprisecommunity.com/solutions-and-innovation/enterprise-green-communities/resources

Government Grants

http://www.grants.gov/search/category.do

Federal Domestic Assistance

https://www.cfda.gov/index?

California:
Energy Commission

http://www.energy.ca.gov/efficiency/financing/index.html

EPA

http://www.epa.gov/greenbuilding/tools/funding.htm#state

Green Building

http://www.energy.ca.gov/greenbuilding/

Strategic Growth

http://www.sgc.ca.gov/urban_greening_grants.html

Local:

Home Depot

https://corporate.homedepot.com/CorporateResponsibility/HDFoundation/Pages/ComImpactGrant.aspx

Lowes

http://responsibility.lowes.com/community/our-programs/lowes-charitable-and-educational-foundation/

Appendix B

Resident Involvement Survey

English:

Hello and thank you for filling out this survey! My name is Noah Donnell-Kilmer and I am a Senior Urban and Environmental Policy major at Occidental College. This survey is a part of my senior research project about rooftop gardens and affordable housing. Your answers and the data collected from this survey will help Esperanza and me gauge your interest in starting gardens on the roof of your building.

Survey for Esperanza Community Housing Corporation Affordable Housing Residents

1) How old are you?

__ 18-30 __30-40 __40-50 __50-60 __60-70 __70+

2) Gender:

__Male __Female

3) How many years have you lived in your building:

1 2 3 4 5 6 7 8 9 10 10+

4) On a scale of 1-10 (ten being very interested), rate your interest in gardening:

Not Interested Neutral Interested

1 2 3 4 5 6 7 8 9 10

5) What experience do you have with gardening (check all that apply):

__ I lived on a farm
__ I grew up gardening at home
__ I was a member of a community garden
__ I tended indoor plants
__ None, but I am interested in learning
__ None, and I am not interested in learning
Other:

6) If you have no gardening experience, on a scale of 1-10 (ten being very interested), rate your interest in learning how to garden:

Not Interested Neutral Interested

1 2 3 4 5 6 7 8 9 10

7) What do you think would be the best location for a garden (check all that apply):

Rooftop___ Back of property___ Side___ Other___ In boxes/ground___

8) Why are you interested in a garden (check all that apply):
__ Desire for a hobby
__ Desire for community space
__ Desire for greener living
__ Desire to grow your own food
__ Relaxation
__ Other

9) If a garden were placed at your building, what would you like to grow (check all that apply):

__ Flowers
__ Vegetables
__ Fruit Trees
__ Other:

10) If a garden were placed at your building, would you be willing to work in it (Tasks like: watering, planting, weeding, harvesting, plant care, building, etc):
__YES __NO

11) If you answered yes, how often would you like to work in the garden:
__30 minutes a week
__one hour a week
__two hours a week
__more than two hours a week
__some other amount of time:

12) On a scale of 1-10 (ten being very significantly), do you think a rooftop garden will improve your relationship with your neighbors:

Not Significantly				Neutral					Significantly
1	2	3	4	5	6	7	8	9	10

13) On a scale of 1-10 (ten being very interested), how interested are you in having a garden at your

building:

Not Interested Neutral Interested

1 2 3 4 5 6 7 8 9 10

If you would like to receive updates about the use of the information provided by this survey, please provide your information below:

Name:

Spanish:

¡Hola! Gracias por hacé este estudio. Mi nombre es Noah Donnell-Kilmer y estoy estudiando política de urbana y medio ambiente en mi ultimo año en la univerisdad Occidental. Este estudio es parte de mi proyecto final sobre jardínes en azoteas y viviendas asequibles. Sus respuestas y los datos de este estudio van a ayudar Esperanza y a mí a estimar su interés en empezar jadines en la azotea de su vividenda.

Estudio para la corporación Esperanza de Comunidad y Viviendas para los residentes de vivendas asequibles

1) ¿Cuanto años tiene?

__ 18-30 __30-40 __40-50 __50-60 __60-70 __70+

2) Sexo:

__Hombre __Mujer

3) ¿Cuantos años ha vivido en su vivienda?

1 2 3 4 5 6 7 8 9 10 10+

4) En una escala de 1 hasta 10 (diez es muy interasado), clasifique su interés en empezar un jardín:

No interesado Neutral Interesado

1 2 3 4 5 6 7 8 9 10

5) ¿Qué experiencias tiene cuidando un jardín (cheque todos los que sean aplicables):

__Viví en una granja
__Crecí cuidando un jardín en casa

__Fuí miembro de un jardín de la communidad
__Cuidé plantas de interior
__Nunca, pero tengo interés en aprender
__Nunca, y no tengo ningún interés en aprender
Otro:

6) Si no tiene niguna experiencia con jardínes, en una escala de 1 hasta 10 (diez es muy interesado), clasifique su interés en aprendé como cuidar un jardín

No Interesado Neutral Interesado
1 2 3 4 5 6 7 8 9 10

7) ¿Donde piensa que está el mejor lugar para un jardín (cheque todos los que sean aplicables):

Azotea__ Detrás de la vivienda___ Al lado de la vivienda___ Otro___
En cajas/tierra___

8) ¿Por que está interésado en cultivar un jardín (cheque todos que sean aplicables):

__Quiero un hobby
__Quiero espacio para la communidad
__Quiero vivir una vida más concienciada con la naturaleza
__Quiero cultivar mi propia comida
__Quiero relajarme
__Otro:

9) Si hubiese un jardín en su vivienda, ¿qué querría cultivar? (cheque todos los que sean aplicables):

__Flores
__Vegetales
__Árboles frutales
__Otro:

10) Si hubiese un jardín en su vivienda, ¿querría trabajar en el jardín? (Tareas como: regado, cultivo, deshierbado, cosecha, mantenimiento, construcción, etcetera):

__SÍ __NO

11) Si su respuesta fue SÍ, **¿**cuánto tiempo le gustaría trabajar en el jardín?:

__30 minutos por semana

__una hora por semana
__dos horas por semana
__más de dos horas por semana
__otra suma de tiempo:

12) En una escala de 1 hasta 10 (diez es muy significativamente), ¿piensa que un jardín en azotea puede mejorar su relacion con sus vecinos?:

No significativamente				Neutral				Significativamente	
1	2	3	4	5	6	7	8	9	10

13) En una escala de 1 hasta 10 (diez es muy interesado) ¿cuánto interés tiene en un jardín en su vivienda?:

Ningún Interés				Neutral				Interés	
1	2	3	4	5	6	7	8	9	10

Si quiere mas información sobre el uso de la información en este estudio, por favor proporcione su información de contacto abajo:

Nombre:

Appendix C

List of Urban Agriculture in Los Angeles:

American Community Gardening Association http://www.communitygarden.org/
Antioch University http://www.antiochla.edu/
Backwards Beekeepers http://www.backwardsbeekeepers.com/
City of LA- Department of Water and Power (DWP)
City of Los Angeles- Department of City Planning http://cityplanning.lacity.org/
City of Los Angeles- Department of Neighborhood Empowerment http://done.lacity.org/dnn/
Community Services Unlimited, Inc. (CSU) http://www.csuinc.org/
Cultivating Sustainable Communities (Garden Swap) gardenswap.org
Earth Flow Design Works www.earthflow.com
Earthworks Farm
Fallen Fruit http://www.fallenfruit.org/
Farmscape www.farmscapegardens.com
Farmworks LA
First 5 LA http://www.first5la.org/
Food Forward http://foodforward.org/
Garden School Foundation hgardenschoolfoundation.org
American Community Gardening Association http://www.communitygarden.org/
L.A. Green Grounds http://lagreengrounds.org/
LA Community Garden Council http://lagardencouncil.org/
LA Conservation Corps http://www.lacorps.org/
LA County Department of Regional Planning http://planning.co.la.ca.us/
LA Farm Hands http://www.lafarmhands.com
LA River Revitalization Corporation http://thelariver.com/revitalization/
LAUSD Joint Use and Innovation Program http://mo.laschools.org/fis/planning/
Los Angeles County Arboretum http://www.arboretum.org/
Los Angeles Neighborhood Land Trust (LANLT) http://www.lanlt.org/
Menlo Lab menlolabcommunities.com
Metabolic Studio metabolicstudio.org
Mia Lehrer Associates http://mlagreen.com/
Milagro Allegro http://hpgarden.org/
Network for a Healthy California- LAUSD http://www.healthylausd.net//
Osborn Architects http://www.osborn320.com/
Pedal Patch Community www.pedalpatchcommunity.org
Proyecto Jardin laeastside.com/
Rootdown LA http://rootdownla.org/
Salvation Army- Bell Shelter grow-good.org/?page_id=50
Silver Lake Farms www.silverlakefarms.com
Social Justice Learning Institute http://www.sjli-cp.org/
South Central Farmers www.southcentralfarmers.com
South East Asian Community Alliance (SEACA) http://www.seaca-la.org/
Team Green Bite http://teamgreenbite.com/
The Growing Experience- Housing Authority of the County of Los Angeles www3.lacdc.org

The Huntington Library and Gardens huntington.org
Timbuktu Resource timbukturesourcecenter.org
UC Cooperative Extension- LA County celosangeles.ucdavis.edu
Ujima Farming Group http://ujimafarminggroup.org/
Urban & Environmental Policy Institute, Occidental College departments.oxy.edu/uepi/
Urban Farming Advocates (UFA) urbanfarmingadvocates.org
Urban Green LA www.urbangreenla.com
American Community Gardening Association www.communitygarden.org
Urban Homestead- Path to Freedom http://urbanhomestead.org/
Urban Semillas www.urbansemillas.com
Venice Learning Garden http://www.thelearninggarden.org/
Verde Coalition http://www.verdecoalition.org/
Volunteers of East Los Angeles (VELA) http://www.velaela.org/
Whittier College http://www.whittier.edu/
Women Organizing Resources, Knowledge, and Services (W.O.R.K.S.) http://www.worksusa.org/
Woodbury University www.woodbury.edu
Woolly School Garden Program www.woollyschoolgarden.org

Appendix D

Chicago Sustainable Development Policy

	Financial Assistance		Non-Financial Assistance
	(RFP/Negotiated Sale w/Land Write Down) (Empowerment Zone Grants) (TIF) (DHED Housing Assistance)	(Industrial Dev. Rev. Bonds) (Enterprise Zone Fac. Bonds) (Bank Participation Loans) (Class L) (Class 6B)	(Planned Developments) (Lakefront Protection Ordinance Developments)
Residential			
Market Rate SF, TH, Multi-units (< 4 units)	Building Certification		
4 or more Townhomes (TH)*	100% Green Roof + Building Certification	50% Green Roof + Building Certification	50% Green Roof + Building Certification
4 or more Market Rate Units (including Hotels)	100% Green Roof + Building Certification	50% Green Roof + Building Certification	50% Green Roof + Building Certification
> 20% Affordable Units or CPAN	Building Certification	Building Certification	Building Certification
Institutional			
Hospitals	100% Green Roof + exceed ASHRAE 90.1-2004 or 75% Green Roof + LEED Certification	75% Green Roof +exceed ASHRAE 90.1-2004 or 50% Green Roof + LEED Certification	75% Green Roof + exceed ASHRAE 90.1-2004 or 50% Green Roof + LEED Certification
Community Centers, Government Buildings and Schools**	50% Green Roof + LEED Certification	25% Green Roof + LEED Certification	25% Green Roof + LEED Certification
Industrial			
	100% Green Roof + exceed ASHRAE 90.1-2004 or LEED Certification or Exceed Stormwater Ordinance by 20%*** or 50% Green Roof + 50% VUA shading in 5 yrs	100% Green Roof + exceed ASHRAE 90.1-2004 or LEED Certification or Exceed Stormwater Ordinance by 20%*** or 50% Green Roof + 50% VUA shading in 5 yrs	100% Green Roof + exceed ASHRAE 90.1-2004 or LEED Certification or Exceed Stormwater Ordinance by 20%*** or 50% Green Roof + 50% VUA shading in 5 yrs
Commercial			
Retail over 10,000 square feet (footprint)	100% Green Roof + LEED Certification or 50% Green Roof + LEED Certification + 50% VUA shading in 5 yrs	100% Green Roof + exceed ASHRAE 90.1-2004 or 50% Green Roof + LEED Certification or 50% Green Roof + exceed ASHRAE 90.1-2004 + 50% VUA shading in 5 yrs	100% Green Roof + exceed ASHRAE 90.1-2004 or 50% Green Roof + LEED Certification or 50% Green Roof + exceed ASHRAE 90.1-2004 + 50% VUA shading in 5 yrs
Retail under 10,000 square feet (footprint)	100% Green Roof + LEED Certifcation	100% Green Roof + exceed ASHRAE 90.1-2004 or 50% Green Roof + LEED Certification	50% Green Roof + exceed ASHRAE 90.1-2004
Grocery Stores located in Food Deserts (see Note #6)	Exceed ASHRAE 90.1-2004 + 50% shading after 5 years	Exceed ASHRAE 90.1-2004	Exceed ASHRAE 90.1-2004
Office	100% Green Roof + LEED Certifcation	100% Green Roof + exceed ASHRAE 90.1-2004 or 50% Green Roof + LEED Certification	50% Green Roof + LEED Certification
Existing Buildings** and Landmark Buildings**			
	Building Certification or LEED-CI Certification or 100% Green Roof + exceed ASHRAE 90.1-2004	50% Green Roof + exceed ASHRAE 90.1-2004	50% Green Roof + exceed ASHRAE 90.1-2004

NOTES:
* Townhomes with common and contiguous roof space without private access to roofs. Emergency access routes do not apply.
** Religious gathering facilities serving multiple purposes will be considered a community center.
***Projects that are regulated by the stormwater management ordinance must provide evidence of a 33% reduction of impervious area from a baseline condition (as defined by ordinance). -OR- Retain 0.60 inches of stormwater from the proposed impervious area (up from 0.5").
****The policy applies to existing buildings when the value of the renovation is more than 300% of the assessed value of the building for Singe-family Residential, Multi-unit (up to 6 units) Residential, Institutional, Industrial and Commercial Projects; 600% of the assessed value of the building for Multi-unit (more than 6) Residential and Mixed-use Residential projects.
1. The area of green roof coverage will be based on the net area of the roof, which is defined as the usable space of the roof including pathways. Up to 10% of the green roof area can be hardscape. Remainder of roof must meet Energy Star level for reflectivity.
2. Projects choosing to exceed ASHRAE 90.1-2004 must exceed the standards by 14% .
3. Building Certification can be LEED, Energy Star or Chicago Green Homes.
4. All new and reconstructed alleys must follow City of Chicago Department of Transportation (CDOT) Green Alley standards.
5. Apply the requirements for the predominant use for mixed-use projects.
6. These requirements pertain to grocery stores that are located within Food Deserts as identified by the "Chicago's Food Deserts by Tract with Community Boundaries" map.

REFERENCES:
LEED Certification: http://www.usgbc.org/
Green Roofs: http://www.chicagogreenroofs.org
Energy Star Certification: http://www.energystar.gov/
Chicago Green Homes: http://www.cityofchicago.org/environment
ASHRAE 90.1 - 2004: http://www.ashrae.org/technology/page/548
City of Chicago Green Alley Standards: Tel. 312.744.5900
City of Chicago Stormwater Ordinance: http://cityofchicago.org/environment

LEGEND:
SF = Single Family
TH = Townhomes
RFP = Request for Proposals
TIF = Tax Increment Financing
VUA = Vehicular Use Area

Bibliography

Austin, Elizabeth N., Yvonne A. M. Johnston, and Lindsay Lake Morgan. "Community Gardening in a Senior Center: A Therapeutic Intervention to Improve the Health of Older Adults." *Therapeutic Recreation Journal* 40, no. 1 (January 24, 2006). http://js.sagamorepub.com/trj/article/view/965.

Bowen, Shannon L. "EMERALD CITY." *Hollywood Reporter -- International Edition* 405, no. 32 (July 11, 2008): 32–33.

California Buildings Standards Commission. "2010 California Green Building Standards Code California Code of Regulations, Title 24, Part 11," January 1, 2011.

Chicago Department of Environment. "A Guide to Rooftop Gardening." The City of Chicago, 2003.

"Chicago Industrial Development Revenue Bonds (IDBs) | World Business Chicago | Economic Development, Chicago, Illinois." Accessed April 17, 2013. http://www.worldbusinesschicago.com/site-selector/chicago-industrial-development-revenue-bonds-idbs.

City of Chicago. "City of Chicago Sustainable Development Policy," 2007.

"City of Chicago: Class L Property Tax Incentive." Accessed April 17, 2013. https://www.cityofchicago.org/city/en/depts/dcd/provdrs/hist/svcs/class_l_propertytaxincentive.html.

"City of Chicago: Enterprise Zone Program." Accessed April 17, 2013. http://www.cityofchicago.org/city/en/depts/dcd/supp_info/enterprise_zone_program.html.

"City of Chicago: Housing and Economic Development." Accessed April 17, 2013. http://www.cityofchicago.org/city/en/depts/dcd.html.

"City of Chicago: Lakefront Protection Application." Accessed April 17, 2013. https://www.cityofchicago.org/city/en/depts/dcd/provdrs/planning_and_policydivision/svcs/lakefront_protectionapplication.html.

"City of Chicago: Planned Development Designations." Accessed April 17, 2013. http://www.cityofchicago.org/city/en/depts/dcd/provdrs/planning_and_policydivision/svcs/planned_developmentdesignations.html.

"City of Chicago: Tax Increment Financing (TIF)." Accessed April 17, 2013. http://www.cityofchicago.org/city/en/depts/dcd/provdrs/tif.html.

City of Los Angeles. "Los Angeles Green Building Code Ordinence," December 15, 2010.

"Cityscapes: Ten Years of Green Roofs in Chicago: Mayor Daley's Green Thumb and Iron Fist Have Produced Impressive Gains, but the Movement Remains in Its Infancy." Accessed April 17, 2013. http://featuresblogs.chicagotribune.com/theskyline/2010/04/theres-been-so-much-hype-about-green-roofs-in-chicago-that-i-went-to-the-willis-tower-sky-deck-last-week-expecting-to-see.html.

Darnall, M. J. *Roof Gardening on a Grand Scale*, 1991.

"Dear Santa: The 50 Parks Initiative Is Great, but Please Bring South L.A. Some Green Space for Christmas | Streetsblog Los Angeles." Accessed April 18, 2013. http://la.streetsblog.org/2012/12/20/dear-santa-the-50-parks-initiative-is-great-but-please-bring-south-l-a-some-green-space-for-christmas/.

Department of Building and Safety. "City of Los Angeles Zoning Code: Manual and Commentary Fourth Addition." City of Los Angeles, 2005.

"Greywater Systems for Residential Buildings." City of Los Angeles, November 5, 2012.

"Los Angeles Municipal Code." City of Los Angeles, n.d.

Department of Planning & Development. "Empowerment Zone Program." City of Chicago, 1998.

Development Incentives Office. “Class 6B Eligibility Requirements.” Office of the Cook County Assessor, n.d.
Deweerdt, Sarah. “A 30,000-Square-Foot Community Garden, in a Parking Garage,” May 29, 2012. http://www.theatlanticcities.com/neighborhoods/2012/05/30000-square-foot-community-garden-parking-garage/2102/.
Environmental Affairs Commission. “Green Roofs-Cooling Los Angeles: A Resource Guide.” City of Los Angeles, 2006.
Espinoza, Ernesto. East Los Angeles Community Corporation, February 6, 2013.
Finnegan, Michael. “In L.A.’s Mayoral Race, Battleground Areas Have Common Concerns.” *Los Angeles Times*, February 16, 2013. http://articles.latimes.com/2013/feb/16/local/la-me-mayor-groundup-voters-20130217.
Flores, Raeven, and Rene Rodriguez. Abode Communities, March 5, 2013.
“‘Food Desert’ Oases: Converting Corner Stores into Healthy Neighborhood Markets in South L.A. (Part I in a Series) | Streetsblog Los Angeles.” Accessed April 18, 2013. http://la.streetsblog.org/2012/07/27/food-desert-oases-converting-corner-stores-into-healthy-neighborhood-markets-in-south-l-a-part-i-in-a-series/.
“Funding Opportunities | Green Building |US EPA.” Accessed April 17, 2013. http://www.epa.gov/greenbuilding/tools/funding.htm#state.
Green Roofs and Rooftop Gardens. Brooklyn Botanic Garden Guides for a Greener Planet handbook #198. Brooklyn, NY: Brooklyn Botanic Garden, 2012.
Kuttner, Robert. “Building Green,” April 2006. http://0-search.proquest.com.oasys.lib.oxy.edu/socialsciences/docview/201128645/1395F34499A453EB47E/3?accountid=12935.
Lawson, Laura J. *City Bountiful a Century of Community Gardening in America*. Berkeley: University of California Press, 2005. http://0-site.ebrary.com.oasys.lib.oxy.edu/lib/occidental/Doc?id=10076810.
Lloyd, Lauren. “From Rooftop To Fork: Downtown L.A. Club Grows Its Own Greens: LAist,” January 31, 2012. http://laist.com/2012/01/31/from_rooftop_to_fork.php#photo-1.
MacVean, Mary. “A Roof Full of Vegetables at the Cobb Apartments on Skid Row,” October 14, 2011. http://latimesblogs.latimes.com/home_blog/2011/10/charles-cobb-apartments-rooftop-garden.html.
McIntosh, Annika. “Green Roofs in Seattle: A Survey of Vegetated Roofs and Rooftop Gardens.” City of Seattle, August 2010.
Northwestern University. “EPA Urban Heat Island Pilot Project City Profile: Chicago.” Environmental Protection Agency, 2001.
NPR. “ANALYSIS: ENVIRONMENTAL PROTECTION AGENCY EXPERIMENTS WITH ROOFTOP GARDENS AND OTHER CHANGES TO TRY TO BRING DOWN THE TEMPERATURES IN CITIES,” November 29, 1999. http://0-search.proquest.com.oasys.lib.oxy.edu/socialsciences/docview/189956062/1395F32CB4D453EB47E/1?accountid=12935.
Osmundson, Theodore. *Roof gardens: history, design, and construction*. New York: W.W. Norton, 1999.
Rachel. Farmscape, February 7, 2013.
Raymond, Laura. Seattle P-Patch, February 27, 2013.
“Real Estate, Land Use and Environmental Law Blog: Real Estate, Land Use and Environmental Law Lawyer & Attorney : Sheppard Mullin Law Firm: Supreme Court Refuses to Hear *Palmer* Case - Are Inclusionary Zoning Practices Due for Change?” Accessed April 17, 2013.

http://www.realestatelanduseandenvironmentallaw.com/land-use-and-entitlements-supreme-court-refuses-to-hear-palmer-case-are-inclusionary-zoning-practices-due-for-change.html.
Rooftop Gardens Task Force of San Francisco Beautiful. *Rooftop gardens: from conception to construction*. San Francisco: San Francisco Beautiful, 1997.
Seattle Department of Planning and Development. "DPD -- Green Factor: Overview," 2010. http://www.seattle.gov/dpd/Permits/GreenFactor/Overview/.
Seattle Public Utilities. "Storm Water Manual Vol. 3 Stormwater Flow Control & Water Quality Treatment Technical Requirements Manual," November 2009.
Sewell, Abby. "L.A. County to Revise Proposed Parcel Tax to Fight Polluted Runoff." *Los Angeles Times*, March 12, 2013. http://articles.latimes.com/2013/mar/12/local/la-me-stormwater-20130313.
Sonenshein, Raphael. *Los Angeles: Structure of City Government*. League of Women Voters of Los Angeles, 2006.
Team, National Weather Service Corporate Image Web. "National Weather Service - NWS Seattle." Accessed April 17, 2013. http://www.nws.noaa.gov/climate/index.php?wfo=sew.
The California Energy Commission. "Energy Efficiency Financing." Accessed April 17, 2013. http://www.energy.ca.gov/efficiency/financing/index.html.
The School of the Art Institute of Chicago. "Chicago Green Roofs," 2006. http://www.artic.edu/webspaces/greeninitiatives/greenroofs/main.htm.
The Strategic Growth Council. "Strategic Growth Council - Urban Greening Grants (Round 2)," April 11, 2013. http://www.sgc.ca.gov/urban_greening_grants.html.
Torres, Jayne. Skid Row Housing Trust and Ur-Bin, February 19, 2013.
"Urban Agriculture | Los Angeles Food Policy Council." Accessed April 18, 2013. http://goodfoodla.org/resources/local-good-food-organizations/urban-agriculture/.
"Violent Crime Ranking - Mapping L.A. - Los Angeles Times." Accessed April 18, 2013. http://projects.latimes.com/mapping-la/neighborhoods/violent-crime/neighborhood/list/.
Wark, Christopher, and Wendy Wark. "Green Roof Specifications and Standards: Establishing an Emerging Technology." *The Construction Specifier* 56, no. 8 (August 2003): 12.
Wingfield, Allan. "Greenroofs101: Drainage," 2013. http://www.greenroofs.com/Greenroofs101/drainage.htm.
"Greenroofs101: Filter Fabric," 2013. http://www.greenroofs.com/Greenroofs101/filter_fabric.htm.
"Greenroofs101: Waterproofing," 2013. http://www.greenroofs.com/Greenroofs101/waterproofing.htm.