Analyzing the green roof: a critical dialogue

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Analyzing the green roof: A critical dialogue

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PREFACE

It is my intention to create a dialogue with the reader. By engaging the reader in the dialogue, he or she is called upon to critically analyze his or her own thoughts and opinions on green roof issues. The dialogue within this thesis is a catalyst for further discussion within various professions about the present state and future possibilities of green roofs. In order to effectively have this dialogue, the traditional thesis format is altered visually and verbally in a manner that invites the reader to participate in a discussion about green roofs.

To enhance the arena for dialogue, the format of the document is rotated from portrait to landscape orientation. Instead of a long running single block of text, several various paragraphs act as the different voices of the discussion. These paragraphs of text may overlap each other, cut each other off, or dominate the page just as separate voices within a dialogue add their opinions at different times and with different inflections of voice. These textual “voices” are also constructed of different fonts that represent the distinctive characteristics of each voice in the dialogue. These textual voices portray various professionals that are involved in green roof design (which will be defined later) such as landscape architects, architects, ecologists, planners, and roofing contractors.

The main body of this thesis constitutes the dialogue. However, before this dialogue is begun it is important to set the stage for the discussion. Therefore, the thesis begins with a conventional introduction, literature review, and historical overview. Also, following conventional thesis format, the dialogue ends with a conclusion. The format of double columns of text and images in these sections allow for quick reference between images and the text that describe them.
INTRODUCTION

“An opportunity is emerging to introduce landscape architecture into another realm - the roofs of buildings - in a revolutionary way.”

- J. William Thompson

Landscape architecture is a domain that lies at the crossroads of many disciplines. Perhaps the most apparent of those disciplines are art and science. The future of landscape architecture depends on the successful integration of art and science. A successful landscape architect is one who understands this intersection and consciously designs to enhance the function of both aesthetics and environmental processes. Unfortunately not all designers focus on these important issues and aesthetics and/or environmental processes are often overlooked. Yet, the integration of aesthetics with environmental function is imperative in the design of the green roof. The green roof is an example of a landscape architectural design that can integrate aesthetics with environmental function as well as a number of other functions.

The green roof is a roof that is covered in vegetation such as grasses and/or plants that provide an environmental function instead of the conventional roofing materials of gravel and tar. However, the green roof is not just a physical structure, it is also a philosophical structure. It is important that the deeper philosophical structures of the green roof are investigated to understand the reasons for their use and to further promote their design and construction. Therefore, this thesis is a critical inquiry into the theory behind and the assumptions that have shaped the green roof.

Theory

Theory is “the talk we talk when a consensus breaks down, when we begin to disagree about fundamental principles and to
argue about which principles are truly fundamental” (Richter 9). Theory is essential to practice a discipline such as landscape architecture because it serves as a foundation from which to build. The discussion of theory is relatively new in landscape architecture and the field is slow in realizing that it is an important element that is needed to practice successfully. One definition of theory is that it is opposite of practice. Theory is that which is proposed and practice is that which is done (Williams 317). However, theory is linked to practice in that practice is based on theory.

The theory behind the practice of green roof design focuses on science and technology. Specifically, green roof design is currently focused on the science of the environment (air pollution, stormwater management, and climatology) and technology of the green roof structure (waterproofing, drainage, and planting system). This can be seen in the literature available on the green roof and will be discussed in further detail within the literature review section of this thesis. I do not agree that the theory of science and technology should be the primary foundation of green roof design. Therefore, I propose a shift to a paradigm based on a cultural approach. By this I mean that a new green roof theory based on culture takes a more holistic approach to green roof design. This theory is more inclusive of not only structural technology and design but also cultural beliefs and traditions that influence green roof design.

This thesis utilizes a framework of literary theory to analyze the green roof. This is due to the fact that according to post-modern theory, the design and structure of the green roof can be read and interpreted as a text. This will be explained in more detail after post-modern theory is explained in the next couple of paragraphs. With this said, a brief history of literary theory and its evolution will be provided because it is important to understand the major issues and concepts behind the two major types of literary theories (formalist theory and post-modern theory) since literary theory is the theoretical framework that will be applied throughout this analysis.

In literary theory, the traditional formalist paradigm of the 1940s to the 1960s stated that, “everything needed for the analysis of the [text] is contained within the [text] itself” (Richter 19). Text in this sense refers to the written work of an author. This premise repressed politics, culture, and economics as influences on the text. This formalist paradigm also assumed that an author’s intentions were not to be taken into account when interpreting the text. This formal theory was established to make understanding and interpreting literature more democratic because anyone could interpret the text from what they found in the text rather than from what educational background or subjective experiences they had acquired. However, this approach was more totalitarian than democratic because it was so rigid in its analysis of strictly the text and did not allow for any questions or interpretations based on author’s intent, social context, or patronage, which would ultimately uncover many more perspectives and interpretations.
Post-modern theory born in the 1970s rejected the notion that text was only written and declared that everything was text. This is to say that everything (such as a documentary film, a newspaper advertisement, and even a green roof) could be read and interpreted as a text because this text is merely a representation of the systems and signs that are understood and interpreted by various disciplines according to their own guiding principles. According to the post-modernists, text does not stand alone but rather acquires meaning through an "awareness of multiple perspectives that yield competing narratives and analyses" (Richter 7). This theory states that there are many perspectives that influence a text and the way it is analyzed and no one perspective is the true and correct way of interpreting the text.

Within a post-modern framework, the green roof is a visual "text" — composed of living and non-living elements that when combined creates a visual text that can be read and interpreted similar to written text. The current view of green roofs is similar to literary formalism in that the technological theory green roof is a text that focuses on its own structure and design. As evident in the majority of the literature written about the green roof, the profession of landscape architecture analyzes the superficial "textual elements" of structure, technology, and overall design of the green roof rather than the deeper meanings hidden within the "text". This deeper understanding of the green roof is evident if the theoretical framework is shifted from science and technology to culture and critical inquiry. This thesis is exploring the uncharted cultural meanings of the green roof by shifting to cultural criticism, which is based on cultural theory.

Necessity For Criticism

Criticism is based on theory. A theoretical base is important because it allows a framework for critical dialogue to operate. If criticism is the primary avenue for the dialogue in this analysis, it is important that criticism is defined. The word criticism has many connotations. Robert Riley, professor emeritus of architecture and landscape architecture at the University of Illinois at Champaign-Urbana and former editor of Landscape Journal, states that criticism consists of analysis and evaluation. Critical analysis occurs in terms of an explicitly stated framework and evaluated against explicitly stated standards (McAvin 167). Elizabeth Meyer, professor of landscape architecture at University of Virginia, defines criticism from the literary writings of John Dewey, Edward Said, and Terry Eagleton to be "the explication of content and context" (McAvin 157). The critical analysis in this thesis will be based on these combined definitions. The framework and standards of literary criticism are adopted in this analysis because of the absence of an established critical framework in landscape architecture. It is relevant to adapt literary criticism to landscape architecture because just as literary text can be read and interpreted, so can landscape architectural design.
So, why is criticism so important? Criticism and critical inquiry provide necessary standards for a profession. Disciplines such as architecture, art, theater, and literature have long integrated criticism into their ideologies, but the field of landscape architecture has been slow in adopting critical methods. Why is this? Could it be because landscape architectural discourse is lacking established norms and codes? Or could it be because landscape architecture does not have a critical language of its own (McAvin 155)? The discipline of landscape architecture needs to start looking into these critical inadequacies in order to adopt a critical method. Criticism is important because it is beneficial for the growth of a profession.

The foundation for the critical analysis in this thesis parallels the ideologies of Robert Riley and Elizabeth Meyer. In a recent editorial in *Land Forum*, Riley states that criticism can make two contributions to a profession: it can encourage debate and it can build an informed and more demanding audience - landscape connoisseurs (22). Meyer supports criticism for three reasons: criticism fosters precision of language, criticism produces new ways to think and evaluate, and critical inquiry agitates for change (McAvin 157).

Criticism and critical inquiry begin with individual critical thinking and leads to dialogues within and between professions. James Corner, explains the fundamentals of criticism:

> The rules for critical discourse were founded on a conversational and circumstantial sense, rather than on doctrines of absolute authority and certainty.

The assumptions that underlaid ideas were reflected upon through dialogue and contemplation, in critical response to specific circumstances and particular situations (McAvin 160).

These professional dialogues are crucial for the development of fresh and creative ideas, which continue to expand the possibilities of design. Margaret McAvin states, “Critical dialogues should be inclusive and essential rather than esoteric and peripheral. They must engage academics and practitioners, designers and planners, artists and researchers; each can contribute design as criticism or criticism of design to the evolution of landscape architecture” (McAvin 156).

The critical inquiry in this thesis is a dialogue about green roof design. This dialogue follows McAvin’s framework for a critical dialogue in that it is inclusive of many viewpoints and presents various professional voices that all add to the development of green roof design. It is important to note here that unlike a discussion, a dialogue does not conclude with an endpoint or solution. Such is the case with the dialogue of this thesis - it does not end with answers to the critical questions that are posed within the analysis. However, it is intended to promote further questioning and debate within and amongst a variety of professions.
Cultural Criticism

Cultural criticism is the focus of this green roof analysis. This type of criticism is relevant to green roofs because the green roof is a cultural construct. Specifically, the green roof is a product of a cultural framework. This framework consists of cultural elements such as economics, politics, social classes, and values that work collectively to influence the development of green roof design. Cultural criticism allows a deep inquiry into how a culture influences the design and use of the green roof. Subsequently, according to Riley and Meyer, these questions can then encourage debate and produce new ways to think about and evaluate green roofs.

As stated earlier, this investigation is based on the fundamentals of literary criticism. Specifically, the framework for this study is derived from Stephen Greenblatt’s essay *Culture*. The essay states that cultural criticism is based on an “awareness of culture as a complex whole” (Greenblatt 226). This is to say that many influences, such as the elements stated in the paragraph above, work together to shape a culture.

Cultural criticism in literary studies is driven by questions that one must ask about the text being analyzed. These questions include the following:

  - What kinds of behavior, what models of practice, does this work seem to enforce?

Why might readers at a particular time and place find this work compelling?

Are there differences between my values and the values implicit in the work I am reading?

Upon what social understandings does this work depend?

Whose freedom of thought or movement might be constrained implicitly or explicitly by this work?

What are the larger social structures with which these particular acts of praise of blame might be connected? (Greenblatt 226)

According to Greenblatt, “such questions heighten our attention to features of the literary work that we might not have noticed, and, above all, to connections among elements within the work” (226).

These questions are also relevant to the “text” of landscape architectural design. They encourage landscape architects to probe deeper into their design intentions by asking the questions stated above. By consciously designing with these cultural questions in mind, landscape architects have the power to produce more meaningful and powerful designs.

A cultural critic implements a variety of strategies in order to validate his or her analysis. These moves include establishing a broad context, focusing on multiple cause and effects, being critical of highbrow culture, emphasizing economics, and testing the
boundaries of culture. In his essay, Greenblatt defines this last move, testing the boundaries of culture, in terms of constraint and mobility (225).

Without the implication of movement, the limits of culture can become meaningless. The reference to constraint and mobility indicates that beliefs in certain issues and values can push and/or pull on the boundaries of a culture. This movement can either constrict an existing culture or push out of the existing culture to form a new culture altogether.

This thesis is a critical inquiry into green roof design. Similar to any critical assessment, this document required critical thinking that involved reflection and speculative contemplation and culminates in a call to action (McAvin 161). It is important to note again, as stated earlier, that critical analysis is not of an authoritative nature, rather it is a medium to promote future explanation and critique (McAvin 161).

There is opportunity for the profession of landscape architecture to add a new dimension to the field by applying critical methods to designs and concepts. It is critical that landscape architects “explore connections to the encompassing realms of nature and culture” (McAvin 156). By providing a professional standard that includes both cultural and natural elements, criticism will encourage the development and evolution of green roof design in America beyond the science and technology of its structure.

The possibilities of green roof design are limitless. Landscape architects are the ideal professionals to design, construct, and promote green roofs because the elements of green roof design fall into both the scientific and artistic realms of the profession due to the fact that the green roof is both environmentally and aesthetically functional. A cultural dimension added to the realm of green roof design through criticism and critical inquiry can only further inform and enhance construction and design. Moreover, a move toward this cultural dimension via criticism also advances green roof theory toward a more post-modern and holistic foundation.

Before the cultural dialogue is begun, it is important to understand some background information on the green roof and rooftop gardens. This information will set the stage for the dialogue. The next few chapters will provide a broad overview of the literature available on the subject of green roofs and rooftop gardens; a typological study that defines and describes various types of vegetative rooftop structures; and a historical overview that traces the cultural and structural evolution of the green roof and rooftop gardens through time.
LITERATURE REVIEW

The green roof has potential environmental, social, aesthetic, and economic benefits within both the urban and suburban context. In following the cultural criticism foundation of this thesis, this literature review looks at the wide range of perspectives that exist in the literature written about rooftop gardens and green roofs. These perspectives come from various disciplines such as landscape architecture, architecture, and horticulture and these perspectives work together to create the “complex whole” (as Stephen Greenblatt describes it) of current green roof knowledge.

Green roof technology has been used extensively in Germany for many years due to these benefits. However, in the United States the green roof concept has not been widely accepted. In an article published in the May 1998 issue of Landscape Architecture Magazine, J. William Thompson stated that the reason for the low popularity of the green roof in America is because little technical information about green roof systems is published in English (51).

A search of green roof literature available in English reveals that most of the information has been written about rooftop garden design rather than green roofs. This thesis analyzes the green roof in relation to rooftop gardens because they are similar structures in that they both exist on rooftops and they share the same history. It is important to study both rooftop gardens and green roofs because these two structures are related and are often times confused with each other. Although green roofs and rooftop gardens may seem like similar entities, they are truly different in both structure and purpose as seen in the following brief definitions:
**Rooftop Garden:** any planted open space, intended to provide human enjoyment or environmental enhancement that is separated from the earth by a building or other structure. A rooftop garden's primary purpose is to provide a place to be among or to view plants (Osmundson 13).

**Green Roof:** a thin-growing medium spread over layers of drainage medium or waterproofing that may cover the entire roof. The primary goals of a green roof are environmental, such as decreasing stormwater runoff, absorbing solar radiation, decreasing air pollution, and insulating the building (Thompson 38).

Another difference between rooftop gardens and green roofs is the type and amount of literature available on each topic. The rooftop garden concept dates further back in time than the green roof, so there is naturally a larger amount literature published on rooftop gardens. Most rooftop garden data can be found in books, journal articles, and magazine articles. These books range in subject from historical accounts of rooftop gardens during ancient times to “how-to” books for the construction of simple residential rooftop gardens. Since the green roof is a fairly new idea, very few books have been published on them at this time. Most green roof information can be found on the Internet, in magazine articles, and from company brochures.

Theodore Osmundson’s book, *Roof Gardens: History, Design, and Construction*, is a major comprehensive resource on rooftop gardens. Published in 1999, this book outlines the evolution of rooftop gardens from the ancient Hanging Gardens of Babylon to the popularity of rooftop gardens after World War II. Although Osmundson’s book reviews a vast array of rooftop gardens over time, it does not discuss the state of the most current green roof technology available. However, Osmundson’s rooftop garden historical timeline is a fundamental framework in which to study the evolution of the current green roof.

Regional history books are key resources for information on ancient rooftop gardens. Books on the history of ancient Mesopotamia and Babylon commonly discuss the legendary Hanging Gardens of Babylon. Similarly, detailed information on the rooftop gardens of ancient Pompeii, the Italian Renaissance, or the Hermitage is located in specific books on each of those topics. Rooftop garden historical information for specific areas such as the Kremlin and Tenochtitlan is scarce and a detailed literature search revealed only minimal descriptions of these gardens in history books. Nonetheless, these stark descriptions give clues to the history of rooftop gardens and are important in compiling a complete evolutionary account of rooftop gardens.

Urban rooftop gardening techniques are widely discussed in books ranging in date from the 1920s to the 1970s. These books illustrate the advantages of residential rooftop gardening and mostly focus on simple container plantings. Early rooftop gardening books, such as Ida Mellen’s *Roof Gardening* published in 1929, promote
the rooftop garden as a profitable real estate investment and a place to practice the hobby of urban gardening. Mellen's book, the first of its kind, explains her experimentations with rooftop gardening on the tin roof of her New York City apartment. She describes the elements of her garden from small seating areas to specific plants that thrive in the rooftop environment.

Residential rooftop gardening books published in the 1960s and 1970s focused on more elaborate designs than Ida Mellen's simple rooftop container garden. During the 1960s, rooftop gardens were becoming more complex and growing into different types: balcony gardens, terraces over parking spaces (i.e. carports), simple roof gardens, and decorative penthouse gardens (Smith 138). These books advocated for creativity in rooftop design by using fountains, brick planters, and outdoor carpeting. A book entitled *The Secret Gardens of Watergate* described a balcony garden that even utilized mirrors to give the illusion of a larger garden space (Innis 20).

Alice Upham Smith's 1969 book, *Patios, Terraces, Decks, and Roof Gardens*, started to discuss the environmental function of rooftop gardens such as shade creation and sun reflection from the plants (138). Furthermore, a book entitled *Rooftop Gardening* published in 1977, dedicated a whole chapter to discussing the role rooftop gardens play in decreasing air pollution (Tinkel 115).

Magazine and journal articles on rooftop gardens flourished in the 1960s and 1970s. These articles focused mostly on large urban plaza rooftop gardens (mostly ground level rooftop gardens built above underground parking garages). These were highly social spaces due to their location within highly populated urban environments. These public spaces were so popular that the October 1962 issue of *Landscape Architecture Magazine* dedicated half of the issue to rooftop gardens. Descriptive articles featured prominent rooftop gardens of the time such as Kaiser Center in Oakland, the Equitable Plaza in Pittsburgh, and Tower Square in Hartford.

In 1976 a book entitled *Roofscape* was published. According to the author, Gary Robinette, the purpose of the book was "to collect and chronicle readily available information concerning the landscape development which has taken place on rooftops throughout North America" (1). As populations grew and cities expanded in the 1970s, it was important to explore "the potential for the use of rooftops as spaces for landscape development" (Robinette 1). This book included information on designing public rooftop spaces, construction of large-scale rooftop development, elements of the urban roofscape, and concluded with several case studies. Similar to the October 1962 issue of *Landscape Architecture Magazine*, many of the case studies discussed in *Roofscape* focused primarily on large urban rooftop plazas and squares such as Constitution Plaza, Mellon Square, and the J.F. Kennedy Center to name a few. Although this was an important publication on rooftop development, it was only a first attempt at collecting information and it admitted that much more information was needed in order for it to be considered a comprehensive resource (Robinette 1). The 1976 edition of
Roofscape was considered a first edition with the hopes that subsequent editions would be added as interest and additional outside support and funding of rooftop development grew. Unfortunately, interest in rooftop gardening did not grow into the 1980s and revised editions of Roofscape were never published.

Rooftop gardening in the 1980s was not prevalent. Little information on rooftop development at this time can be found in books or articles. However, the 1990s saw a renewed interest in rooftop gardening with many articles published in landscape architectural magazines as well as architectural periodicals. A disproportionate amount of this rooftop garden information was found in architectural periodicals rather than landscape architectural magazines and journals, which prompts the following question: does the roof of a building fit into the realm of architecture or landscape architecture?

The field of architecture has seen how a “heightened awareness of earth-centric information has influenced architecture in the 1990s” with the popularity of “green architecture” (Wines 9). According to an online article by Centerline Designs Inc., a green architecture firm, green architecture is sustainable and “focuses on the environment, economy, public health and comfort. It’s about quality, durability, and longevity. It’s about environmental consciousness, energy saving design, the use of nontoxic materials, and the use of efficient techniques to construct a more cost-effective [building]” (Centerline).

While rooftop gardens can be considered an element of architecture, green roofs are elements of green architecture because their environmental functions correspond with the above definition of green architecture. The increase in green architecture during the 1990s brought forth an awareness of green roofs in American the architecture, even though they have been used extensively in Europe for the past three decades. British architectural journals such as Royal Institute of British Architect’s Journal (RIBA Journal), Architectural Review, and The Architects’ Journal and Canadian architectural journal, Canadian Architect are just some of the international publications that have featured articles or architectural designs of green roofs within the past decade. All of the green roofs mentioned in journal articles have been located abroad in England, the Netherlands, Canada, and Germany.

In the United States, green roofs have not been widely publicized especially in the field of landscape architecture. However, since 1998 green roofs have been gaining more attention in landscape architecture and horticultural periodicals such as Landscape Architecture Magazine and Garden Design. However, not one scholarly journal in the discipline of landscape architecture, such as Landscape Journal or Landscape has published any articles, editorials, commentaries, and/or critiques on green roof design.

The scarcity of green roof literature in America compared to literature on the rooftop garden could be due to the fact that so little written material is available in English. Most green roof
information [available in English] is found in roofing company product literature, *Landscape Architecture Magazine* articles, websites on the Internet, and from the few architectural and landscape architectural firms that are trying to promote green roof design in the United States. These sources generally focus on the construction technology of green roof systems as well as the specific design and layout of the green roof rather than theoretical and critical critiques of the overall concept.

It is apparent in the search of available literature that green roof design lacks a critical foundation - there has been no critical inquiry into the complex issues or theories of the green roof concept. The broad cultural context of the green roof is important to its design and construction. Unfortunately, little information is available on the widespread perspectives that inform the cultural aspects of the green roof. In order to create a dialogue and bring the issues of green roofs to the forefront of landscape architectural design, this thesis will address some of the critical questions about the cultural context of green roof.

Another interesting point about green roof literature is the scale in which they are discussed. Green roofs are usually understood on a small scale. They are viewed as one singular green roof “island” within the concrete jungle. But what if green roofs were seen on a larger scale? This is to say that several green roofs together would create a “system” of green roofs rather than the green oasis of just one building. This would provide more ecological, economic, and aesthetic benefits to both the urban and suburban environments.

The architect Le Corbusier in his 1923 published work, *The City of Tomorrow and It’s Planning*, first described a planning approach that involved the importance of rooftop systems. His vision of proper city planning incorporated open space both on the ground and on the rooftops of buildings. Le Corbusier’s ideal city plan was composed of connected buildings that reached for the sky instead of sprawling across the landscape in order to conserve open space at the ground level. Each building in Corbusier’s city plan included a rooftop that was utilized for social recreation. When viewed together on a citywide scale, these rooftops function as social systems. Le Corbusier describes the design and function of these rooftops in *The City of Tomorrow and It’s Planning*, “On the roof of the building there is a 1000-yard track on which to run in the fresh air” (216).

Landscape architect, Geoffrey Jellicoe proposed an equivalent town planning system in his book, *Motopia*. This space age view of urban living featured tall apartment buildings connected in a grid across the landscape. Similar to Le Corbusier’s design, Jellicoe proposed buildings to grow upwards instead of outwards to conserve open space. However unlike Le Corbusier, Jellicoe’s rooftops would be paved and serve as traffic arterials for the community, thus keeping vehicular traffic away from human recreation in the open space of the ground level (Clay 13).
Although Le Corbusier and Jellicoe's rooftops provided entirely different uses, they both functioned in a system. These systems both functioned as corridors and matrices for movement across the city. A system of green roofs could function in much the same way except it would provide the safe movement of wildlife across the congested urban landscape. A system of green roofs would also provide a larger green surface area, which in turn would largely benefit urban climate, stormwater drainage, and air pollution at higher rates than by building only singular green roof islands. A system approach to the implementation of green roofs in the urban environment is one of the cultural issues that will be posed within the dialogue of this thesis.

As seen throughout a review of relevant literature, information on rooftop gardens far outweighs information on green roofs. This could be because the green roof concept is fairly new in America. The green roof concept could also be lacking recognition because the distinction between rooftop gardens and green roofs is unclear. This is due to the fact that many terms have been used throughout history to describe these vegetated rooftops such as roof garden, rooftop garden, eco-roof, grass roof, sod roof, roof terrace, green roof, and roof meadow to name a few. These terms are commonly used interchangeably and thus lead to confusion of what each term specifically represents. A standard needs to be agreed upon for these terms so that everyone understands the differences between a rooftop garden and a green roof. This thesis proposes a standard by using only the terms rooftop garden and green roof. These terms have very specific definitions that will be presented in the typology.
Typology: a study that explores a group of objects characterized by the same formal structure.

The purpose of this typology is to define and classify different types of vegetative roofing structures such as rooftop gardens and green roofs. It is important to distinguish between rooftop gardens and green roofs because these terms will be used throughout this thesis and because their definitions are different - rooftop gardens and green roofs are dissimilar entities that serve very different purposes.

A thorough investigation into the terms rooftop garden and green roof has yielded vague definitions. When these definitions are applied to roofing structures, they do not clearly explain a variety of situations. The terms rooftop garden and green roof have been used to define the same structure, even though in reality these terms describe very different structures.

In his book, Roof Gardens: History, Design, and Construction, Theodore Osmundson defines rooftop gardens as the following:

...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. While it may serve other functions - as a means of circulation or access or as a dining space, for example - a roof garden's primary purpose is to provide a place to be among or to view plants (13).

In the above definition, Osmundson states that the rooftop garden’s primary purpose is to “provide a place” for people. This definition
stresses that the major function of the rooftop is as a social space to move through, dine in, or view plants.

According to Charlie Miller of Roofscapes, a green roof technology supplier, a green roof is based on a completely different concept than a rooftop garden. He defines a green roof as:

A thin veneer of living vegetation installed on top of a conventional roof...It is important to distinguish green roofs from conventional roof gardens, which are essentially container plantings on a roof and may incorporate trees and other plants that require deep rooting. A green roof, by contrast, is a thin-growing medium spread over layers of drainage medium or waterproofing that may cover the entire roof...In terms of plantings, then, green roofs more closely resemble meadows than what we normally think of as gardens. If the primary purposes of a conventional roof garden are outdoor seating and enjoyment, the primary goals of a green roof are environmental, primarily the following: soaking up stormwater; absorbing solar radiation and converting it into plant foliage through photosynthesis; and insulating the building (Thompson 38).

For the purposes of this thesis, the terms rooftop garden and green roof will be defined according to the function the roof carries out - function being defined as the action or special duty that the roof performs. As mentioned in the definitions of Osmundson and Miller, the function of the rooftop garden is primarily social while the function of the green roof is primarily environmental. The following definitions also apply throughout this thesis for the terms social, aesthetic, environmental, and ecological:

Social: of or relating to human interaction with other humans (Guralnik 567).

Aesthetic: the conditions of sensuous perception that define beauty (Williams 31).

Environmental: of or relating to the circumstances or conditions that surround an organism or group of organisms as well as the complex of social or cultural conditions that affect an individual or community. Concern with the interaction between the human and natural habitat (Cunningham 614).

Ecological: of or relating to the relationships of living organisms with each other and with their environment. These relationships form systems in which living and non-living entities exist. It is concerned with the life histories, distribution, and behavior of individual species as well as the structure and function of natural systems at the level of populations, communities, and ecosystems (Cunningham 614).

However, not all vegetated roofing structures fall into either one true type [rooftop garden] or the other [green roof]. Therefore, this typology proposes a continuum of types of vegetated rooftops (see Figure 1).
In viewing various vegetative roofing structures across a continuum, this typology is implementing the strategies of cultural criticism, which is the foundation of this thesis. As stated in the introduction, Stephen Greenblatt asserts that the principles of cultural criticism are based on an "awareness of a complex whole" (226). This typology is also based on an awareness of a complex whole in that it acknowledges that various types of vegetative roofing structures are the product of cultural forces. These cultural forces determine the specific duty each vegetative roofing structure should perform such as social or environmental functions.

This continuum also implies movement along cultural lines. As the continuum shifts from end to the other, the cultural contexts also shift from social to environmental, public to private, and from low-brow to high-brow. These cultural contexts and elements will be discussed in greater detail within the dialogue.

This is a continuum that describes both past and present rooftop structures. At one end of the continuum lies social function and at the other end lies environmental function. The benefit of aesthetic function is not considered in this vegetative rooftop descriptive continuum diagram because all rooftop gardens and green roofs are assumed to be aesthetic compared to a conventional roof whether they are designed specifically to be aesthetic or not.
However, it is important to note that aesthetic function is intentionally designed into a majority of vegetative rooftop structures. Most of these vegetative roofing types are specifically designed to have a high aesthetic when a social function is involved. This will be explained in more detail in the following type descriptions.

Within the scope of social and environmental function, lies the issue of accessibility. Accessibility is defined as that which can be obtained, approached, and/or entered easily by humans. It should be noted that in this thesis accessibility does not refer to the accessibility standards of the Americans with Disabilities Act, but rather the ability for a non-disabled person to enter onto a rooftop area. As the continuum shifts from purely social function on the left to environmental function on the right, accessibility also shifts from highly accessible to not accessible. A true rooftop garden, designed for pure social function, is a highly public and accessible place. On the other hand, a true green roof that is designed for only environmental function would more than likely be private and not be accessible to any person (except for maintenance) because it would not consist of any paths, benches, or other social elements.

This typological study will highlight five major vegetative roofing types that exist along this descriptive and functional continuum. These rooftop gardens and green roofs will be described in more detail in the historical overview section.

**Type I: True Rooftop Garden**

Type I, the true rooftop garden, is located at the far left of the continuum. This type is purely social in function; therefore it is largely accessible to the general public. Because of this social function, this roofing structure is truly a rooftop garden according to the definition described earlier. Since a large number of people utilize true rooftop gardens, they are designed to have a strong visual aesthetic. A Type I roofing structure is a large public urban plaza that is both visible and easily accessible. Typically, a true rooftop garden is located at or slightly above ground level to heighten its accessibility and social function. Most of these Type I rooftop gardens sit atop underground parking garages in urban environments. Examples of this type of rooftop garden are Equitable Plaza in Pittsburgh and Union Square in San Francisco.

![Figure 2. Equitable Plaza, Pittsburgh, PA (Robinette 48).]
Type II

Type II vegetative roof structures are also highly accessible and built for social reasons, but not for the general public. Type II roof structures are also considered rooftop gardens, so these structures also incorporate a designed visual aesthetic. These rooftop gardens consist of terrace sitting areas and container gardens that are only accessible to certain groups of people. Specifically, the people that are allowed to access these gardens are owners of the residence in which the rooftop garden is located, employees of the building where the rooftop garden is built, and/or people involved in tours that pay to access the garden. Examples of Type II rooftop gardens include the rooftop gardens on the residences of ancient Pompeii; The Derry and Toms Department Store rooftop garden in London, England; and common residential rooftop gardens that are found atop urban apartment buildings.

Type III

In the middle of the continuum, the Type III rooftop structure contains characteristics of both the rooftop garden and the green roof. Therefore, they can be called either rooftop gardens or green roofs depending on the priority of their functions. Most of these structures are still considered rooftop gardens because of their primary social function and accessibility. However, whether it is their primary function or not, Type III roofing structures also have
an environmental component. Type III vegetative roofing structures have a designed aesthetic because of their social function. Examples of Type III rooftop gardens are the ancient ziggurats of Mesopotamia and the Hanging Gardens of Babylon. Although these rooftop gardens were designed primarily for their social function, these gardens utilize vegetation on the roof for climatic control because of their location in a warm climate. These environmental benefits can be felt both as shade on the roof and cooling insulation inside the building on which they are located. Modern examples of Type III green roofs can be found in Germany. These are called green roofs because they are designed primarily for the environmental benefit of stormwater management but are placed in the Type III category because they perform a secondary social function by containing seating areas, benches, and/or paths to make them accessible for social uses.

Type IV

Type IV rooftop structures are green roofs accessible only for maintenance purposes. These structures are considered green roofs because their primary functions are environmental - stormwater management, reducing air pollution, climate regulation, and wildlife habitat. Although this green roof is designed primarily for environmental function, a second function evident in the green roof is a designed visual component for the viewing pleasure of those that can see the rooftop from surrounding buildings. This
green roof is designed because the plants chosen for this roof are placed in a particular manner or pattern to create a visual aesthetic. Examples of Type IV green roofs are Chicago City Hall and the green roof seen in Figure 10 that covers a German office building.

Type V: True Green Roof

A Type V rooftop structure located at the far right of the continuum is a true green roof. A true green roof is constructed specifically for the environmental functions of stormwater management, air pollution control, insulation of the building on which they are located, and environmental climate control to name a few. The true green roof is not accessible to humans for social purposes, although it may be accessible strictly for maintenance purposes. The true green roof is highly accessible to wildlife such as birds and insects. Also, the vegetation on a true green roof is also not specifically placed or designed in patterns for a visual aesthetic. The green roof vegetation mimics a vast meadow or lawn. Examples of Type V true green roofs are the roofs on the buildings on the corporate campus of Gap, Inc. in California and the roofs on the Great Plains sod houses built by the Native Americans and early American settlers.

Figure 7. Ancient Mesopotamian ziggurat (Osmundson 113).

Figure 8. German green roof (Zinco 11).
Figure 9. Chicago City Hall green roof (Conservation Design Forum).

Figure 10. Type IV green roof on top of an office building in Germany (Courtesy of Conservation Design Forum).

Figure 11. True green roof at Gap Inc. headquarters in San Bruno, CA (Thompson 39).

Figure 12. Pioneer sod house in Nebraska is a Type V true green roof (Osmundson 121).
Cultivation of vegetation on rooftops has been a tradition since ancient times. Many different cultures have adapted vegetative rooftop structures to perform a variety of functions from social to environmental. A broad historical overview is necessary to document the evolution of rooftop gardens and green roofs. It is important to reveal how these structures have been situated within cultural contexts over time and to note that this cultural element plays an important role in the modern forms of rooftop gardens and green roofs.

A historical overview is appropriate for this study because its structure parallels the standards for cultural criticism - the critical theory upon which this thesis is based. As stated earlier, one of the major strategies of cultural criticism is to establish a broad context that takes into account many cultural perspectives. This historical overview is an example of that broad context in that it investigates the use of rooftop gardens and green roofs in many different cultures and contexts from ancient Mesopotamia to the United States in twenty-first century. Furthermore, cultural criticism tests the boundaries of cultures through the implication of movement. If we can recall from the introduction, Steven Greenblatt's definition of cultural criticism characterizes this movement through the terms constraint and mobility (225). This historical overview is based on a timeline and thus shows the constraint and mobility that causes the movement and evolution of the rooftop garden and the green roof through various cultural contexts over time.

As discussed in the literature review, the historical
background of vegetative rooftop structures is documented in one comprehensive resource. Theodore Osmundson's book, Roof Gardens: History, Design, and Construction, outlines the evolution of rooftop gardens and green roofs from the ancient Hanging Gardens of Babylon to the popularity of rooftop gardens after World War II. Although Osmundson's book reviews a vast array of rooftop gardens over time, it does not discuss the state of the most current green roof technology available. However, Osmundson's rooftop garden research is a fundamental framework in which to begin the historical evolution of the current green roof. The foundation of this historical overview is based on Osmundson's research and adapted to include examples of the most current green roof technology and design.

**Ancient Rooftop Gardens**

**The Ziggurats of Ancient Mesopotamia**

The history of the green roof concept dates back to antiquity. Historical mention of human-made roof gardens has been found to reference between the fourth millennium and 600 B.C. with the ziggurats of ancient Mesopotamia. Ziggurats are “great stepped pyramid towers of stone, built in stages” (Osmundson 112). The large steps within the pyramid were accessible by smaller staircases that stretched up the sides of the ziggurat. These large structures were typically placed within the courtyards of temples in major cities (Osmundson 112).

Figure 13. Ziggurat of ancient Mesopotamia (Osmundson 113).

Figure 14. Ziggurat of Ur, Sumeria (Mann 10).
According to the archaeological accounts of Sir Leonard Woolley, each large step was planted with trees and shrubs that acted as an oasis or point of relief during the workers' climbs up the sides of the ziggurats during their construction (Osmundson 112). This description of vegetated above ground “steps” is what places them within the ranks of the earliest known rooftop gardens.

Etemenanki is the most well known of the ancient Mesopotamian ziggurats. This ziggurat was located in the great square of the temple Esagila in the ancient city of Babylon. The structure was approximately 300 feet tall and measured 100 yards in length on each of its four sides. It was seven stages tall, which means it had seven “steps” and therefore seven levels of gardens.

Although Etemenanki was an important structure in Babylon, it was destroyed in 482 B.C. during revolts against the Persian king Xerxes I (Osmundson 112). There are, however, preserved examples of the ancient ziggurats such as the ziggurat of Nanna in the ancient city of Ur (Osmundson 112). The structure of Nanna was constructed of a mud core and brick facing and measured 68 feet tall (Osmundson 113). Nanna is the best preserved of the ancient ziggurats and provides a glimpse back to the beginnings of vegetated roofs.

The Hanging Gardens of Babylon

One of the Seven Wonders of the Ancient World, the Hanging Gardens of Babylon, was one of the earliest known 'gardens
in the sky'. The ancient city of Babylon was located on the Euphrates River in the Mesopotamian empire. In the modern era, this territory is present day Iraq.

Babylonian citizens had a fascination with luxurious gardens. In 302 B.C., King Seleucus of the Mesopotamian empire sent an ambassador to India. This ambassador, named Megasthenes, reported numerous stories during his travels to India. One of these stories exuded his high impressions with Chandragupta's gardens at the royal palace of Pataliputra in the capital city of Patna.

According to Philo of Byzantium, who wrote The Seven Wonders in 225 B.C., the Hanging Gardens grew in the air. “The roots of trees above form a roof over the ground. Stone pillars stand under the garden to support it and the whole area beneath the garden is occupied with engraved bases of the pillars.” (Romer 108)

It has been said that the Babalonian King Nebuchadnezzar II was responsible for building the royal palace as well as a better part of Babylon. He ordered the fortification of Babylon by the construction of three walls around the inner city and another three walls around the outer city. He added decorated gateways with sacred images as well as the fabled Hanging Gardens. According to Diodorus Siculus in The Library of History, the Hanging Garden was “built by a later Syrian king for one of his concubines. For they say that she was of Persian race and that, as she missed the meadows in the rolling hillside, she asked the king to imitate the distinctive features of her native Persia by means of a wonderfully designed
The following is a detailed description of the garden structure and the irrigation system extracted from the writings of Josephus, Diodorus, and Philo:

In the palace he built lofty stone terraces, made a vista as if of mountains, and planted all sorts of trees... The approach to the garden is mountainous and it is built tier upon tier. The result looks like a theatre... On the roof enough earth had been spread for roots of the biggest trees [to grow in]. Once the ground had been leveled, it was filled with trees of every kind... On top grow broad-leaved trees and garden trees, and there are varied flowers of all kinds - in short everything that is most pleasing to the eye and most enjoyable. The area is cultivated just as happens on ground level. In much the same way as on normal ground, it sees the work of people who plant shoots: ploughing goes on above those wandering through the supporting colonnade... Although no one can see from the outside what is happening, there are machines for irrigation: a great amount of water is brought up from the river by these machines... From above, aqueducts carry in running water: along one way the stream follows a wide downhill course, along the other way the water runs up, under pressure, in a screw; the necessary mechanisms of the contraption make the water run round and round in a spiral. The water goes up into many large receptacles and irrigates the whole garden. It dampens the roots of the plants deep in the earth and keeps the earth moist... (Romer 110)
Due to this description of the garden structure, it is obvious that the gardens themselves were not actually 'hanging' but rather this term was a misinterpretation. It has been said that the word 'hanging' was "probably a misunderstood translation of the Greek term for a farmer's terrace" (Romer 111).

In 1899, the first scientific archaeological expedition was mounted in the Middle East to unearth the grand temples, palaces, and houses of Babylon along with the legendary Hanging Gardens. Dr. Robert Koldewey, a German archaeologist, presided over the scientific excavation. By using Philo's texts, Koldewey was able to locate the garden "in a corner of Nebuchadnezzar's great southern palace, equipped with high stone vaults and a unique and ingenious irrigation system" (Romer 111). The only problem with calling this site the true location of the Hanging Gardens was that it was situated quite a distance from the Euphrates River.

Modern archaeologists refute Koldewey's location of the Hanging Gardens and say that his defined location was "in a part of the palace that was not made for recreation but administration" (Romer 112). Also, the immense distance of Koldewey's location from the river did not convince modern archaeologists that it was the correct spot. Another problem with Koldewey's assertions is that the stone vaults that he talks about would not have held the immense weight of the vegetation that sat upon them. Rather, the stone supporting terraces would have crumbled to the ground and the roots of the trees and shrubs would have also quickly damaged.

Figure 21. The Villa of the Mysteries as it looks today. Plantings have been added on the rooftop garden to replace those destroyed in the eruption of Mt. Vesuvius (Osmundson 115).

Figure 22. Stone arch vault that supports the rooftop garden of the Villa of the Mysteries, Pompeii (Osmundson 115).
Since the excavations of Koldewey at the turn of the century, many other researchers have challenged themselves to locate the Hanging Gardens. However, to this day no one (except Koldewey) has found even a pebble of the ruins of any ancient garden. The mystery that shrouds the Hanging Gardens makes them the most wonderful wonder of them all. According to Romer, “of all the Seven Wonders they are the one that everyone first names, but they are also the one that is the most insubstantial and elusive” (110).

The Rooftop Gardens of Pompeii

The eruption of Mount Vesuvius in A.D. 79 preserved buildings with impressive garden terraces, or rooftop gardens that had grand views of the Bay of Naples. These buildings were mostly lavish residences located on the edge of the volcanic ledge in the southwestern and western part of Pompeii (Jashemski 7).

During an archaeological excavation, The Villa of the Mysteries is one of the Pompeian buildings that was found to include rooftop gardens. This villa has a U-shaped terrace along the northern, western, and southern perimeters of the building where plants were grown directly in soil (Osmundson 115). Similar to the Hanging Gardens of Babylon, the terrace at the Villa of the Mysteries is supported by an arched stone colonnade on all three sides.

Archeological excavations of the villa’s terraces have

Figure 23. Hanging garden with pond in the House of Fabius Rufus, Pompeii (Jashemski 203).

Figure 24. Enlarged view of pool within the hanging garden of the House of Fabius Rufus, Pompeii (Jashemski 204).
revealed much information about the rooftop garden. The shape of
the paths and beds were evident as well as empty spaces in the soil
where roots had grown (Jashemski 283). Restoration experts have
poured plaster into these empty spaces and made molds of the roots
in order to find out the specific types of plants that were used in the
garden. These plaster root casts have revealed that flowers such as
roses would be the only vegetation that would be able to grow in the
shallow soil (Jashemski 283). With this knowledge, efforts are being
made to recreate and restore the rooftop gardens of the Villa of the
Mysteries (Osmundson 115).

Another building in Pompeii that contained a three level
rooftop garden was the House of Fabius Rufus. This large house
was built along the western wall of the city during the Imperial
period (Jashemski 202). This luxurious courtyard rooftop garden
consisted of a round pool painted blue and low shrubs that lined the
north, west, and south edges of the garden (Jashemski 203). Also, as
with most gardens in Pompeii, the House of Fabius Rufus contained
a gutter around the edge of the garden to collect water (Jashemski
203).

Middle Age and Renaissance Rooftop Gardens

Mont-Saint-Michel, France

A Benedictine abbey located off the coast of northwestern
France is home to a thirteenth century rooftop cloister garden. The
Mont-Saint-Michel cloister garden is enclosed around all four sides

Figure 25. The cloister garden in the abbey at Mont-Saint-
Michel is on the highest level of the monastery and rests on
a chamber below (Osmundson 116).

Figure 26. A small rooftop garden that overlooks the gulf at
the abbey in Mont-Saint-Michel, France (Osmundson 116).
with its center exposed to the open sky. The cloister garden rests on top of a stone chamber (Osmundson 115).

**Palazzo Piccolomini, Pienza, Italy**

Palazzo Piccolomini is an example of a well-preserved Italian Renaissance rooftop garden. Commissioned by Pope Pius II, the palazzo was built as the summer papal center in the mid-fifteenth century (Osmundson 116). Palazzo Piccolomini is built on a ridge and the rear of the building looks out on the valley of the river Orcia. The palazzo is constructed with stone and is located next to the town’s cathedral. Although designed by Rossellino, the Pope provided much of the inspiration for the design. Pope Pius highly appreciated the surrounding Tuscan landscape and encouraged the rooftop design to include spectacular views of it from the garden (Masson 76).

Since it is built along the slope of a ridge, the building consists of lower floors under the main floors as the grade slopes away. Specifically, as one exits the palazzo’s street-level main floor onto a rear courtyard they find themselves standing on top of a rooftop garden. This is because the street-level grade slopes down as the building’s main floor remains level so that a lower floor fits under half of the main level. This causes the rear courtyard to sit on top of a rooftop, therefore making it a rooftop garden. The lower floors under the rooftop garden consist of four rectangular rooms that house artisans’ shops and storage (Osmundson 116).

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**Figure 27.** This aerial sketch of Palazzo Piccolomini shows the rooftop garden on top of a structure that steps down the slope of a ridge (Osmundson 117).

**Figure 28.** Plan view of Palazzo Piccolomini. The rooftop garden is located at the bottom of this plan (Jellicoe 37).
The rooftop garden as described by Georgina Masson in her book, *Italian Gardens*:

On entering the garden, however, it appears as a small enclosed garden room, filled with the scent of the clipped box hedges that surround the raised parterres and provide a screen on the far side. This is pierced by three arches, and, it is only from there, and from the loggia of the piano nobile of the palace, that the subtlety of the garden design is fully appreciated, which in so small a space provides the amenities of a sheltered giardino segreto combined with one of the most spectacular views in Italy (76).

During the reign of Pope Pius II, the rooftop garden was used greatly for entertaining audiences (Osmundson 116). Today, the only visitors in the garden are tour groups that routinely visit the site.

**Tower of the Guinigis, Lucca, Italy**

This Italian Renaissance tower houses a small rooftop garden 120 feet above the street (Osmundson 116). The tower was a late addition to the house built by the wealthy Guinigi family around 1384. Although an exact date of the tower's addition is not known, "the garden does appear in a drawing of the city of Lucca dated 1660" (Osmundson 117).

The rooftop garden is accessible by an interior stairway.
located within the tower and is open to the public. The garden provides a panoramic view of the town of Lucca and the surrounding landscape. The garden consists of live oaks that grow in raised brick beds that are about 2 feet high and are watered by an underground sprinkler system (Osmundson 116).

**Medici Rooftop Garden, Careggi, Italy**

The Medici Rooftop Garden in Careggi, Italy, was built in the early fifteenth century by Cosimo de’Medici. There is little information known about this rooftop garden except that it was the pride of Medici because it was heavily planted with exotic plant species imported from foreign lands (Osmundson 117).

The garden followed classical garden design and included bays, box, cypress, myrtle, pomegranates, quinces, lavender and scented herbs and flowers (Masson 56). The Medici rooftop garden was the site of many horticultural innovations. Carnations first made their appearance here and orange and lemon trees were first grown in pots that were located along paths and around a fountain (Masson 56).

Today the villa is used as a hospital and the garden has fallen into ruin. The only remains include “lemon trees, some of the pebble mosaics of the paths, and a gently trickling fountain” (Masson 56).
Tenochtitlan

Hernan Cortes in 1521, evidence of the existence of rooftop gardens in the great Aztec city of Tenochtitlán can be found in the writings of the Spanish invaders. Cortes described Tenochtitlan, now present day Mexico City, in a letter to King Charles I of Spain in 1519: “…there are many rich citizens who also possess very fine houses. All these houses, in addition to having very fine and large dwelling rooms, have very exquisite flower gardens both on the upper apartments as well as down below” (Osmundson 118-119). Cortes continued to write about the residences of the Aztec nobles, “on the upper stories as well as on the ground floor there are fine gardens, with many trees and flowers of pleasing scent” (Moctezuma 149).

William H. Prescott described Tenochtitlan’s main street in The History of the Conquest of Mexico (1843):

The great avenue through which they [Cortes and his army] were now marching was lined with houses of the nobles, who were encouraged by the emperor to make the capital their residence. They were built of red porous stone drawn from quarries in the neighborhood and, though they rarely rose to a second story, often covered a large space of ground. The flat roofs, azoteas, were protected by stone parapets, so that every house was a platform for trees. Sometimes these roofs resembled parterres of flowers, so thickly were they covered with them, but more frequently these were cultivated in broad terraced gardens, laid out between the edifices (Osmundson 118).
Rooftop Gardens From 1600-1875

Passau, Germany
At the turn of the seventeenth century, the German cardinal Johann van Lamberg constructed a parterre garden on the roof of his residence in Passau (Osmundson 118). Planted terraces created grottoes and paintings on three walls of the building enhanced the aesthetic of the rooftop terrace's view.

The Kremlin, Moscow, Russia
In czarist Russia, the nobility regarded rooftop gardens as a great luxury. During the rebuilding of the Kremlin in the seventeenth century many “house-chapels” were erected, the living quarters of the royal family were extended and remodeled and many indoor and “hanging” gardens were laid out on the upper levels (Markova 10). Specifically, an extensive two-level hanging garden called the Winter Garden was installed on the roof of one Kremlin palace.

The Grand Princes’ Wing was connected to the Great Kremlin Palace by a passageway that was built from arched vaults upon which the Winter Garden was placed (Markova 12). Lead plates waterproofed the roof of the passageway and weighed approximately 10.24 tons (Osmundson 120). The lead sheets were covered with a layer of soil that measured one meter thick and supported the growth of trees, shrubs, and flowers (Markova 44). This rooftop garden was so heavy that it required extensive reinforcement of the vaults on which the garden was built (Osmundson 120).
The upper level of the Winter Garden had an area of 10 acres and was measured at 400 feet long. It was surrounded by a stone wall with embrasures and consisted of fruit trees, shrubs, and vines planted in boxes or tubs. The upper garden featured a 1,000 square foot pond with fountains fed with water from the Moscow River that was located next to the palace (Osmundson 119).

The lower terrace garden was built in 1681 and also had a large pond with a water-lifting tower and a lead-lined reservoir. The stone walls enclosing the lower garden were painted with scenic landscapes in order to create “the illusion of visually expanding the space” (Osmundson 120). Although the gardens were destroyed in 1773 to make room for a new Kremlin palace, they are still an important part of rooftop garden history.

The Hermitage, Saint Petersburg, Russia

The Hermitage in Saint Petersburg was the site of another Russian palace rooftop garden. In 1764, Catherine II commissioned the Italian architect, Bartolomeo Francesco Rastrelli to build a rooftop garden on top of the Winter Palace’s stables (Osmundson 120). This formal garden is long and rectangular and enclosed by the walls of the palace. The rooftop garden connected Catherine’s private apartments at one end with rooms for her lover, Count Grigory Orlov, on the other end (Norman 5). Galleries that housed Catherine’s extensive collection of paintings flanked the long sides of the garden and were built in 1770 (Norman 37).
The garden consists of a broad flagstone walk, an allee of small lilac trees, and a lawn connecting stone paved courts at both ends of the garden. The main square is designed as a partarre with four identical flower beds separated by flagstone walks. The entire garden is centered on a pool and fountain. Throughout the garden, classical statues emphasize the formal design (Osmundson 120). At one time, a conservatory opened up onto the rooftop garden where Catherine kept songbirds (Norman 5).

Rabbitz Rooftop Garden, Berlin, Germany

Berlin, Germany was the location of a ground-breaking discovery for a rooftop garden waterproofing technique in the late nineteenth century. Karl Rabbitz built a rooftop garden on his typical middle-class residence in an area known for its cold winters and year-round rain. An effective waterproofing technique was necessary to protect the structure of the residence, so Rabbitz designed and patented his own vulcanized cement sealant. The cement sealant was recognized as such a breakthrough in waterproofing that it was exhibited on a scale model at the Paris World Exposition in 1867 (Osmundson 121).

The Rooftop Garden of King Ludwig II, Munich, Germany

King Ludwig II of Bavaria built a large conservatory on the roof of a building in Munich. The indoor garden included a

Figure 39. House roofed with sod in Norway. Note the two trees that have taken root in the shallow soil (Osmundson 121).

Figure 40. A reproduction of a pioneer sod house in Gothenberg, Nebraska (Osmundson 121).
large pool and luxurious paintings. The inadequate waterproofing consisted of copper plates on stone arcading and ultimately led to the demise of the gardens. The roof leaked so badly that the rooftop conservatory was torn down in 1897 (Osmundson 121).

Sod Roofs

Sod roofs have been used effectively in both Scandinavia and America for over a century. The harsh freezing temperatures of Norwegian winters led to the use of the sod roof. The sod roof was “a roof covered with soil for insulation that was planted with grasses and other plants to stabilize the soil” (Osmundson 121). With modern insulation and heating systems, sod roofs are rarely built today, however a number of these sod roofs remain in the rural regions of Norway (Osmundson 121).

The Norwegians were not the only people taking advantage of the benefits of sod roofs. The Native American Omaha tribe of eastern Nebraska utilized the tallgrass prairie’s coarse grass sod on the roofs of their lodges. Because little timber was available on the open plains, they cut up the sod into rectangles and overlapped them like modern day roofing shingles to keep their homes dry (Welsch 5).

The first settlers that moved across America’s Great Plains mimicked the earthen architecture of the Omaha tribe and constructed their own sod houses in the mid-1800s. A large number of this pioneer population consisted of Mormons who fled Nauvoo,
Illinois in 1846 in search of religious freedom (Welsch 14). The Mormons established “Winter Quarters” in eastern Nebraska and built sod houses to carry them through the harsh Plains winter. According to Cass G. Barns in The Sod House, the Mormons continued to build sod houses on their journey across the prairie (Welsch 14).

These earthen structures were built with bricks of soil and buffalo grass. The roofs were made of growing sod, which functioned as insulation from the harsh prairie winters and protection from the intense heat of the summer (Welsch 24). The roofs were said to be the most important element of the sod house. According to Roger Welsch in Sod Walls, “if the roof failed, the house failed, for the endurance of the walls depended ultimately on the protection of the roof” (48).

The typical sod roof rested on a base of cedar beams and willow-pole rafters. On top of these poles was were three more layers of organic materials such as wild plum or chokecherry brush, wild grass, fine clay or gypsum. The sod was placed on the outermost layer and was anywhere from one to three layers thick depending on the strength of the underlying structure. It was laid “grass side up so that it would continue to grow, to re-establish roots, to form a protective layer of grass and prevent erosion” (Welsch 71).

Although not intended as a primary function, the roofs also had an aesthetic value. Typically, colorful wildflowers blossomed
from season to season to decorate the roofs. One pioneer woman, Mrs. Clarence Carr, recalled of her Dawson County sod house, “my mother was always throwing flower seed up on our roof; they would bloom out in damp weather” (Welsch 88).

Although their benefits were many, the sod roofs did have their drawbacks. They were not necessarily waterproof and leaked constantly. Because of this inadequacy, they were quickly abandoned when better building materials became available (Osmundson 122). However, many sod houses still remain in rural parts of Nebraska as a testimonial to their usefulness on the plains.

Rooftop Gardens From the Turn of the Century Until World War II

Theater Rooftop Gardens

The term rooftop garden was originally used around 1893 to describe the summer rooftop theaters found in major American cities (Osmundson 122). The idea for these rooftop spaces was conceived from European theaters located in gardens. The writings of Vitruvius explained that in ancient Rome a close relationship existed between theatrical and garden design. At the time, stage setting was a composition of “trees, caves and mountains to imitate a landscape” (Masson 18). At the turn of the century, American theaters borrowed this ancient Roman style and retrofitted it to rooftop gardens. These garden theaters were designed on the roofs
of existing theater buildings for use in the summer months due to the lack of ground-level open space in America's major cities.

Rudolph Aronson, a New York conductor, musician, and impresario, built the first rooftop garden theater on top of New York’s Casino Theater in 1882 (Osmundson 122). The Casino’s rooftop garden theater was used for operettas, musicals, concerts, and other entertainments throughout the summer.

The success of the Casino Theater’s rooftop garden spurred on the development of other rooftop garden theaters such as Madison Square Garden, which opened its rooftop theater in 1890 (Osmundson 124). In the 1890s, rooftop garden theaters reached their popularity with nine operating theaters in New York alone (Osmundson 124).

The rooftop theaters often had a full or partial sliding-glass roofs that offered protection from the rain. Plantings consisted of palms, ivy, and flowers in containers that were strategically placed to enhance the atmosphere of the theater while allowing space for chairs and tables for the audience (Osmundson 124). Some other amenities of the theaters were running streams, fountains, grottoes, bridges, arbors, and even simulated mountain crags (Osmundson 124).

The new century brought about changing times for rooftop garden theaters and they were no longer frequented with crowds. The reasons for this change were many - changing tastes, the invention of air conditioners, and the introduction of motion pictures.
to name a few (Osmundson 125). A book on rooftop gardening published in 1929 noted the establishment of rooftop gardens on hotels and theaters was still a profitable investment (Mellen 15). With this said, some theaters must have continued the rooftop garden tradition into the early 1900s. Although the well-known theaters were short-lived, they had an enormous impact on the future of rooftop garden design.

Residential and Hotel Rooftop Gardens

Hotels and restaurants were the next types of buildings to adopt the rooftop garden concept brought about by theaters. New York hotels such as the Waldorf-Astoria and the Hotel Astor and restaurants such as Delmonico’s advertised dining and dancing on top of roofs with a view of the city (Osmundson 124). These roofs, similar to the rooftop theaters, featured gardens, potted plants, fountains, vine-covered pergolas, topiary trees, and brick and flagstone paving (Osmundson 124). Robert H. Montgomery described these rooftop gardens in a popular magazine of the period:

New hotels flower out in astonishing utilizations of their roofs. The restaurant fresco, the roof café and substellar promenade spring into notoriety in exotic beauty and diversity. Italian pergolas, Venetian arbors, wisteria groves, and flowering alleys make mazes on the mansards of great hostelries. From early June until late September nightfall brings to
birth a new and fairy city on hotel tops, a city of pleasure, of suave shaded lights, of tinkling fountains, of gay music, song and dancing, of luxurious food and wine (Osmundson 124).

The Hotel Astor's garden was one of the great rooftop gardens of its time. It was decorated with flowering plants and vines growing in large urns (Mellen 115). The garden, located nine stories above the street, was a full block long and "featured a 1,000 foot long tree-lined promenade that was lit on summer evenings with thousands of starlike electric lights" (Osmundson 124-125).

Following the popularity of hotel and restaurant rooftop garden, residential rooftop gardens began popping up on New York City's new high-rise apartment buildings along Central Park (Osmundson 125). Only the best landscape architects in the city were commissioned to build these exclusive rooftop gardens that were the ultimate status symbol.

The upper class was not the only group experimenting with rooftop gardening at the time. Many middle class apartment dwellers were establishing modest container gardens on their small apartment roofs. Ida Mellen described the reason for the rise in popularity of rooftop gardening in 1929, "in city and suburb many a tin roof is coaxing to be transformed into a little Paradise that shall afford its fortunate possessor play, rest and tonic" (15).
Frank Lloyd Wright and Le Corbusier

Landscape architects were not the only designers involved in rooftop garden architecture. Architects such as Frank Lloyd Wright and Le Corbusier were influential in integrating functional rooftop spaces in their designs. Both Wright and Le Corbusier used outdoor roof areas as extensions of indoor space, therefore creating exterior rooms.

Examples of Wright’s designs that assimilate rooftop terraces as garden areas include the Larking Building in Buffalo, New York, and the Imperial Hotel in Tokyo. Le Corbusier also was an advocate of using rooftop terraces for living areas. He even “included roof terraces as one of the elements of his five tenets of modern architecture” (Osmundson 125). Buildings that demonstrate Corbusier’s use of roofs are the Domino houses, the Pessac workers’ housing estate, the Unite d’Habitation apartments in Marseilles, and his governmental buildings for Chandigarh, in Punjab, India.

Perhaps the most famous of Corbusier’s designs that features rooftop terraces is Villa Savoye located just outside Paris, France. This rooftop terrace was built to enhance the view of the French countryside that surrounds the residence. The terrace consists of raised planters that hold permanent vegetation for an aesthetic touch. However, landscape architects were frequently brought in for the design of vegetation on Corbusier’s rooftop terraces because he “never took the types or arrangement of plant materials very seriously” (Osmundson 126).
Pioneering Rooftop Gardens of the Pre-War Era

Rooftop gardens in the 1930s and early 1940s continued to thrive. Two of these gardens built in the 1930s, the Derry and Toms garden in the Kensington section of London and the gardens on top of Rockefeller Center in New York, were highly influential on the future of rooftop garden design. Another influential rooftop garden, Union Square in San Francisco, was first created in 1850 as a public garden but was eventually transformed in 1942 into the first street-level rooftop garden atop a 1,700-space parking garage (Osmundson 126).

The Derry and Toms Rooftop Garden

The Derry and Toms rooftop garden in London rests atop a six-story building. It opened in 1938 on top of a busy department store and was used for social and charitable events until the department store closed in 1978 and the garden became run down (Osmundson 128). Since then, the building was sold to new owners and the rooftop garden has been restored.

Before the restoration, the garden contained more than five hundred varieties of trees and shrubs (Osmundson 128). Although most of the plants succumbed to disease and died over the years, some of these original trees and shrubs still exist today. The design of the one-acre rooftop provides three garden areas: the English Woodland Garden, the Tudor Garden, and the Spanish Garden.

Figure 55. The Derry and Toms rooftop garden features a naturalistic pond in its English Woodland Garden (Osmundson 131).

Figure 56. The original design of Rockefeller Center's rooftop gardens (Osmundson 134).
The waterproofing of the garden was accomplished via a layer of bricks, a layer of clinkers (gravel), and a layer of breeze (residue from making charcoal). An average of twenty inches of topsoil was loaded on top of the waterproofing followed by a layer of nutrient-rich topsoil mixed with peat and manure that measure approximately two to three feet deep. The total depth of the garden from the waterproofing to the top of the soil averages four to five and a half feet deep (Osmundson 130). Waterproofing technology has come a long way since the design of the Derry and Toms rooftop garden, however the original waterproofing is still proving effective to this day.

Rockefeller Center Rooftop Gardens

The Rockefeller Center gardens are definitely the first major and most famous rooftop gardens in the United States. Located in New York City, five separate gardens reside on the roofs of Rockefeller Center and were built between 1933 and 1936. Architect Raymond Hood envisioned the idea for the gardens. According to Hood, the gardens were to primarily function as “foreground viewscapes” for taller neighboring buildings (Osmundson 132). Therefore, workers in these buildings could look out their windows and see a beautiful green garden rather than dull conventional gravel roofs.

The gardens were built on the roofs of the Maison Francaise, the British Empire Building, the Palazzo d’Italia, the International
Building North, and the RCA Building. Their original designs consisted of elements such as, central parterres of lawn, flower beds, trimmed hedges of privet, fountains, ponds, trees, potted shrubs, vegetable gardens, and sculptures (Osmundson 132-133).

The drainage of water on the roof was accomplished through four-inch agricultural tiles that were laid twenty feet apart over the entire roof and connected to eight-inch roof drain outlets. Layers of coarse cinders and crushed stone and pebbles were used to add additional drainage, hold the drain tiles in place, and prevent settling of the one foot of topsoil that rested on top of the drainage medium (Osmundson 134).

Since their development, the Rockefeller Center's rooftop gardens have deteriorated due to the harsh conditions of the urban environment. Over the years, many original plants and lawns have died giving the impression of neglect (Osmundson 134). In recent years, however, the original elegance of these famous gardens has slowly begun to be restored.

**Rooftop Gardens After World War II**

The Depression of the 1930s and the end of World War II shifted economic priority away from building construction. It was not until the late 1950s and early 1960s that the advantages and possibilities of rooftop gardens were again noticed by architects and landscape architects. It was during this time period that the large public and private rooftop gardens that remain today were built.
Examples of these rooftop gardens are the Kaiser Center in Oakland, Portsmouth Plaza in San Francisco, Equitable Plaza in Pittsburgh, Constitution Plaza in Hartford, Watergate Plaza in Washington D.C., and Harvey’s Department Store in England.

**Kaiser Center Rooftop Garden**

At three and one half acres, the Kaiser Center rooftop garden in Oakland, California, is one of the largest rooftop gardens in the United States. The garden is a semi-public park, which is located above a five-story parking garage that is attached to the 28-floor office tower that houses Kaiser Industries. According to designer, Theodore Osmundson, the rooftop was designed “to exemplify the progressive nature of the company, the management wished to design a symbol, as well as an office building” (Kaiser Center 15).

The rooftop garden is sustained independently from the ground by its own drainage system that consists of gravel aggregate, downspouts, and a catch basin that ultimately direct water into the city’s storm-sewer system (Kaiser Center 17). The thin garden soil holds trees such as Holly Oak, Olives, Magnolia, Cork Oak, Japanese Maple, Flowering Crabapple, and Cherry that are irrigated from an extensive system under the soil. The garden also features an 8,800 square foot pool with circulating water, extensive lighting, and paved walking paths (Kaiser Center 17).
Portsmouth Plaza

Portsmouth Plaza has been said to be one of the “most successful, heavily utilized, and most relevant rooftop landscape developments in the United States” (Robinette 95). The site where Portsmouth Plaza sits is a historically significant area in the San Francisco area, which adds to the plaza’s success. Before American occupation, the site was the village center for Spanish town of Yerba Buena. When California became a part of America, Portsmouth Plaza was the site where the American flag was raised for the first time in San Francisco (Robinette 95).

In 1960, the present day Portsmouth Plaza was constructed to top an underground parking garage. Its socially functional design consists of “a large playground, outdoor sitting areas, game tables and a great deal of planting, lighting, and site furniture” (Robinette 95). The plaza’s ground-level accessibility makes it a popular place during both the daytime and nighttime hours.

Equitable Plaza

The Equitable Plaza in Pittsburgh is another example of a rooftop garden over an underground parking garage. The plaza is located within Equitable Life Assurance Company’s Gateway Center in the heart of Pittsburgh’s Golden Triangle. According to John Simonds, the landscape architect responsible for the design of the rooftop, “The plaza’s construction and maintenance is a demonstration of Equitable’s belief that a pleasant park-like
environment for its office towers is a sound investment with many dividends in tenant comfort and enjoyment and in public good will” (19).

The rooftop features decorative multi-colored paving, fountains, arbors, and floral displays. It is a very popular urban plaza because it rests slightly above ground level and is easily accessible. Although most people can be seen using the space during the midday lunch hour, the plaza is also frequently used after the sun goes down. The rooftop is also the setting for the popular Three Rivers Arts Festival that is held annually each spring (Simonds 19).

Constitution Plaza

This rooftop garden is a busy urban plaza in downtown Hartford, Connecticut. Constitution Plaza, like many other urban rooftop plazas, is built above five levels of parking garage. The plaza is composed of several different levels and terraces, each with their own character and ambiance that highly encourage pedestrian use (Robinette 32).

Two large paved open areas contain a clock tower and fountains and smaller spaces are decorated with evergreens and flowering plants. Other theme gardens feature a mound garden, a water garden, a rhododendron garden, and a crabapple orchard. Technical elements added to the design include an irrigation system, humidity control system, drainage system, lighting, and radiant heat for melting snow (Robinette 32).
Harvey’s Department Store

An unusual rooftop garden can be found on top of Harvey’s Department Store in Surrey, England. Designed by G. A. Jellicoe and Partners, the garden features a matrix of shallow organically shaped pools and planting beds. Stone bridges and small paths connect the “islands” of planting beds that seem to float on the water.

The vegetation is grown in shallow soil with an average depth of only six inches (Roof 24). Because of this thin stratum, few shrubs were included and the three willow trees in the design are planted in large tubs. Due to the amount of water in the garden, all the plants are those that are found in water gardens such as irises, primulas, astilbes, and ferns. The pools of water also average six inches in depth but different colored gravel placed on the ground of the pools gives the illusion of varying water depths (Roof 24).

Watergate Plaza

The exclusive and infamous Watergate development in northwest Washington D.C. is home to an elaborate rooftop garden. The rooftop development was designed as a connection between Watergate’s office, residential, and shopping facilities. Located on top of a multi-level parking garage, the garden includes lawn, flowering and shade trees, shrubs, pools, fountains, waterfalls, and swimming pools (Robinette 113).
The design of the Watergate Plaza is much like that of a city park - naturalistic and gardenesque. This was done so that the rooftop blended in with the “character of the landscape development along the parkway between the Watergate and the Potomac River” (Robinette 113).

The plantings of the Watergate rooftop garden can be found in containers, mounded soil, and raised plating beds. Vegetation is used in a very functional manner throughout the garden. For example, hedges are deliberately used to control the paths of pedestrian traffic and hanging vines are used to soften the hard edges of the Watergate’s architecture. Gary Robinette expands on the function of the vegetation, “the planting on top of the roof, because of its size and placement provides visual screening from building to building at ground level while it provides distinctive pattern and form as viewed from above” (113).

The Green Roof of Today

The green roof of today is not only built for aesthetic reasons but more importantly for environmental reasons. According to J. William Thompson in an article for Landscape Architecture Magazine, “if the primary purposes of a conventional roof garden are outdoor seating and enjoyment, the primary goals of a green roof are environmental, primarily the following: soaking up stormwater; absorbing solar radiation and converting it into plant foliage through photosynthesis; and insulating the building” (38). Green roofs can
be incorporated into new architecture such as the Gap office complex in San Bruno, California and retrofitted to update older buildings such as Chicago’s City Hall.

The Gap Inc. Headquarters

In 1997, the architectural firm of William McDonough + Partners celebrated the completion of their design of the corporate office space for The Gap, Inc. in San Bruno, California. The 191,000 square foot building features McDonough’s sustainable design principles of utilizing daylight, fresh air delivery, natural ventilation, and environmentally intelligent materials such as a green roof (William McDonough).

The grass-covered roof is purely environmental in function since there is no public or private access to it. It provides thermal and acoustic insulation to the airy interior of the building. Planted on the roof in six inches of soil are native grasses and wildflowers that also benefit the local wildlife by providing habitat. According to McDonough, “our idea was that if a bird flew over the building, it would not know that anything had changed” (Rosenblatt 70).

Chicago City Hall

The cooperation of several design firms and contractors from around the country led to the recent development and construction of a green roof that sits atop Chicago’s City Hall. The green roof was brought about by the U.S. Environmental Protection Agency’s

Figure 71. Watergate Complex main rooftop garden (Robinette 116).

Figure 72. Close-up view of naturalized plantings and stone path in Watergate Complex rooftop garden (Robinette 115).
Urban Heat Island Initiative, whose goal is to reduce the rising temperatures in cities caused by air pollution and the concrete of the urban jungle. Of the five cities chosen to participate in the project, Chicago was the only one to develop a green roof (Lenart 16).

Chicago’s City Hall green roof will reflect the sun in order to cool the temperature. The vegetation will filter and cool the air by evapotranspiration, which is a biological process that utilizes carbon dioxide and releases oxygen and water. The released water is in the form of humidity which in turn brings temperatures down. The roof also will function to decrease stormwater runoff because the plants will naturally absorb rainwater before it falls off the building.

The vegetation used on the City Hall green roof is primarily native, because they are best suited to survive the conditions of Chicago’s warm summers and cold and windy winters. Specifically, groundcover plants such as sedums, mosses, and grasses are used because they are highly drought tolerant species (Lenart 17). The 20,000 plants that make up the green roof are grown in soil that measures between three to thirty inches deep (Lenart 16). Of course, this soil is layered over extensive waterproofing and drainage structures to prevent leakage.

Chicago’s City Hall green roof is providing a unique opportunity for research on the effectiveness of the green roof on the city’s climate (Lenart 17). Because of its research purpose and safety issues, the roof is not open to the public. However, the design for the roof does include paths to aid in roof maintenance.
One of the goals of this thesis is to bring green roof design to the forefront of discussion in the various fields of landscape architecture, planning, architecture, environmental studies, and ecology. In order to spark the beginning of this discussion, the thesis will create a dialogue with the reader. It will engage the reader in a series of cultural critical questions about the aesthetic, ecological, economic, and social characteristics of green roof design. Just as it is important to note the human's cultural involvement in the landscape, it is important to involve the reader within this critical dialogue.

In order to effectively involve the reader in this dialogue, the text is formatted in a manner that creates a dialogue with the reader and invites the reader to critically analyze his or her own thoughts on green roof issues. Instead of a long running single column of text, various paragraphs in variegated columns act as the different voices and perspectives within the dialogue. These columns of text may overlap each other, cut each other off, or dominate the page just as separate voices within a dialogue add their opinions at different times and with different inflections of voice. These textual "voices" are constructed of different fonts that will portray the distinctive characteristics of each voice in the dialogue.

The green roof is a cultural construct - nature designed and constructed by human hand. The green roof also lies within a particular situation and time period - a cultural context. There
would be no need for green roofs if not for the human built environment of the urban metropolis. In order to completely understand the “narrative text” of green roof design, it is important to look at the “complex whole” of the cultural situation in which they are produced. According to Edward B. Tylor in 1871, “Culture or Civilization, taken in its wide ethnographic sense, is that complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society” (Greenblatt 225).

This paper will address one of the cultural questions that Greenblatt posed in his essay, Culture: Upon what social understandings does the work depend? These social understandings and cultural beliefs include the urban ideology of nature, metropolitan ecological values, views of technology in the urban landscape, urban aesthetics, and economics to name a few. This essay will discuss all of these social understandings within the context of the city.

As stated by Stephen Greenblatt, art is a transmission of culture. The idea and design of green roofs reflect highly integrated cultural beliefs that take the forms of constraint and mobility, which push and pull on the boundaries of the “text” or design as well as the boundaries of cultural beliefs, values, and codes. These cultural beliefs are both conscious and unconscious and shape societal behaviors.

A cultural analysis allows for an examination of multiple perspectives. The best way to show this is through a dialogue that involves characters with multiple perspectives on the cultural issues of the green roof due to their various careers. In order to differentiate the voices of each character, their comments are portrayed with different fonts that will represent the different characteristics of each voice participating in the dialogue. To fully understand the opinions of each character, some background information is needed on each of their philosophies. The following character sketches are an introduction to each participant (and the fonts that will represent them) in the dialogue.

**Moderator**

The moderator is responsible for the overall organization and flow of the dialogue. The moderator has a neutral perspective of the topic and is concerned with asking important cultural questions of the other members involved in the dialogue. The moderator is also in charge of adding background information to the dialogue such as historical facts, quotes from influential people, and links to cultural criticism strategies.

**Landscape Architect**

The landscape architect is an important part of this dialogue because of her vast knowledge that ranges from art to
engineering. The landscape architect understands the relationship between natural and cultural contexts and designs places that enhance both of these elements in the landscape. She wants to promote green roof design because of its many benefits ranging from environmental to social.

Environmental Scientist
The environmental scientist has a broad background in the natural and social sciences. This foundation helps the environmental scientist understand the complex issues that surround green roof design. She understands the environmental processes of the green roof. Her approach is based on the knowledge of systems, so she follows the principles of landscape ecology. She wants to encourage green roof design for its environmental benefits.

Urban Planner
The planner's goal is to guide development of economics, public services, and resource development of the urban community in a rational manner. The planner has a broad view of the cultural context of the green roof. His philosophy is to develop the city using a sustainable approach. The planner wants to promote green roof design for its economic benefits.

Architect
The architect is concerned with the technology and structure of the green roof. His approach is focused on the design of useable space and therefore wants to transform the wasted rooftop space into an outdoor extension of the building's interior in order to make it socially functional. He wants to encourage green roof design for its social benefits.

The city is an ideal locale to study the culture and nature of green roofs. This is because “The city is both natural and contrived, a transformation of ‘wild’ nature to serve human needs, an evolving entity shaped by both natural and cultural processes” (Spim 108). The green roof is simultaneously both nature and culture just like the city.

The green roof can be linked to the idea of nature because the organic green vegetation of which it consists is considered a natural material. In order to comprehend why green roofs are used at all, it is important to dissect the concept of nature and understand how it is related to green roofs.
The Urban Ideology of Nature
What is Nature?

"The material world itself, taken as including or not including human beings" (Williams 223).

Every culture has its own ideology of nature. Ideology is commonly defined as the doctrines and opinions of an individual or a group of people. In his essay, *Ideology and Ideological State Apparatuses*, Louis Althusser defines ideology as "a representation of the imaginary relationship of individuals to their real conditions of existence" (17). An important element in the understanding of ideology lies in how it is interpreted. Ideology "needs to be interpreted to discover the reality of the world behind their imaginary representation of that world" (Althusser 17).

When Althusser's definition is applied to the ideology of nature, one can see why there are so many different ideas and definitions of nature. A society’s concept of nature changes with their conditions of existence. As mentioned above, different cultures have different ideologies of nature.

For example, in Germany open space is rare. Due to centuries of human civilizations inhabiting the small country, the land has been extensively built up, which has caused environmental problems such as flooding. Because of these environmental problems, the Germans have gained an ideology of nature that is environmentally based. The German local governments have mandated that citizens give back to the nature that was built up by incorporating green roof "nature" on all new buildings and are offering tax cut incentives to retrofit older buildings with green roofs (Cadji 68). With green roofs being mandated, the ideology of the german culture has shifted towards a nature that involves environmental function.
The ideology of nature differs greatly between urban societies and rural societies simply because of the physical location which each society inhabits.

The urban ideology of nature is highly influenced by the built environment.

To a city dweller nature can be anything from a suburban riverbank forest preserve to inner-city community garden plots. The common thread between these two "natural" territories is the idea of undeveloped "open land". In an area known as the "concrete jungle", open land is at a premium and usually it is associated with city parks such as Central Park in New York City. This urban ideology of nature includes any space outdoors that resembles the "natural" vegetation of woodlands, wetlands, or grasslands and which also may have living organisms associated with it.

Since the urban ideology of nature is one of open space and vegetation, the green roof fits into these cultural boundaries in that it is situated on the open rooftops of buildings, contains natural living plant materials, and may provide habitat for a variety of living organisms. This cultural view of nature supports the use of the green roof and explains one reason why it is starting to be used and should be constructed in America - to create much needed open green spaces in the city.

This particular cultural belief exemplifies Greenblatt's mobility of culture in that this ideology is driving designers to look for new options in creating natural environments. This mobility is pushing the traditional cultural norms of viewing nature only on ground level toward the sky in an effort to creatively transform wasted rooftop space into a new concept of natural open space.
Humans have an unconscious cultural connection with the land and nature, and therefore, “our particular affection for land and landscape is very often actualized through the use of technological products” (Thayer, 85). The human unconscious believes that nature is good and that the use of technology such as a mountain bicycle can get us closer to nature and the landscape.

This unconscious cultural belief is most recently played upon in sport utility vehicle (SUV) advertising. These ads promote the human need for adventure and reconnection with the natural world - to buy a SUV is to become more in touch with the environment (Campanella 30). Of course, human conscious beliefs tell us that SUVs cause environmental problems such as erosion and energy depletion, but our unconscious drives us to this need for natural connection.

In the case of the green roof, the technological product is the green roof, which we build consciously for aesthetic and ecological purposes and unconsciously to create nature within an urban context that is severely lacking the “good” that nature provides.

![Figures 76-79: Good vs. Bad... Nature vs. Technology. a.) smoggy photograph of Los Angeles skyline (Cunningham386). b.) the nature of the Northern Californian forest ecosystem (Meffe 610). c.) the pollution of science and technology (Cunningham 38). d.) clear streams and native plants are nature at its finest (Meffe 611).]

The urban ideology asserts that the green roof is nature, however not everyone adheres to this view...
Metropolitan Ecological Values
Is the green roof "true nature" to an ecologist?

If we can recall Althusser's definition, ideology changes with an individual's condition of existence.

Therefore, the ecologist's ideology of nature is completely different from the urban citizen's ideology of nature. This shifting ideology proves that the concept of nature is a cultural construct that changes with the educational, environmental, or physical influences put upon a person.

For example, the typical urban-dweller is probably not as familiar with the concepts of ecology in connection with the definition of nature as the ecologist.

An ecologist would look for ecological function in an open space for it to be considered true nature.

Joan Nassauer comments on the importance of the ecologist's concern with function in nature and how it relates to cultural beliefs of static, non-functioning nature:

"The fact that apparent naturalness can lead to such perceptual mistakes about ecological function underscores the cultural concept of naturalness. If we acknowledge the distinction between ecological function and natural appearance, we can begin to critically analyze the cultural language of naturalness and use it as a language to intentionally communicate ecological function" (Nassauer 163).
This is to say that ecological function can be revealed in design through the language of culture. The green roof exemplifies this quote as being a cultural construct that reveals the ecological functions of wildlife habitat and stormwater drainage.

It is important to understand a few of the basic ideas and theories of ecology in order to fully comprehend the ecologist’s ideology of nature and expand the cultural possibilities of green roofs.

The word ecology is a concept with many definitions.

**Ecology** - the study of relations of plants and animals with each other and with their environment (Williams 111).

These relationships form systems in which living and non-living entities exist. Ecology is concerned with the life histories, distribution, and behavior of individual species as well as the structure and function of natural systems at the level of populations, communities, and ecosystems (Cunningham 614).

Ecology has also branched off from this technical definition to include other areas such as general human relations with the social world and also addresses concerns with human and natural habitat.

These areas of ecology are evident in the relationship of nature and culture of the green roof.
Jost Hermand's article, *Rousseau, Goethe, Humboldt: Their Influence on Later Advocates of the Nature Garden*, discussed a number of early theorists and their attitudes toward nature and gardens. Alexander von Humboldt was the only person in this article who had strong views, which closely matched the contemporary concept of ecology. With the publishing of a book in 1808 entitled *Views of Nature*, Humboldt discussed the idea of vegetative communities, which was an early description of the ecological community concept. He also was very interested in botanical origins and frequented faraway lands to study these exotic species and their habitat. Humboldt’s theories were also related to the human aspect of ecology. He stated that “Europeans show increasing lack of consideration for natural associations of plants, shrubs, and trees.” Furthermore, Humboldt stressed the need for humans to protect natural environments and plan to not sacrifice wilderness to industrialization and urbanization. This could be said to be a foreshadowing of the environmentalism of the late 20th century.

Hermand’s article also discusses Jean-Jacques Rousseau and Johann Wolfgang Goethe as nature advocates. Although they both saw themselves closely tied to nature, they came from different views (neither strongly tied to contemporary ecological definitions). Rousseau preached the idea of "wild nature" and harmony with nature through parks designed in a romantic style. Goethe came closer to the concept of ecology with his statement, “everything in nature is tied together in a Spinozistic-pantheistic way.” This quote closely resembles the contemporary definition of ecology in that he stresses the relationships of everything within the realm of nature and culture.
The idea of relationships among everything is a key concept in landscape ecology.

However, landscape ecology is concerned with large-scale relationships of landscape features and how various connected or fragmented landscape habitats affect the living organisms that reside within them such as plant and wildlife species.

Generally, the concepts of landscape ecology are often not considered in green roof design because the design is constructed on built material and it is not seen as a natural landscape where landscape ecology is typically applied.

It is important to take into account the fundamentals of landscape ecology when looking at green roofs because they are habitats for plant species as well as wildlife such as birds and insects and can function in the same manner that natural environments can for this purpose.

Currently, green roofs are being designed and perceived as a single entity - a green island within the urban sea.

When the concepts of landscape ecology are applied to the green roof one can begin to envision an entire green roof system.

**SYSTEM -**

1. a set or arrangement of things so related as to form a whole
2. a set of facts, rules, etc. arranged to show a plan
3. a method or plan
4. an established, orderly way of doing something (Guralnik 607)
Specifically, several buildings in close proximity to one another all with green roofs would constitute a system of green roofs not just a singular island.

This system would function to provide ecological corridors and matrices instead of isolated patches. These corridors and matrices would allow movement of vegetative seeds and wildlife species in order for them to carry out natural biologic functions such as breeding, birthing, feeding, or roosting.

Figure 80. System of rooftops envisioned by Geoffrey Jellicoe in his book, Motopia. This rooftop system was covered with concrete and functioned for vehicular traffic flow (Clay 13).

To design green roofs on a larger scale to promote functioning green roof systems is an example of Greenblatt’s idea of cultural mobility.

Often times a culture does not look at a big enough picture when constructing the built environment and many possibilities get overlooked. That is to say that the culture needs to make a shift in its thinking in order to push the boundaries of conventional architecture and landscape architecture.

The idea of a system of green roofs pushes on that cultural boundary and creates an entirely new way of looking at the relationship between green roofs and ecology.
Green roof ecological systems are also an example of the future possibilities in urban planning.

What will cities look like in the year 2015?

Using landscape ecology concepts in the design of green roofs brings about a new vision to the urban environment - an ecologically sustainable vision.

The “concrete jungle” can become a truly “green jungle” which will shape the cultural views of the urban society.

“Just as gardens express the makers’ views of their relation to the natural world, so does the form of the cities a society creates express that society’s values” (Spirn 117).

Just think of the statement a city could make to the hundreds of thousands of people that view a city from the air everyday...

“Flying into O’Hare, you see acres and acres of bare roofs. They all could be green and that could make an enormous difference” (Lenart 16).
The green roof straddles the margin between built and natural environment, which makes it a cultural construct not only in theoretical sense but also a physical sense. It is an organic system built on top of inorganic concrete and steel buildings.

**Why use vegetation to cover the roof of a building?**

**What is the social function of a green roof?**

These are important questions to ponder in a cultural critique, “There is much to be done in the way of cultural analysis even without an integrated structure of courses, much that depends primarily on asking fresh questions about the possible social functions of works of art” (Greenblatt, 230).

With this quote from Greenblatt in mind, other cultural beliefs that the green roof depends on are the ideas of concealment, camouflage, and symbolic transformation as its social functions.
Views of Technology in the Urban Landscape
Unconscious cultural beliefs label the city with its crime and pollution as evil and the country with its soft green pastures and fresh air as good. Therefore, the function of the green roof is as a symbol of good that masks the evil of the city.

The idea of using nature to conceal the built environment was discussed by Robert Thayer in his book, *Gray World Green Heart*. Thayer attributes the act of concealment to "the guilt people feel over the predominance of technology in their lives" (74).

Concealment of the built environment forms an idealized version of nature and reality.

Thayer states, "modern American culture applies strict but unwritten codes to what technological features it considers appropriate in residential gardens and townscapes" (75).

Most commonly, air conditioning units are considered to be the most inappropriate utilities to be exposed on a building. This stems from an unconscious cultural belief that we are accepting to use "evil" technology to cool buildings over opening the windows to let the "goodness" of nature cool us. Therefore, we feel guilty about this dependence on technology and about breathing in this simulated natural air rather than Mother Nature's pure air so we try to hide the technology with the "goodness" of nature in order to make ourselves feel better.

The true reasoning for this concealment is done on a highly unconscious level that shapes our cultural beliefs. On large commercial buildings these indoor environmental control systems are located on roofs. Consequently, the design and construction of green roofs are concealing the technology of the urban environment.
Camouflage is another cultural technique used to appease landscape guilt.

"Camouflage is the manipulation of the surface pattern, texture, color, or form of the technological feature to blend in with 'natural' landscape context or to appear as a less threatening architectural feature" (Thayer, 76).

The idea of camouflaging architecture is used by the Weyerhaeuser Corporation, a forest products company that grows and harvests trees and manufactures, distributes and sells forest products. Their corporate campus is located in the outskirts of Tacoma, Washington. Vegetation is used to camouflage the architecture of the concrete building and enable it to seamlessly assimilate with the surrounding wooded landscape. In the design of the building the five floors are stacked unequally upon one another (similar to the lower half of a pyramid) as to leave open roof space on each level. In this open roof space, climbing vegetation grows so that it hangs down over the sides of the building and camouflages the concrete walls as an organic mass of vegetation. The use of greenery on the roofs of this building enables it to fit seamlessly into the environment.

![Figure 81. Weyerhaeuser corporate campus outside Tacoma, WA blends seamlessly into the surrounding landscape (Into 34).](image1)

![Figure 82. Close-up of rooftop vegetation (Into 35).](image2)
Green roofs can also be an example of symbolic transformation.

“Symbolic transformation is the alteration of the surface symbolism of technological features such that a symbol of nature or romanticized culture counteracts, contradicts, or replaces the essential symbolism of the technology” (Thayer 77).

The green roof replaces the evil of the building technology with vegetation that symbolizes the good of “nature”.

Figure 83. Vegetation conceals building technology on this rooftop garden (Tinkel 1).

Figure 84. This green roof vegetation grows around building heating and cooling system technology (Thompson 36).

The ideas of concealment, camouflage, and symbolic transformation are cultural beliefs that consciously and unconsciously influence why green roofs are used and how they function in the urban environment. The landscape guilt that the built environment causes reflects constraint on the urban culture. Urban inhabitants feel constrained to do something about making technology disappear within nature in order to gain public acceptance or in other cases to simply follow the law. The cultural norms have become the belief that technology is bad and must be hidden in order to be aesthetically acceptable to the general public.
Urban Aesthetics
What is aesthetically acceptable to the general public?

Aesthetics is defined as beauty as phenomenal perfection.

More specifically, aesthetic beauty is felt by the conditions of sensuous perception (Williams 31).

Aesthetics are strongly shaped by cultural beliefs and values. For example, American culture values the aesthetics of a freshly cut suburban lawn rather than a natural prairie ecosystem.

Figure 85. Native prairie has diverse plant communities that creates abundant habitat for wildlife (Hough 131).

Figure 86. A freshly cut suburban lawn is not diverse in plant species and provides little environmental and economic benefits (Schultz 51).
What is an urban aesthetic?

“An aesthetic of urban design must therefore be rooted in the normal processes of nature and of living. It should link function, feeling, and meaning and should engage the senses of the mind” (Spiro 108).

Because the city is a highly cultural entity, it is important to have an aesthetic that includes both nature and culture. Spirn proposes an aesthetic that “recognizes both natural and cultural processes and reveals the rhythms and the patterns created by their discourse” (108).

In accordance with Sprin’s urban aesthetic, an aesthetic design is functional. Function can occur on a variety of levels - social, ecological, and economic to name a few.

Specifically, a design that is ecologically functional is not always seen as being aesthetically pleasing. For instance, a Midwest prairie functions to increase vegetative biodiversity, provide wildlife habitat, and restore groundwater hydrology. On the contrary, most people look at a patch of prairie plants and think they are a bunch of useless weeds to do away with because American cultural beliefs say that the look of the prairie is not aesthetically pleasing.
With that aesthetic theory in mind, the green roof is a perfect example of an urban aesthetic because its functions are both natural and cultural and also can be experienced on a multi-sensory level.

The green roof's environmental functions include reducing dust and air pollution, providing wildlife habitat, decreasing stormwater runoff (therefore reducing flooding), and decreasing the urban heat island effect (Griswold 21).

Green roof design that promotes and reveals this environmental function is also aesthetic because it creates unity - one of the fundamental principles of aesthetics (Bartuska and Young 80).

“Design which highlights nature’s processes for our contemplation permits the experience of a sense of unity with a larger whole which is the universe in which we live” (Spirn 109).
Economics
The economics of the green roof is often an overlooked aspect of the green roof, but it is an important component of cultural criticism.

The Marxist elements of power and modes of production are evident in green roof design and construction.

However, according to Michel Foucault, power is not something exercised by a dominant class (highbrow culture) over a subservient class (lowlowbrow culture) but rather is a whole complex of forces that work together to produce what happens (Murfin 263).

The green roof could be considered a highbrow structure for a variety of reasons such as basic roof structure, professionals involved and knowledge needed to complete the design and construction, amount of economic investment needed to produce the green roof, accessibility of the green roof, and visibility and location.

Nevertheless, this notion of the green roof as exclusively highbrow culture can be refuted.
The physical structure of the green roof is complex compared to that of a typical rooftop garden.

A rooftop garden is primarily a patio or terrace space built over conventional roofing structure that contains plants held mostly in containers and can include trees and taller shrubs.

On the other hand, a green roof is composed of a thin layer of strata installed within the structure of the roof that includes a waterproof membrane, a drainage layer, and planting media that supports low growing plants such as sedums.

Figure 88. Rooftop garden cross-section (Osmundson 139).

Figure 87. Green roof cross-section (Osmundson 183).
The idea of the green roof as a structurally thicker and more complex composition can lead one to believe that it is more highbrow than the rooftop garden.

Nonetheless, the rooftop garden can be just as intricate in its design and components as a green roof. For instance, deep in the heart of Manhattan an elaborate rooftop garden based on a Japanese tea ceremony garden contains detailed elements such as statues, marble paths, meditation pools, and small trees (Dooley).

Therefore, mere structure alone should not elevate the green roof into highbrow culture.

Another potential link to highbrow culture for the green roof is the knowledge and technology required for its construction.

There are many different professionals involved in the design and construction of the green roof.

Landscape architects and architects are responsible for the overall design of the roof and a roofing contractor is a necessity for the construction of the structure, which includes technical knowledge of waterproofing, drainage, and planting materials.

Since knowledge is generally considered highbrow and the green roof requires technical knowledge to construct it, the green roof could be considered a part of highbrow culture.

However, rooftop gardens also require knowledge and expertise of such things as plant materials, irrigation, and hardscape design in order to get them established, too.
The funding of and investment in green roofs also leads to particular highbrow cultural beliefs.

As compared to a conventional building roof, the green roof has more upfront costs for its installation due to more technical infrastructure as well as the addition of planting materials.

This may seem like highbrow culture at first but when one considers long-term costs as well as a cost-benefit analysis the green roof is far more economical than a conventional rooftop.

A green roof lasts up to twenty years longer than a conventional roof.

This is due to the fact that on a conventional roof, the roofing infrastructure is exposed to various weather elements such as acid rain, snow, and ultraviolet sunlight that quickly depreciate and degrade the roofing materials.

Consequently, green roofs do not have a problem with exposed infrastructure because vegetation covers and protects the waterproofing and drainage structures and therefore they last twice as long.

A green roof clearly provides a better investment than a conventional roof.
If one were to do a simple cost-benefit analysis of a green roof as compared to a conventional roof, the green roof would prove to be the better roofing option due to its many benefits.

As discussed earlier the green roof has many ecological benefits, but it also has economic benefits as well.

The vegetation on the green roof has an insulating effect on the building which it is built. A building equipped with a green roof uses less energy in the winter for heating and also less cooling energy in the summer, therefore greatly reducing energy costs.

Therefore, green roofs are a benefit to the environment as well as the building owner because they help to save both energy resources and money (Griswold 22).

Another economic benefit is a long-term increase in real estate value. “any amenity such as a rooftop garden could easily add up to 20 percent value to a domestic property” (Cadji 68).

To look at the green roof on these economical terms, it would be considered a bargain, which is not generally consistent with the beliefs of American highbrow culture that prefers to extravagantly spend money.
So, who is investing in and funding green roofs?

A survey of existing green roofs illustrates that these structures are located on both private and public buildings alike.

Private corporations such as Gap, Inc. has invested in a green roof on their corporate headquarters in San Francisco and public buildings such as the Vancouver Public Library and Chicago City Hall both exhibit the green roof technology as the wave of the future in environmentally sustainable design.
Money is not the only characteristic of green roofs that refute highbrow cultural beliefs.

Accessibility carries a Marxist element into the realm of green roofs in that accessibility is power and power is in the hands of the upper class that has money to build green roof structures.

There are important questions to be asked about the accessibility of green roofs:

*Who is able to gain access to these “gardens in the sky”?*

*Are green roofs generally privatized or are they open to the community as a whole?*

The term green roof automatically conjures up images of lush gardens located on top of tall buildings such as skyscrapers that are not easily accessible to the public.

Entrances to these green roofs are usually restricted to building maintenance employees or, if the building is privately owned, employees of the company that owns the green roof. Even public buildings such as libraries and city halls may not allow citizens to gain entry to the green roof.

Such is the case with the Chicago City Hall green roof, which was designed primarily for environmental research purposes.
Accessibility is often linked with visibility.

If a green roof is not visible, people may not even know the green roof exists. If the existence of a green roof is not known, it may not be accessed as regularly as a green roof that is visible.

Thayer discussed need for more visible landscapes in his article, *The Experience of Sustainable Landscapes*:

"There is a significant need for designers and artists to attempt to assign visible, observable character to sustainable landscapes so that the public may come to 'know' them more easily and create them more frequently" (108).

These ideas of limited accessibility and visibility are usually connected with the exclusivity and privatization of green roofs. Therefore, these constitute other reasons why green roofs are considered a part of highbrow culture.
However, green roofs are not necessarily limited in accessibility and visibility. If one looks close enough, they will notice that green roofs are not only located on tall skyscrapers but also shorter buildings where the roofs are visible from street level.

There are also rooftops that are located at street level because they cover underground buildings such as parking garages. These rooftops are highly visible and accessible yet not recognized as rooftops because our cultural beliefs tell us that rooftops are located above our heads.

An example of a street level rooftop park is Barney Allis Plaza in Kansas City, Missouri. Built in the mid-1980s, the roof of a 1,100 car underground parking garage has been landscaped and turned into one of Kansas City’s busiest and visually exciting public spaces.

These street level rooftops push on the boundaries of our cultural beliefs and prove that rooftops can provide a social function to the city.
The concept of street level green roofs is an example of cultural mobility. Since these rooftops are not recognized as tops of underground buildings, there is an opportunity for designers to push the limits of green roof technology by integrating the infrastructure of the green roof onto street level parks that would increase their visibility and accessibility. Therefore, this accessible design removes the cultural highbrow label and enables everyone to take advantage of and learn about the benefits of green roofs while at the same time providing much needed open green space in the city.

By examining the economic aspects of the green roof in depth, it is evident that Foucault was correct in saying that power is not something exercised by a dominant class over a subservient class but rather is “a whole complex of forces that work together to produce what happens” (Murfin 263).

When it comes to the economics of green roof design, neither highbrow culture nor lowbrow culture claims power over the other; everyone has role in working together to change the cultural codes of the city.

The power lies in the complex forces of the landscape architects, architects, and roofing contractors that have the ability to push the boundaries of cultural beliefs in design issues to increase green roof accessibility and visibility.

The urban public also has the power for cultural mobility in choosing to accept green roofs consciously for their long-term economic benefits rather than short term cost savings and unconsciously for the public’s need to create and be connected to nature.
Summary

This dialogue explored one of the cultural questions that Greenblatt posed in his essay, *Culture*: Upon what social understandings does the work depend? According to the dialogue, these social understandings and cultural beliefs include the urban ideology of nature, metropolitan ecological values, views of technology in the urban landscape, urban aesthetics, and economics.

Greenblatt's definition of culture implies movement through mobility and constraint. Greenblatt summarizes the great influence of culture on a "text" or design, "An awareness of culture as a complex whole can help us recover that sense by leading us to reconstruct the boundaries upon whose existence the works were predicated" (226). Whether green roofs are designed consciously or unconsciously to adhere to these cultural beliefs and social functions, it is imperative to reveal these cultural influences in order to understand the role of green roofs in the urban setting.

The existence of green roofs can be explained by examining cultural beliefs of urban inhabitants. The multiple perspectives that inform cultural context are shown through the voices of the moderator, landscape architect, environmental scientist, urban planner, and architect. Of course, these are just a representation of the many perspectives involved in green roof design and construction. Other important people whose voices should also be involved in the green roof dialogue include roofing contractors, government officials, citizens, and educators to name a few.

The characters represented in this dialogue revealed that the green roof is the product of cultural forces such as the ideology of nature, ecological values, technology, aesthetics and economics. Each character was important in exposing a different aspect of the green roof. These varying perspectives are the essence of postmodern theory and the cultural context of the green roof.

This dialogue has unmasked only a part of the deeper meaning of the green roof. The dialogue must continue to be discussed with a wider variety of characters who will add more perspectives into the dialogue so that the green roof can begin to be fully understood within the urban environment.
CONCLUSION

The work presented here is by no means complete, however it provides a foundation upon which to build. This thesis is just the beginning of a large exploration into the cultural issues surrounding the green roof. It is important to take this first step towards a greater knowledge of the role that culture plays in landscape architecture.

This thesis is a call to action to look deeper into green roofs by critically inquiring about their meaning in order to gain an understanding of the insight they can provide about our culture. As mentioned earlier, this critical analysis is not intended to be of an authoritative nature, but rather a spark that ignites critical dialogues within and amongst professions such as landscape architecture, architecture, planning, and environmental science.

Critical inquiry opens up the possibilities for the future. "Criticism is not only interpretive and evaluative, it is also creative. It not only assesses the way things are, but also speculates, at least implicitly, about how things could and should be otherwise" (McAvin 156). There are vast opportunities for the future of green roofs. This includes viewing green roof design on a larger citywide scale to continued integration of environmental and social functions on a small scale in green roof design. It is important to note that change can be a slow process; it will not and should not be expected immediately. Therefore, I suggest that the evolution of green roof design should be prioritized into three distinct stages: stage 1, the current state of vegetative rooftop structures (Figure 95); stage 2, implementing ecological function on a large-scale "systems" approach (Figure 96); and stage 3, creating the ideal vegetative rooftop structure by further integrating social and environmental functions within an ecological system.
Rooftop gardens and green roofs of the past and present have been described and documented in this study. These existing vegetative rooftop structures can be defined according to the functions they perform - social function, environmental function, or a combination of both functions. The descriptive vegetative rooftop continuum first presented in the typology (and shown again here in Figure 95) illustrates the past and present conditions of rooftop gardens and green roofs. This is the first stage in the evolution of vegetative rooftop structures.

The second stage in the evolution of the future of vegetative rooftop structures focuses on implementing a large-scale systems approach. Specifically, a large-scale systems approach expands the vegetative rooftop structures beyond a singular “green” island within the urban sea to include a system of many buildings throughout the city. By applying the fundamentals of landscape ecology through expanding singular islands of green roofs into larger systems of corridors and matrices, viable wildlife habitat can be formed and these large systems can also have a significant effect on urban temperature regulation and stormwater management. A systems approach based on the principles of landscape ecology adds a new function to the current vegetative rooftop structure continuum - an ecological function. A new rooftop structure

![Diagram of vegetative rooftop structure continuum](image)

FIGURE 95. Stage 1 in the evolution of the vegetative rooftop structure.
continuum should be established to show the addition of ecological function of vegetative rooftop structures. Figure 96 illustrates a possible diagram for this new continuum.

The third stage in the future evolution of vegetative rooftop structures is the development of the ideal vegetative rooftop structure. This stage should occur after the large-scale systems approach is implemented. The ideal vegetative rooftop structure transcends the present-day vegetative rooftop structures discussed in this thesis. Ideal vegetative rooftop structures exhibit an extreme integration of social and environmental function so that rooftops are utilized social spaces that also enhance and sustain the environments in which we live. The ideal vegetative rooftop structure should be designed with both social and environmental function in mind rather than just one function or the other as in the rooftop structures of present day.

The current Type III vegetative rooftop structures described in the typology are just the beginning of the ideal rooftop structures of the future. Unlike the current Type III vegetative rooftop

![Figure 96. Stage 2 in the evolution of the vegetative rooftop structure.](image)
structures, the ideal rooftop structure is seen as one entity that integrates both social and environmental function to the highest potential rather than either a rooftop garden or a green roof. Therefore, the ideal vegetative rooftop structure of the future will need a new name that will differentiate it from the Type III rooftop gardens and green roofs of today.

The future success of vegetative rooftop practices depends on the education of and acceptance by the general public. It is important to the vitality of the green roof to publicize the benefits that they can provide. The more the general public knows about the green roof, the more they will accept and promote this sustainable practice.

As the popularity and acceptance of green roofs grow, there will be a need to continue to expand research and critical inquiry in order to assess and promote the progress of green roof design. Further research opportunities include studying the aesthetic components and performing visual assessments of the green roof, expanding the boundaries of critical inquiry outside of the urban environment to examine green roof design in both suburban and rural areas, analyzing the economic impacts of green roof systems on an individual [residential] level and on a citywide scale, and assessing the effectiveness of a large-scale planning approach to name a few.

It is time for a revolution in the theory and criticism of green roofs in the United States. In order to accept and promote environmentally, aesthetically, and economically sustainable design practice, scholarly American journals need to further discuss and expose the cultural issues of green roof design. While it is important to continue working on English translations of green roof literature, it is also imperative to push the limits of current green roof design by creating citywide systems of green roofs while looking at the cultural implications of this development. Green roof design and criticism is not only relevant to the field of landscape architecture but also to fields such as planning, architecture, ecology, art and design, and environmental studies since everyone will benefit from it.

This thesis is a call to action to begin a dialogue on the subject of green roofs. Everyone must work together to promote green roof design. It is imperative that this dialogue encompasses not only the professions that are responsible for designing and building green roofs but also the private and public agencies that can invest in and fund the green roofs and the citizens who will interact with and learn from the green roofs. I am now passing on the torch to you, the reader. It is up to you to continue the dialogue and promote the social, environmental, aesthetic, and economic benefits that green roof systems can provide for the long-term sustainability of the world's urban environments.
WORKS CITED


