URBAN BIOPHILIA IN ANKARA: ENHANCING THE ENVIRONMENTAL EXPERIENCE THROUGH BIOPHILIC DESIGN IN THE ALACAATLI NEIGHBORHOOD

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ABSTRACT

URBAN BIOPHILIA IN ANKARA: ENHANCING THE ENVIRONMENTAL EXPERIENCE THROUGH BIOPHILIC DESIGN IN THE ALACAATLI NEIGHBORHOOD

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The integration of nature into urban environments is becoming increasingly prevalent worldwide in response to growing challenges that threaten the quality and experience of our environments. The biophilia hypothesis, popularized by Edward O. Wilson and Stephen R. Kellert, asserts that humans possess a genetic predisposition to seek connection with and experience the natural world. However, contemporary urban environments not only isolate individuals from nature but also introduce additional challenges inherent to city living, all of which collectively impact the experience of the environment and quality of life.

In Ankara, uncontrolled urbanization driven by rapid population growth and the urban land market has further compromised both the quality of life and environmental conditions for its residents. The objective of this thesis is to enhance the biophilic environment within the Alacaatlı neighborhood, with the intention of setting a precedent for the broader urban planning initiatives in Ankara. Through a case study approach encompassing the historical background of the city of Ankara and the Çayyolu district, current climatic conditions and population trends in the Alacaatlı neighborhood, and systematic field observations to assess the biophilic experience, this study aims to demonstrate the application of biophilic design strategies. These strategies seek to enhance both quality of life and environmental experience in response to the distinct challenges present in this area.

Keywords: Biophilia, Biophilic City, Nature Experience, Ankara, Alacaatlı

ÖZ

ANKARA'DA KENTSEL BİYOFİLYA: ALACAATLI MAHALLESİNDE BİYOFİLİK TASARIM YOLUYLA ÇEVRE DENEYİMİNİN GELİŞTİRİLMESİ

Ayla, Nurten Müge
Kentsel Tasarım Yüksek Lisans, Şehir ve Bölge Planlama
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Doğanın kentsel ortamlara entegrasyonu, çevre kalitesini ve deneyimini tehdit eden zorluklara yanıt olarak dünya genelinde giderek daha yaygın hale gelmektedir. Edward O. Wilson ve Stephen R. Kellert tarafından popülerleştirilen biyofilya hipotezi, insanların doğal dünya ile bağ kurma ve deneyimleme konusunda genetik bir eğilim taşıdığını öne sürmektedir. Ancak, çağdaş kentsel ortamlar yalnızca bireyleri doğadan izole etmekle kalmayıp, aynı zamanda şehir yaşamına özgü ek zorluklar da getirmektedir. Bu durum çevre deneyimini ve yaşam kalitesini topluca etkilemektedir.

Ankara'da, hızlı nüfus artışı ve arsa piyasası tarafından yönlendirilen kontrolsüz kentleşme hem yaşam kalitesini hem de çevresel koşulları daha da kötüleştirmiştir. Bu tezin amacı, Alacaatlı mahallesinde biyofilik ortamı geliştirmek olup, Ankara'daki geniş çaplı kentsel planlama girişimleri için öncü olmayı hedeflemektedir. Ankara şehri ve Çayyolu bölgesinin tarihsel arka planını, Alacaatlı mahallesindeki iklim koşullarını ve nüfus trendlerini kapsayan ve biyofilik deneyimi değerlendirmek için sistematik saha gözlem yöntemlerini kullanarak, biyofilik tasarım stratejilerinin uygulanmasını göstermeyi amaçlamaktadır. Bu stratejiler, bu bölgedeki belirgin zorluklara yanıt olarak yaşam kalitesini ve çevresel deneyimi artırmayı hedeflemektedir.

Anahtar Kelimeler: Biyofilya, Biyofilik Şehir, Doğa Deneyimi, Ankara, Alacaatlı

Dedicated to my family, friends, and my cats Navy and Ghost.

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TABLE OF CONTENTS

LIST OF TABLES

TABLES

LIST OF FIGURES

FIGURES

LIST OF ABBREVIATIONS

ABBREVIATIONS

AMANPB	Ankara Metropolitan Area Master Plan Office
AMM	Ankara Metropolitan Municipality
CUGE	Centre for Urban Greening and Ecology
EDP	Environmental Development Plan
LRP	Landscape Replacement Policy
METU	Middle East Technical University
NParks	National Parks Board
OIZ	Organized Industrial Zones
SEDI	Socio-Economic Development Index
SWOT	Strengths, Weaknesses, Opportunities, and Threats
UHI	Urban Heat Island

CHAPTER 1

INTRODUCTION

Despite being a new concept, popularized in the 1980s by Edward O. Wilson, biophilia has gained significant traction in recent decades, inspiring a wealth of research across various disciplines such as psychology, interior design, architecture, urban planning, environmental sciences, health, and medicine. Biophilic city design in particular, has been increasingly embraced and implemented in various global contexts such as Singapore and Milwaukee, WI (Beatley, 2016). This thesis will explore global examples like these along with the other various research on biophilia and biophilic city design to implement these findings within a new context in Ankara. Çayyolu, much like the broader Ankara region, is experiencing rapid urbanization and infrastructural growth. In parallel with most expanding cities, this invites a host of new challenges while exacerbating existing problems. Issues such as urban heat island (UHI), deforestation, diminished quality of life, and a disconnect from nature have become prominent concerns (Beatley, 2016). This thesis seeks to address these challenges by leveraging the principles of biophilic city design. The overarching goal is to facilitate urban expansion while mitigating or balancing the negative consequences through the implementation of biophilic solutions. Drawing upon the theories of biophilia and biophilic city design, this research aims to propose practical interventions tailored to the specific context of the neighborhood of Alacaatlı, in hopes that it will also benefit the city of Ankara with future developments. In addition to contributing to the enhancement of Alacaatlı, this thesis also seeks to enrich the emerging database on biophilic city design on a global scale.

1.1 Problem Statement

Currently, 55% of the global population resides in urban areas, with projections indicating that this figure will rise to 68% by 2050 (United Nations, 2018). While urbanization offers certain benefits, it also introduces new challenges, chief among them being the loss of connection to nature—a critical issue that often goes unnoticed (Sukanya & Tantia, 2023). This diminishing connection has far-reaching consequences, impacting quality of life, environmental health, community well-being, and the economy (Beatley, 2016). To mitigate the effects of urbanization, restoring lost natural elements in cities and introducing new ones is essential, requiring a concerted effort from the entire system. Although this thesis focuses on incorporating biophilic urban design, it recognizes that community engagement, public opinion, and the involvement of city leaders are equally important. It is hoped that the solutions proposed in this thesis will inspire further action and contribute to a comprehensive approach to urban challenges.

Türkiye is not significantly represented in the research and applications that define biophilic city design. This thesis seeks to address this gap by contributing research that highlights the unique cultural, economic, and environmental factors of Çayyolu, Ankara, thereby enriching the global discourse on biophilic urban design with new context-specific insights.

1.2 Objectives and Methodology

The Alacaatlı neighborhood in Çayyolu was chosen as the study area due to its recent and ongoing development, thereby presenting an ideal pilot location for proposing biophilic strategies. The area's unique blend of new and existing spaces makes it optimal for exploring the integration of biophilic design principles, providing valuable insights into the potential benefits and challenges of integrating nature into different development stages of the urban environment. The residential component of the study area was selected as the primary focus due to its relevance to daily life, as it is a setting where individuals spend a significant amount of time. This is particularly pertinent in a location like Alacaatlı, where the reliance on vehicular transportation to access most destinations makes the residential environment an even more critical aspect of daily experience. Çayyolu was specifically chosen due to its socio-economic profile, which is characterized by a predominantly upper-middle-class income demographic. As biophilic design strategies are often resource-intensive and not yet at the forefront of urban development, it is strategic and more feasible to initiate the integration process in higher-income neighborhoods, with the aim of eventually disseminating these benefits to lower-income groups in the future.

This thesis is guided by two primary objectives. Firstly, it seeks to contribute to the existing body of knowledge on biophilic city design and experiences, thereby advancing our understanding of the complex relationships between urban environments and human well-being. Secondly, it aims to develop evidence-based recommendations for the Alacaatlı neighborhood, with the goal of creating a model for urban planning that can be replicated and adapted in other contexts throughout Ankara. These objectives are summed up by the following research questions:

- What new knowledge can be gained by studying biophilic city design in the context of Alacaatlı?
- How can the findings from Alacaatlı inform a broader transformation of Ankara into a more biophilic city?

The research methodology centers on evaluating the biophilic experience within the designated study area of Alacaatlı through the application of multiple approaches, including historical research, trend analysis of both current and past conditions, and systematic field observations based on biophilic principles. The aim is to translate these findings into practical applications, thereby proposing a strategic plan applicable to the broader context of Ankara. The biophilic design proposals and recommendations will emphasize feasibility, utilizing a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis to ensure that the solutions are both pragmatic and achievable, rather than solely focusing on the most biophilic interventions. This approach seeks to establish realistic and practical goals specifically tailored to the needs of Alacaatlı.

1.3 Organization of Thesis

Chapter 2 will present a literature review that begins with an exploration of biophilia and its origins, followed by an examination of its design applications and examples of biophilic cities. This review will then address the benefits of biophilic design, highlighting themes in human health, environmental impact, economic advantages, and cultural significance.

Chapter 3 will offer a contextual background for the city of Ankara, the Çayyolu District, and the Alacaatlı neighborhood, examining the development history, population trends, socio-economic development, and climatic conditions.

Chapter 4 will conduct an analysis of Alacaatlı's biophilic elements through a field study and review of its climatic data. Recommendations for the proposed biophilic plan will be discussed based on the literature review, followed by a SWOT analysis, to aid in developing the proposal in the subsequent chapter.

Chapter 5 will propose biophilic design strategies, plan, and detailed drawings tailored to the feasibility and unique context of Alacaatlı. This will be followed by concluding thoughts as well as notes on limitations and future studies.

CHAPTER 2

LITERATURE REVIEW

2.1 What is Biophilia?

The first mention of the term "biophilia" originated from the psychoanalyst Erich Fromm, in his book *The Anatomy of Human Destructiveness*. His initial depiction of biophilia can be reflected in the line "the passionate love of life and of all that is alive" which would later be expanded on by the American biologist Edward O. Wilson who officially coined the term "biophilia" in the 1980s (Dennehy, 2017; Fromm, 2013). Meaning "love for our living systems," biophilia refers to a human's innate desire to be near and connected to nature and other life forms (Wilson, 1984). Along with his collaborative partner Stephen R. Kellert, Ph.D., a professor of social ecology at Yale School of Forestry & Environmental Studies, they built upon the concept with numerous literary articles and book publications, including their renowned *The Biophilia Hypothesis* (Dennehy, 2017). The biophilia hypothesis states there are biophilic tendencies in humans because of a genetic link stemming from a coevolution with natural organisms and the natural world for the greater span of human evolution (Kellert & Wilson, 1993). Although our modern world consists of mostly artificial cities, technology, and mass production, most of this human-engineering only dates to 12,000 years ago. Considering the remaining 99% of human evolution and development has been without modern technologies, our species is more biologically adapted to respond to natural environments as opposed to artificial ones (Kellert & Calabrese, 2015). Expanding on their biophilia hypothesis, in his 2008 publication Kellert adds that regular contact with environmental features and other living organisms is unarguably a necessity for human physical, emotional, and intellectual health and well-being because of our evolutionary history (Kellert, Heerwagen, & Mador, 2008). The biophilia hypothesis has also paved the way to biophilic design in the fields of interior, urban, and landscape design as well as architecture, further spreading this ideology and the benefits of nature into our daily lives and environments.

2.2 What is Biophilic Design?

Biophilic design is a concept that reintegrates natural elements and experiences into our built environments, aiming to meet our innate biophilic needs and enhance our health and wellbeing (Kellert, 2006). Kellert and Calabrese (2015) have devised a framework of biophilic design guided by five fundamental principles:

"1. Biophilic design requires repeated and sustained engagement with nature.

2. Biophilic design focuses on human adaptations to the natural world that over evolutionary time have advanced people's health, fitness and wellbeing.

3. Biophilic design encourages an emotional attachment to particular settings and places.

4. Biophilic design promotes positive interactions between people and nature that encourage an expanded sense of relationship and responsibility for the human and natural communities.

5. Biophilic design encourages mutual reinforcing, interconnected, and integrated architectural solutions."

These principles collectively guide the implementation of biophilic design to create environments that not only accommodate but also enhance our connection to nature (Kellert & Calabrese, 2015).

2.3 The Practice of Biophilic Design

Effective implementation of biophilic design hinges on adhering to its five core principles and integrating them harmoniously into the overall design. This involves tailoring the application to the specific context and intended purpose of the space, including factors such as building or landscape size, usage, economic viability, logistical considerations, cultural relevance, and ecological sustainability. Each design must be customized to optimize its long-term sustainability while fostering a meaningful connection between occupants and their environment. Additionally, biophilic design should not be approached piecemeal or in isolation; rather, it should be integrated in a way that allows different applications to mutually reinforce and complement each other, creating a cohesive and ecologically integrated whole (Kellert & Calabrese, 2015).

2.3.1 Experiences of Nature

At the core of the biophilic design framework are three categories that represent how we interact with nature: direct experience of nature, indirect experience of nature, and the experience of space and place. These three categories comprise a total of 24 attributes, each elaborating on and connecting them to their role in biophilic design within real-world settings (Kellert & Calabrese, 2015).

2.3.1.1 Direct Experience of Nature

The direct experience of nature involves incorporating environmental elements such as plants, animals, fresh air, natural lighting, and water into the design or surroundings. Below is the list of the full attributes provided by Kellert and Calabrese along with a description of their role in biophilic design (Kellert & Calabrese, 2015).

LIGHT. Experiencing natural light is essential for human health and well-being, allowing us to adjust to daily, nightly, and seasonal variations influenced by the sun's position and cycles. Additionally, it aids in movement, navigation, and contributes to overall comfort and satisfaction (Kellert & Calabrese, 2015).

AIR. The experience of natural ventilation, enriched by natural patterns of fluctuations in airflow, temperature, humidity, and barometric pressure, has significant impacts for human comfort and productivity (Kellert & Calabrese, 2015).

WATER. The presence of water, especially when stimulating multiple senses of sight, sound, touch, taste, and movement, can reduce stress while simultaneously enhancing overall health, performance, and satisfaction (Kellert & Calabrese, 2015).

PLANTS. The presence of vegetation can reduce stress while simultaneously enhancing overall physical health, performance, productivity and comfort (Kellert & Calabrese, 2015).

ANIMALS. The positive and non-threatening presence of non-human animals is essential to fulfilling our daily need for nature, as evidenced by sustained interactions throughout human history. Frequent contact with diverse, native species proves to be the most effective form of experience (Kellert & Calabrese, 2015).

WEATHER. The presence of fluctuating weather patterns and seasons adds another layer of satisfaction and stimulation to the experiences of nature. Awareness and adaptation to weather has been a fundamental aspect of human evolutionary history that contributes to enhancing skills of survival and human fitness (Kellert & Calabrese, 2015).

NATURAL LANDSCAPES AND ECOSYSTEMS. The experience of natural landscapes and ecosystems refers to being in contact with plants, animals, water, soils, rocks, and geological forms interconnected as a whole system rather than individual natural elements (Kellert & Calabrese, 2015).

FIRE. The experience of fire can enhance stimulation and comfort by providing both a light and heat source, while also introducing color and movement into the environment (Kellert & Calabrese, 2015).

2.3.1.2 Indirect Experience of Nature

The indirect experience of nature encompasses a wide range of elements associated with the natural environment, including depictions through imagery such as paintings or screens, the use of natural materials in furnishings, ornamentation that incorporates natural shapes and forms, and representations of environmental processes that hold significance in human evolution. Below is the list of the full attributes provided by Kellert and Calabrese along with a description of their role in biophilic design (Kellert & Calabrese, 2015).

IMAGES OF NATURE. Depictions of nature, including plants, animals, and landscapes, whether through traditional mediums like photographs and paintings or digital media such as videos and computer simulations, can offer profound emotional and intellectual fulfillment in urban environments deficient in natural elements, particularly when presented in an abundant, repetitive, and thematic manner (Kellert & Calabrese, 2015).

NATURAL MATERIALS. The use of natural building materials such as woods, stones, cotton, wool, or leather, helps facilitate visual and tactile connections with the natural environment and can prove to be more stimulating than utilizing artificial materials (Kellert & Calabrese, 2015).

NATURAL COLORS. The use of color in built environments done in a manner to mimic the natural environment can be an effective form of biophilic design. The significance of natural colors in environments traces back to human evolution, where colors played a crucial role in wayfinding and navigating landscapes while searching for essential resources like food and water (Kellert & Calabrese, 2015). Therefore, incorporating natural colors can promote stronger connections with the natural environment.

SIMULATING NATURAL LIGHT AND AIR. When artificial lighting is used, it should aim to simulate the diverse qualities of natural light including its spectral and dynamic qualities throughout the day. Processed air should mimic natural ventilation displaying shifts in temperature, humidity, airflow, and barometric pressure. Implementing these practices promotes a more biophilic environment, enhancing the physical and psychological well-being of humans (Kellert & Calabrese, 2015).

NATURALISTIC SHAPES AND FORMS. Designing built environments with shapes and forms inspired by natural elements (i.e. leaf-life patterns, animal prints) can be more appealing as it stimulates qualities found in living systems (Kellert & Calabrese, 2015).

EVOKING NATURE. This pertains to designs drawing inspiration from nature and interpreting it in abstract and imaginative ways. Even without directly incorporating natural elements, these designs can create a deeply satisfying and stimulating experience in a built environment (Kellert & Calabrese, 2015).

INFORMATION RICHNESS. Many regard the natural world as the most information-rich environment they've encountered. With our evolutionary history spanning millennia in the natural world, similar types of complex yet coherent environments, whether natural or constructed, continue to evoke positive responses by fulfilling our innate desire for a diversity of options and opportunities (Kellert & Calabrese, 2015).

AGE, CHANGE, AND THE PATINA OF TIME. Nature is a dynamic force, continually aging and evolving. Within this constant flux, it embodies qualities of adaptation, healing, and growth. Environments that reflect a patina of time, combined with qualities of unity and stability, can significantly enhance the overall satisfaction of the human experience (Kellert & Calabrese, 2015).

NATURAL GEOMETRIES. This refers to refer to mathematical properties frequently observed in nature, including but not limited to self-repeating yet variable patterns, sinuous geometries, and organized scales, with notable examples including the "Golden Ratio" and "Fibonacci Sequence" (Kellert & Calabrese, 2015).

BIOMIMICRY. Biomimicry is an innovative approach that draws inspiration from nature's designs, processes, and strategies to solve human problems and create sustainable solutions. By studying and emulating biological systems, organisms, and ecosystems, biomimicry seeks to apply their efficient and time-tested solutions to technological, architectural, industrial, and environmental challenges. Examples include designing materials inspired by spider silk for their strength and flexibility or using the shape and structure of termite mounds to improve building ventilation systems. Biomimicry not only aims to enhance efficiency and performance but also to promote harmony with natural systems, thereby contributing to sustainability and ecological stewardship (Kellert & Calabrese, 2015).

2.3.1.3 Experience of Space and Place

The experience of space and place in biophilic design involves incorporating natural environmental characteristics into the design of features that enhance user interaction, perception, ergonomics, and cultural and ecological significance. Below is the list of the full attributes provided by Kellert and Calabrese along with a description of their role in biophilic design (Kellert & Calabrese, 2015).

PROSPECT AND REFUGE. Prospect is characterized by clear perception and surveillance, facilitated by unobstructed, expansive views of the surroundings. Refuge, on the other hand, represents safety and protection, entailing access to separation and shelter. These complementary evolutionary adaptations in humans fulfill both functional needs and enhance satisfaction in constructed environments (Kellert & Calabrese, 2015).

ORGANIZED COMPLEXITY. Organized complexity strives for a balance in order and chaos. A complex environment signifies variety and new opportunities, yet in excess can be overwhelming and confusing. Conversely, an organized environment embodies interconnection and coherence, yet excessive order can feel artificial and monotonous (Kellert & Calabrese, 2015).

INTEGRATION OF PARTS TO WHOLES. People are drawn to environments where diverse elements come together seamlessly as a unified whole. This sense of coherence often arises from the gradual and interconnected arrangement of spaces, as well as from clearly defined boundaries (Kellert & Calabrese, 2015).

TRANSITIONAL SPACES. Transitional spaces are essential for facilitating effective navigation within environments and establishing connections between different areas (Kellert & Calabrese, 2015).

MOBILITY AND WAYFINDING. Sufficient space for unrestricted movement, along with well-defined entry and exit points, is essential for human comfort, wellbeing, and a sense of security, particularly in diverse and intricate environments. The inability to navigate effectively can result in feelings of confusion and anxiety (Kellert & Calabrese, 2015).

CULTURAL AND ECOLOGICAL ATTACHMENT TO PLACE. Cultural and ecological attachments to an environment appeal to the innate territorial nature of humans. This territorial nature historically provided us comfort and increased quality of life through better resource control, security, and mobility. Today, it fosters a sense of connection and identity through cultural expressions, alongside emotional bonds and heightened awareness of indigenous species, local landscapes, and weather patterns. These connections also play a crucial role in promoting the long-term sustainability and resilience of both built and natural environments because they tap into our innate instinct to protect what we perceive as ours (Kellert & Calabrese, 2015).

2.3.1.4 Conclusion

These attributes and the way we experience them are all tied to our sensory abilities of sight, sound, touch, smell, taste, and movement. Among these, sight is particularly significant as it strongly influences how people perceive and react to natural elements such as plants, animals, water, and landscapes. Direct and even indirect visual contact with nature, such as through images, natural materials, and organic shapes, triggers physical, emotional, and cognitive responses like curiosity, imaginative thinking, and creativity. Conversely, spaces lacking visual ties to nature, like windowless and bland environments, often lead to boredom, fatigue, and occasionally, physical or mental strain. Despite sight's prominence, our interaction with nature encompasses more than just what we see. Touching plants, hearing water, smelling flowers, and sensing air movement enrich our emotional and intellectual engagement as well (Kellert & Calabrese, 2015). Kellert, Heerwagen, and Mador states that these attributes and our experiences with them have become ingrained in human DNA over the course of evolution. Humans possess an inherent longing for these multisensory experiences as essential for leading a satisfying, healthy life of enhanced comfort, satisfaction, enjoyment, and cognitive function, underscoring the necessity of integrating them into urban design (2008).

2.3.2 Experiences of Nature Applied to Urban Design

This section will explore in greater depth the experiences and elements of biophilic design, focusing on their application in urban design.

2.3.2.1 Direct Experience of Nature

LIGHT. While Kellert and Calabrese primarily discuss lighting principles for indoor spaces, these principles can be applied to urban design with similar objectives. In urban settings, the height and clustering of buildings and infrastructure often obstructs the natural flow of light, resulting in dark alleyways, inadequate natural lighting for building occupants, and limited sunlight for vegetation growth. To address these issues, urban planners can consider building orientation strategies and incorporate transparent or reflective colors and materials to create spaces that allow light to penetrate more effectively (Kellert & Calabrese, 2015).

AIR. Despite the assumption that natural ventilation would be readily available in outdoor spaces, urbanization has often hindered or degraded its quality in many cities. In fact, studies indicate that building density is the main factor limiting proper ventilation corridors (Liu, Zhang, Jiang, & Wang, 2021). Therefore, addressing density issues and exploring different orientation strategies can be effective approaches to enhance natural ventilation. However, in many cities, altering density and orientation may not be feasible due to existing development and infrastructure. Therefore, exploring alternative strategies such as increasing urban vegetation remains an effective approach to enhance natural ventilation. Increasing vegetation in urban areas not only enhances air quality by supplying fresh oxygen but also helps mitigate the UHI effect by regulating evaporation (Zhou, et al., 2020). This can contribute to more stable temperature control and humidity levels that align more closely with native environmental conditions. It also presents a more feasible and aesthetically pleasing alternative for urban spaces aligned with biophilic ideals.

WATER. In urban design, the direct experience of water can be achieved through making use of existing bodies of water such as lakes, seas, oceans, or by artificial means such as water fountains and constructed wetlands (Kellert & Calabrese, 2015). Ponds are especially effective for creating this urban experience, as they serve the dual purpose of enhancing resilience—a concept emphasized by Beatley as synonymous with a biophilic city (Beatley, 2016). In a 2020 study investigating the advantages of urban local ponds in addressing domestic water scarcity and enhancing resilience, researchers concluded that constructing urban ponds contribute significantly to bolstering water-supply resilience. Capturing rainwater locally and utilizing it with connections to local water systems in lieu of transporting water over long distances will not only reduce environmental impact, but also establish a more readily available water source in the event of potential conflicts (Domènech, March, & Saurí, 2013). However, it is also important to note that in certain climatic regions, the incorporation of traditional ponds is not viable due to the prevailing low humidity levels and high temperatures, which result in reduced precipitation and increased evaporation rates. As an alternative, various innovative designs of rain gardens offer more feasible solutions that provide immersive water experiences while prioritizing sustainability and water conservation (Dunnett & Clayden, 2007).

Figure 2.1 Dry Detention Basin (HR Green, n.d.)

Figure 2.1 illustrates a dry detention basin, a stormwater management system designed to collect and store rainwater during rainstorms, subsequently drying out during periods of low rainfall. This type of rain garden is particularly well-suited for implementation in larger-scale, public landscapes and requires more aesthetic appeal as it lacks a permanent water presence (Dunnett & Clayden, 2007).

Figure 2.2 Mauerpark, Berlin where parts of the flower sculptures function to circulate rainwater for the park (Dunnett & Clayden, 2007)

Figure 2.2 illustrates an innovative design that builds upon the concept of the dry detention basin, transforming it into a recreational park. This park incorporates a rainwater circulation system, where rainwater is channeled through the flower sculptures to create a dynamic water play feature during and immediately following rainfall. Notably, the design ensures that the park's play value and water-like ambiance are maintained even during dry periods, achieved through the strategic incorporation of steppingstones and pebbles that evoke a beach-like atmosphere (Dunnett & Clayden, 2007).

Figure 2.3 Gully down the central path at the Welsh Botanic Gardens in Carmarthen (Dunnett & Clayden, 2007)

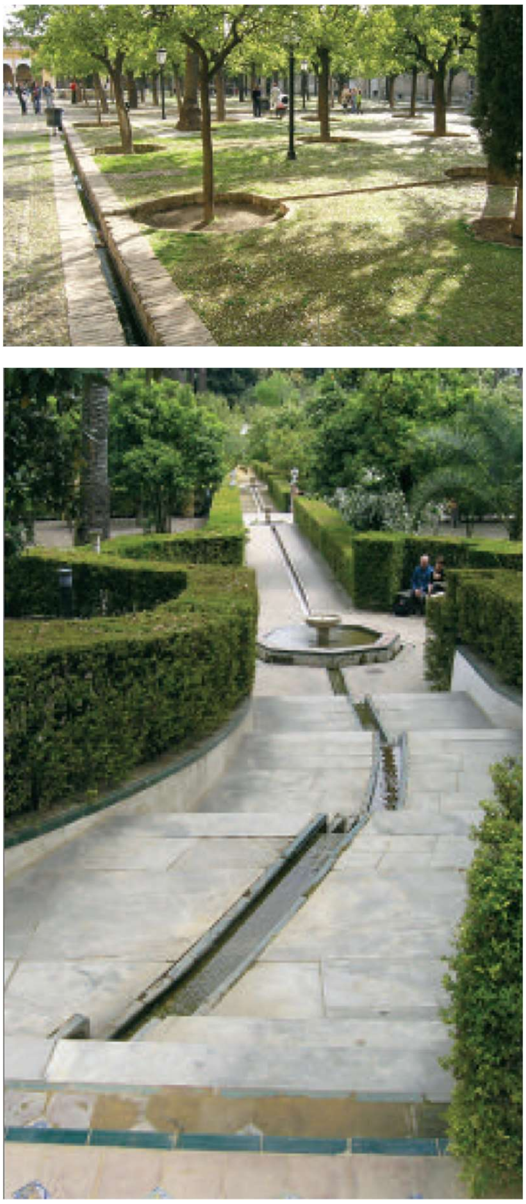

Figure 2.4 Gully in the gardens of Alcazar, Spain, with channels directing water towards various connecting features rather than a traditional drainage system (Dunnett & Clayden, 2007)

Figures 2.3 and 2.4 shows examples of gullies that can be used to direct rainwater from the roof to an underground drainage system while also maintaining an interactive presence of water on the surface. Gullies work well in most scenarios due to their flexibility, as they can be temporarily damned or redirected to play elements or gardens to act as a watering system.

Figure 2.5 Stormwater planter temporarily filled with rainwater after a storm (Dunnett & Clayden, 2007)

Stormwater planters, as depicted in Figure 2.5, constitute a valuable addition to the overall experience of water through the implementation of sustainable design practices. These planters serve as temporary repositories for rainwater, which can subsequently be utilized as a visually appealing and functional means of irrigating adjacent vegetation, while also creating the opportunity for more diverse and lush plantings around their bases (Dunnett & Clayden, 2007). Furthermore, they contribute to the creation of a dynamic water experience by integrating with the existing network of rain gutters and gullies, thereby fostering a more holistic and interconnected approach to water management.

PLANTS. The incorporation of plants into an urban space requires an approach of abundance. Single or isolated plants do little to yield any benefits, as well as buildings and constructed landscapes with sparse vegetation (Kellert & Calabrese, 2015). A noteworthy example is Singapore's Land Replacement Policy, which mandates the replacement of any nature lost at ground level during the construction of new buildings (Beatley, 2016). Embracing design applications aligned with this policy can foster a balance between the built and natural environment, reinforcing the need for abundance to maximize the experience of plants and its benefits.

Singapore is also renowned for its effective implementation of vertical greening design solutions, which encompass a range of applications, including green walls, green roofs, and multiple external garden terraces (Beatley, 2016). By integrating vegetation into building facades and rooftops, these design solutions enable the experience of nature to transcend traditional horizontal boundaries, providing a more immersive and multidimensional experience of plant life.

ANIMALS. While any form of positive animal contact could be favorable, Kellert and Calabrese (2015) note that isolated and infrequent experiences do not provide notable benefits. Various forms such as bird feeders, outdoor aquaria or ponds, green roofs, and gardens are great ways to integrate animal life into the urban environment, however, creating meaningful and sustained interactions may require more creative and unique design solutions.

A notable example of frequent and prolonged interaction with animals can be observed in Istanbul, where both locals and tourists regularly provide food and shelter for the city's stray cats. This practice not only fosters lasting bonds with the animals but also cultivates a strong sense of community among residents. While this example may not be a direct result of urban design, it serves as evidence that such enriching experiences can thrive within dense urban environments. The city of Kayseri has enhanced this effort by establishing an outdoor park dedicated to stray local cats, providing them with food, water, and shelter. This park also features numerous play areas and toys where town residents can interact and play with the animals, fostering companionship and offering opportunities for adoption (Kocasinan Belediyesi, n.d.). This solution is an excellent way to introduce meaningful and regular experiences with animals in an urban environment, while also contributing to the management of the stray animal population.

Figure 2.6: Images of "Küçük Dostlar Kedi Kasabası" in Kayseri (Kocasinan Belediyesi, n.d.)

WEATHER. In urban settings, it is crucial to prioritize designs that do not obstruct natural airflow, temperature regulation, barometric pressure, and humidity. According to Keller and Calabrese (2015), these factors significantly influence the quality of weather experience in urban environments. While it is essential to offer protection from natural elements such as sunlight and inclement weather, structures and infrastructure should be strategically designed to accommodate dynamic weather patterns and preserve these natural qualities.

NATURAL LANDSCAPES AND ECOSYSTEMS. Integrating natural landscapes fully into urban environments may prove difficult, but they can still be incorporated into parks or serve as visible backdrops that complement the built environment. The city of Gilbert, AZ, USA has created a riparian preserve that is a 110-acres of wetland consisting of a wildlife sanctuary, numerous parks, hiking trails, urban fishing lake, campsites, and even an ethnobotanical garden where visitors can experience and learn about native plants to Arizona. The Riparian not only provides a natural habitat for wildlife and helps preserve natural resources, but also cultivates a sense of responsibility for residents through direct experiences and education programs. Situated adjacent to the local library, schools, and residential neighborhoods, this preserve successfully integrates an accessible natural landscape and a self-sustaining ecosystem within the city environment (Gilbert, AZ, n.d.).

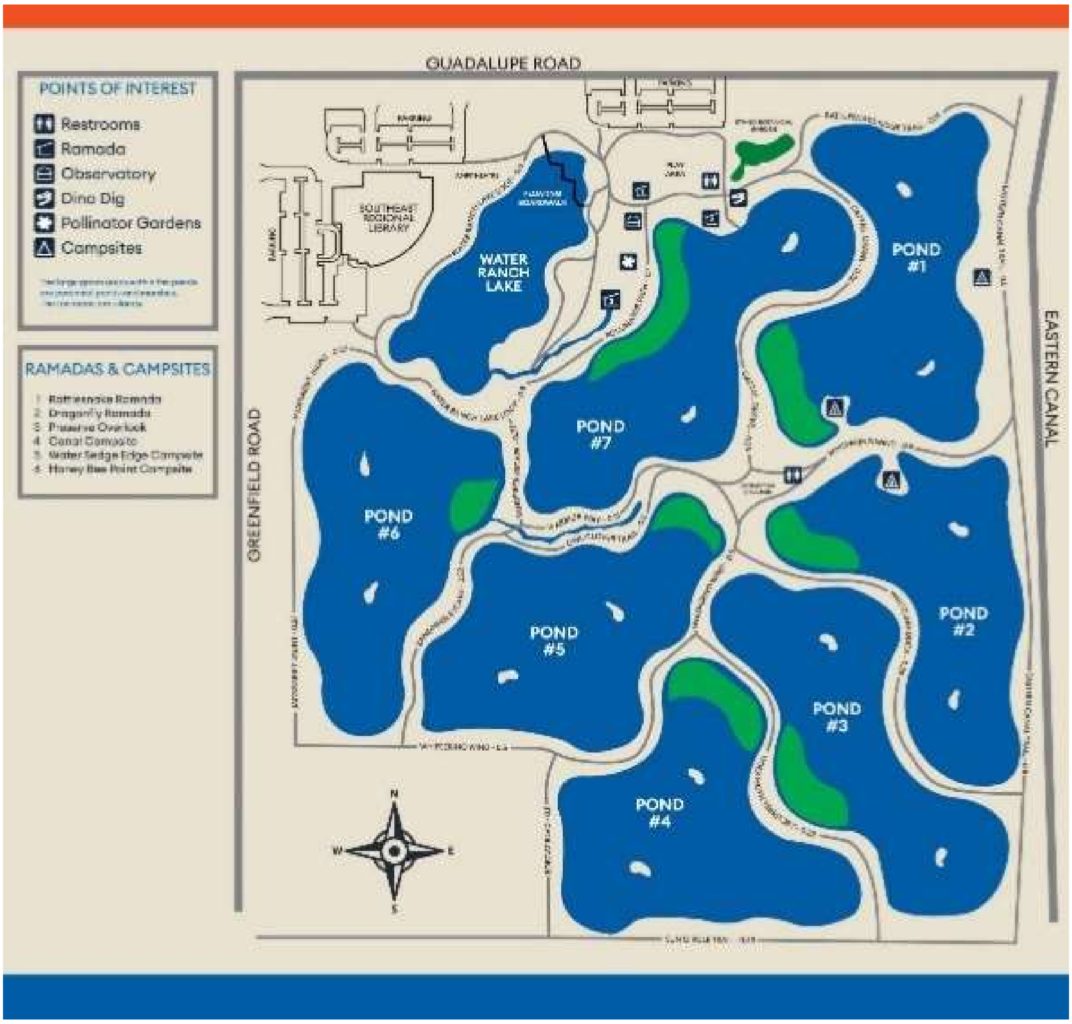

Figure 2.7: Map of the Riparian Preserve at Water Ranch in Gilbert, AZ, USA (Gilbert, AZ, n.d.)

FIRE. While Kellert and Calabrese (2015) primarily discuss indoor applications such as fireplaces and hearths, these concepts can be adapted to outdoor environments through the use of firepits or fireplaces in communal gathering areas. In addition to providing direct experiences to fire, this also serves to enhance community and social interaction.

2.3.2.2 Indirect Experience of Nature

IMAGES OF NATURE. In urban design applications, images of nature can be displayed on building facades, sidewalks, billboards, park benches and more, which can help blend the built environment to the natural environment to create the illusion of a mostly natural system.

NATURAL MATERIALS. Natural building materials such as wood, stone, and leather can be prioritized over artificial materials, enhancing both visual and tactile connections with the natural environment (Kellert & Calabrese, 2015).

Figure 2.8 Various designs and uses of gabion walls (Altman, 2010) (Banyon Tree Design Studio, n.d.) (Badec Bros Group, 2009) (CSDesign LLC, 2010)

Gabion walls, as depicted in Figure 2.8, are typically composed of a combination of metal mesh or wiring and natural rocks or stones, thereby creating a visually cohesive integration with the surrounding landscape. The incorporation of gabion walls as a design solution offers a versatile and effective means of integrating natural materials into the built environment, owing to their flexibility, cost-effectiveness, and environmental sustainability. The permeable design of gabion walls prevents water accumulation, while the use of local stones promotes ecological balance and vegetation growth, thereby fostering a more harmonious relationship between the built and natural environments (UGREEN, n.d.).

NATURAL COLORS. In urban design applications, muted, earthy tones representative of soil, rocks and plants shall be prioritized while overly bright and artificial colors shall be kept to a minimum unless being used to depict forms found in nature (Kellert & Calabrese, 2015).

SIMULATING NATURAL LIGHT AND AIR. Artificial lighting in urban settings often consists of streetlights or lights from nearby residences and buildings. These sources can disrupt natural environments and affect organisms, while also shaping an artificial experience for human inhabitants. To foster a more biophilic urban environment, it's beneficial to use lighting that mimics daylight and adjusts to seasonal changes in terms of brightness and temperature (Kellert & Calabrese, 2015).

Simulated air is not pertinent to this study since processed air is mainly utilized indoors rather than in urban design scenarios. However, the principles of Kellert and Calabrese's discussion of processed air in indoor spaces can be adapted to urban design with a similar goal. Increasing natural vegetation to improve oxygen levels and air quality, and designing built environments that facilitate proper ventilation, can greatly enhance the urban experience. This approach helps mitigate the unnatural effects of UHI, which can often disrupt local temperature and humidity patterns.

NATURALISTIC SHAPES AND FORMS. Examples of naturalistic shapes and forms in urban design can range from columns in the form of trees (Figure 2.9), leaf motifs or impressions on sidewalks (Figure 2.10), to life size animal statues (Figure 2.11). Design applications such as these helps bridge the gap between artificial environments and the natural world while preserving the functional and ergonomic capabilities of the built environment.

Figure 2.9: Tree forms from the site reflected in the structure of *The Tote* restoration project (Serie Architects, 2011)

Figure 2.10: Concrete leaf walkway (Whiteley Creek Homestead)

Figure 2.11: Stainless-steel life-size animal statues (Metal Art Sculpture)

EVOKING NATURE. Abstract inspirations from nature in architecture and design that can be seen in numerous applications worldwide. One of the examples Kellert and Calabrese (2015) mention is the Sydney Opera House (Figure 2.12) as a case where the architecture evokes the shape of bird wings. Another instance they mention is Notre Dame's stained-glass windows, which are inspired by roses and other flowers found in nature. Even certain skylines of some cities evoke that of the vertical heterogeneity found in forests. All these designs are interpreted in a unique and non-literal manner and are not typically found in nature (Kellert & Calabrese, 2015).

Figure 2.12: Sydney Opera House (Kellert & Calabrese, 2015)

INFORMATION RICHNESS. In urban design applications, it is essential to prioritize complexity and variability, while minimizing repetitive and monotonous designs unless they contribute to enhancing coherence and legibility. For instance, rather than arranging trees and vegetation in straight, uniform plots, dispersing them in a manner akin to natural settings can be more effective. Similarly, integrating sidewalks and pathways that mirror the diverse textures and elevations in nature or utilizing a rich variety of colors and materials can help in creating a more stimulating and information-rich environment.

AGE, CHANGE, AND THE PATINA OF TIME. In urban environments, we often encounter a patina of time expressed through artificial materials and methods. However, a more authentic representation of natural progression and the patina of time can be achieved through design strategies that incorporate naturally aging materials. These materials exhibit patterns of weathering and decay, mirroring the processes found in nature, leading to a more biophilic approach (Kellert & Calabrese, 2015). Another effective strategy is to incorporate trees and vegetation that undergo noticeable changes in appearance throughout the year, such as leaves changing color in the fall or flowers blooming in the spring. This approach fosters a stronger connection to seasonal variations as well as creating an enriching urban environment with dynamic visual changes representing age, change, and the patina of time.

NATURAL GEOMETRIES. The "Golden Ratio" and "Fibonacci Sequence" are mathematical concepts that embody patterns observed in nature. These principles have been applied extensively in architecture and urban design to incorporate natural aesthetic balance and harmonies. A notable historical example is the Parthenon, where its dimensions are thought to reflect the Golden Ratio, demonstrating the longstanding influence of these aesthetics in early construction practices. Beyond their aesthetic appeal, these concepts also offer practical solutions from the natural world. The Fibonacci Sequence can be observed in the hexagonal packing of cells in honeybee hives for example. This is a natural design that is widely adopted globally for its efficient and optimized use of space and building materials (Sanni & Oyetoro, 2024). The honeycomb design's versatility is further demonstrated in the urban garden design by OFL Architecture (Figure 2.13), where the hexagonal pattern in the pavers provides a flexible and cohesive solution for implementing walkways, seating areas, and planters (OFL Architecture, 2016).

Figure 2.13: Zighizaghi: multi-sensorial urban garden in Favara, Italy (OFL Architecture, 2016)

BIOMIMICRY. Singapore's Gardens by the Bay project demonstrates an exemplary form of biomimicry through its supertrees. These towering metal structures, adorned with plants and vegetation, emulate the beneficial functions of natural trees by offering shade, cooling effects, and habitats for wildlife. Housing over 160,000 plants, the 18 supertrees are interconnected by elevated skyways and feature two conservatories, a restaurant, and incorporate solar panels, enhancing their functionality and sustainability (Beatley, 2016).

Figure 2.14: Supertrees at the Gardens by the Bay, Singapore (Kellert & Calabrese, 2015)

2.3.2.3 Experience of Space and Place

PROSPECT AND REFUGE. In urban design applications, allowing spaces to have long, unobstructed views of an area can fulfill the objective of prospect. This can involve strategically situating buildings, signage, trees, and other design elements to enhance the sense of openness and visibility within the area. Refuge, on the other hand, can be attained through the incorporation of separation and shelter. This might involve using trees and vegetation as physical barriers between roads and sidewalks to enhance feelings of safety for pedestrians and mitigate noise disturbances from vehicles. Similar applications can be applied to other shared public spaces, such as park benches, where the strategic use of trees and vegetation can help provide a sense of visual and sound privacy for individuals using the space.

ORGANIZED COMPLEXITY. To achieve organized complexity, a space should integrate a diverse array of built and natural features while ensuring that the functionality of the space, such as wayfinding and comprehensibility, remains uncompromised.

INTEGRATION OF PARTS TO WHOLES. While each space requires clear and defined boundaries, established through the use of diverse materials, fences, walls, foliage, or signage, they should also feature points of integration that serve as unifying elements. This could entail a lake, public park, or town square that connects the surrounding residential areas, offices, or public buildings, serving as a symbolic focal point for the community.

TRANSITIONAL SPACES. In urban design applications, this involves the use of trails, sidewalks, roads, bridges, or other discernible transitions that facilitate seamless navigation and connectivity across different spaces.

MOBILITY AND WAYFINDING. Urban design applications should incorporate clear and defined pathways, entry points, and exits, complemented by universally comprehensible signage. In addition to promoting a sense of comfort and safety, this ensures a positive experience of mobility and wayfinding for pedestrians and vehicles alike in urban spaces.

CULTURAL AND ECOLOGICAL ATTACHMENT TO PLACE. Urban environments should embody the local culture and identity through culturally relevant designs while preserving and restoring historical landmarks and unique ecological features of the area. Initiatives such as edible community farms or environmental awareness programs can further establish ecological connections, as they necessitate an active participation from the local community, cultivating a sense of responsibility attachment.

2.3.2.4 Conclusion

These experiences and attributes of biophilic design offer a compelling framework for enhancing urban environments by integrating natural elements into the built landscape. By prioritizing direct experiences of nature such as light, air, water, plants, animals, weather, natural landscapes, and fire, urban designers can create more sustainable and resilient cities. These elements not only contribute to environmental sustainability by improving air quality, mitigating UHI, and conserving water resources but also enhance the well-being of urban inhabitants by fostering connections with nature. Moreover, strategies for indirect experiences such as natural materials, colors, forms, and biomimicry further blur the boundaries between urban spaces and the natural world, creating visually appealing and functional environments that promote health, happiness, and community. The experience of space and place in urban design, emphasizing prospect and refuge, organized complexity, integration of parts into wholes, and transitional spaces, contributes to creating inclusive and cohesive urban landscapes. Additionally, prioritizing cultural and ecological attachments to place, cities can celebrate local identity and heritage while fostering community engagement and resilience. By embracing these biophilic principles, cities can not only meet the challenges of urbanization but also nurture thriving urban ecosystems that benefit both humans and the environment alike.

2.4 Examples of Biophilic Cities

This section will explore various biophilic design applications from around the world. These examples will aid in exploring feasibility and innovative biophilic solutions for the Alacaatlı neighborhood.

2.4.1 Singapore, Republic of Singapore

One of the world's earliest and most famous biophilic cities is Singapore. Dating all the way back to the national tree planting campaign that began in 1963 by prime minister Lee Kuan Yew, Singapore has been constantly striving to create a city fully integrated with nature for its dense population. This greener vision for the city has been one of the main focuses of Lee Kuan Yew up until his passing in 2015, though the city continues to bear the torch, aspiring to be a "City in a Garden." Throughout the years, this initial vision has evolved by growing research, technology, and ideals to make the city world renowned as one of the best examples for biophilic and sustainable design. Even the original motto, once "Singapore - Garden City," has been reworked to "City in a Garden" reflecting the new mindset that the city is not just a place of many gardens, but that it is a garden itself in its entirety and the built environment is simply a part of it (Beatley, 2016, pp. 51-52).

One of Singapore's most notable biophilic features comes from its model of Asian vertical green living. Due to its high-density, with most of the population living in high-rise buildings, vertical modes of implementation prove to be necessary to increase the number of green surfaces in the city. Vertical greening and gardening in this city take on many forms from building facade trellising in native, tropical plants to sky parks, green rooftops, and external garden terraces on numerous floors of high-rises, making buildings not only more aesthetic but also more efficient, healthy, and biodiverse. The Solaris (Figure 2.15) is a remarkable fifteen story office building, designed by Ken Yeang, that displays an impressive combination of various biophilic design features, including vertical greening, that flow throughout its floors. The interior of the building takes advantage of the abundant sunshine of the tropical climate and utilizes natural daylight to illuminate most of its rooms and corridors, a detail not only beneficial for its users but the energy usage of the building. The exterior embraces the idea of a linear forest with its "continuous ribbon of green" adorning its facade, also proving beneficial for the energy usage by cooling the building. Along with a continuous ramp surrounding the perimeter, providing easy access to nature and a place for exercise, the green features of this building total to about 1.5 kilometers in length. The most impressive aspect is that the square footage of the building's footprint is surpassed by the number of green features it holds, creating a coherent system where nature is abundant and able to preside in ways to enhance the functions of the built environment rather than be a mere aesthetic inclusion (Beatley, 2016). Yeang's firm adds that, "The continuity of the landscaping is a key component of the project's ecological design concept, as it allows for fluid movement of organisms and plant species between all vegetated areas within the building, enhancing biodiversity and contributing to the overall health of these ecosystems" (Hamzah & Yeang, 2008). This statement aligns and illustrates the city's overall vision of becoming a "City in a Garden" as the design strays from unmethodical placements of green features for the mere sake of inclusion, instead focusing on integrating biodiversity and a functioning ecosystem as a part of the initial design strategy.

Figure 2.15: Solaris, Singapore (Hamzah & Yeang, 2008)

Adding to Singapore's innovative biophilic buildings, the urban design and planning also feature impressive and creative green additions to the city. Due to Singapore's naturally lush, tropical environment, there is little difficulty in growing and maintaining vegetation. The focus turns to protection as well as accessibility so the public can enjoy this abundant nature without introducing disruptions from the city. Southern Ridges is a series of parks designed to meet this goal, consisting of elevated connectors allowing visitors to walk, bike, or hike throughout the lush forest canopy of the island. These elevated paths (Figure 2.16) combine both the natural and built environment as they are always within viewing or hearing distance of the city's high-rises and roads while also providing remarkable views of the beautiful forest vistas and fauna that coexist within the same environment. These parks also function as alternative transit routes for many residents living in the city as they tie together numerous population centers and residential areas while providing a more serene and safe way to cross over busy roads and highways (Beatley, 2016). Southern Ridges is one of the many creative design strategies employed in the city that create seamless transitions from the urban and natural environment along with functional elements to ensure benefits and longevity to both.

Figure 2.16: Southern Ridges Forest Canopy Walk, Singapore (Beatley, 2016)

In addition to possessing an optimal climate fit to support the numerous creative biophilic solutions implemented into the city, Singapore is fortunate to have past prime minister Lee Kuan Yew's initial mission, a catalyst that further evolved into continual support and efforts from the government to this day. Some of this government support includes the National Parks Board (NParks), whose efforts began in 1963 with Lee Kuan Yew's tree planting campaign, sponsoring numerous projects throughout Singapore (National Parks Board of Singapore, 2024). Projects including green walls, green rooftops, sky parks, terraces, and vertical green features are provided generous subsidies by NParks, covering half of the installation costs. These sponsored projects are also monitored and used for research and development for further improvements and innovations. NParks also puts forth efforts in creating and sustaining a community in support of this green vision: their Centre for Urban Greening and Ecology (CUGE) are tasked with training landscape workers while also promoting greening efforts through several other means such as their publications of CityGreen magazine (Beatley, 2016). The government also shows its support for greening the city through various policies such as the Landscape Replacement Policy (LRP). This policy ensures that any nature that is lost at ground level during the construction of new buildings must be replaced. Due to the dense, land-scarce nature of the island, vertical builds are the most efficient way to employ this. Making use of NParks's support, covering half of the installation costs for vertical greening features, LRP is a smart strategy in creating collaborative efforts for the government and private sectors (Beatley, 2016).

2.4.2 Milwaukee, Wisconsin, USA

Biophilic design has a plethora of benefits to communities that are less talked about. Improved health, sustainability, and aesthetic quality are typically at the forefront of these benefits while the less trendy and glamorized but just as important benefits of improved education, crime rates, employment, and food scarcity issues take a backseat. Milwaukee, a city in Wisconsin, USA, exemplifies how biophilic interventions can profoundly impact communities grappling with these challenges. By integrating ecological and historical connections into its urban landscape, Milwaukee demonstrates the transformative potential of biophilic design in addressing and alleviating these critical issues.

The North End of Milwaukee is regarded as the epicenter of gun violence, high homicide rates, and significant poverty. These conditions have contributed to the presence of over 2,400 vacant lots, further highlighting the area's lack of safety and economic stability. During his term, former Mayor Tom Barrett proposed the conversion of these vacant lots into agricultural and communal spaces. This initiative was intended to not only cultivate a stronger sense of community and responsibility, which could contribute to a reduction in crime rates, but also to supply fresh, locally grown produce to neighborhoods experiencing high levels of poverty. A notable example of the success of his plan can be observed in an urban garden in Lindsay Heights, one of the city's most economically disadvantaged neighborhoods. Known as Alice’s Garden, this two-acre parcel of land serves multiple functions. It functions not only as a site for growing and supplying fresh, healthy produce to local farmers' markets but also as a venue for educational classes, community clubs, and various other programs. The garden not only fosters ecological connections within the community but also reinforces historical ties related to African American heritage. It seeks to educate visitors about the significance of food during the period of slavery and the targeting of African communities by enslavers due to their specialized agricultural knowledge and skills. The historical narrative is further substantiated by the strategic integration of historical elements, which provide a visually engaging and interactive framework for conveying the diverse experiences of individuals during the era of slavery (Beatley, 2016).

2.5 Benefits of Biophilic Design

While previous sections of this chapter touched on the benefits of biophilic design, this section will explicitly define how biophilic environments and design benefit users, the environment, and various facets of our lives including economics, safety, education, and community. The aim of this exploration is to reinforce the argument for the crucial role of biophilic design.

2.5.1 Human-health

A prevalent theme in discussions on biophilia and urban design revolves around human health and well-being. Kellert and Calabrese state that through the effective implementation of biophilic design, individuals can experience a range of physical, mental, and behavioral improvements. Physically, this may involve heightened physical fitness levels, reduced blood pressure, heightened comfort and satisfaction, decreased symptoms of illness, and overall improved health. Mentally, individuals may experience increased satisfaction, motivation, reduced stress and anxiety, enhanced problem-solving abilities, and heightened creativity. Positive changes in behavior may include improved coping and mastery skills, enhanced attention and concentration, better social interaction, and decreased hostility and aggression (Kellert & Calabrese, 2015).

With a growing majority of the population residing in urban areas, there is a noticeable decline in exposure to nature, manifesting in significant negative effects on public health. While urban living offers advantages like access to education, healthcare, and entertainment, it also brings forth detrimental effects such as chronic stress, depression, and anxiety disorders, contrasting with rural settings. While these can be attributed to urban stressors like air pollution and social isolation, it is essential to recognize that these health impacts may also arise from disregarding the innate human inclination to connect with nature and the natural environment (Schiebel, Gallinat, & Kühn, 2022).

Recent studies indicate that urban living, lacking nature's influence, correlates with a range of mental and physical health concerns, such as ADHD, obesity, depression, anxiety disorders, chronic stress, and schizophrenia (Hopkins, 2017; Schiebel, Gallinat, & Kühn, 2022). Studies focusing primarily on children suggest that the lack of connection with nature and outdoor environments may lead to decreased cognitive and emotional development, higher obesity rates, and poorer school performance (Moll, Collado, Staats, & Corraliza, 2022). Conversely, children exposed to natural surroundings throughout their schooling are said to exhibit notably higher academic performance (Hopkins, 2017; Moll, Collado, Staats, & Corraliza, 2022). Moreover, research conducted in Denmark demonstrates that children raised in greener neighborhoods exhibit better mental health and a lower likelihood of developing mental illnesses later in life compared to those raised in less green areas (Reuben, 2019). Similarly, adults exposed to green spaces in their work environments demonstrate higher productivity, happiness levels, and lower stress levels compared to their counterparts without such exposure. A study based in Philadelphia, USA assessing the impact of nature on mental health across various neighborhoods, by implementing varying levels of greenery, reveals that increased exposure to greenery leads to improved mental well-being. Depression rates decrease by 42%, while feelings of worthlessness decline by 51% in these neighborhoods (Reuben, 2019).

Expanding upon these studies is a surge of literature centered around biophilic design in healthcare environments. The incorporation of biophilic elements such as nature views and daylight into healthcare settings is demonstrating a positive impact on both patients and workers. These elements contribute to reducing stress, enhancing emotional well-being, alleviating pain, and facilitating improvements in various other outcomes (Kellert, Heerwagen, & Mador, 2008).

Kellert highlights stress as a significant challenge within the healthcare sector, affecting patients and healthcare workers both. The necessity to uphold sterility and ergonomic standards in the environment often results in features such as harsh fluorescent ceiling lights and monochromatic color schemes. Coupled with other stressors of hospitalization, such as painful procedures, loss of control, diminished physical capabilities, and disruption of daily life and relationships, these elements collectively foster an unwelcoming and stress-inducing environment. Nurses, doctors, and other healthcare workers contend with their own set of stressors, such as patient deaths, persistent noise, and the combined physical and mental strain inherent in their demanding roles. The stress induced by these unfavorable environmental conditions results in various psychological and physiological manifestations, exacerbating the patients' existing conditions and disrupting the workflow of healthcare workers. These manifestations encompass feelings of fear, anxiety, sadness, and helplessness, alongside physical symptoms such as elevated blood pressure and heart rate (Ulrich, Simons, Losito, & Fiorito, 1991). Research indicates that these stress-related responses can impair immune function, thereby impeding infection control and wound recovery processes (Kiecolt-Glaser, Marucha, Mercado, Malarkey, & Glaser, 1995).

The importance of nature exposure and its effects is highlighted in numerous studies in healthcare environments correlated with a reduction in various forms of stress, pain, and job dissatisfaction. In a 1995 study, Marcus and Barnes conducted observations and interviews of patients in four hospital gardens in California, USA. Their findings revealed that the primary benefit reported by almost all patients using the gardens was a reduction in stress. This conclusion was supported by another study conducted at a pediatric cancer center, where emotional stress was found to be lower for all users in the gardens compared to when they were inside the hospital (Sherman, Varni, Ulrich, & Malcarne, 2005). Furthermore, Ulrich's experiments exploring the relationship between nature exposure and pain suggest that being in natural environments significantly influences pain relief. A study conducted on patients recuperating from abdominal surgery found that individuals with rooms offering bedside views of nature, such as trees, experienced significantly reduced pain levels and required fewer doses of pain-relieving narcotics compared to patients with windows facing a brick wall (Ulrich, 1984). In a comparable study, patients recovering from heart surgery were divided into two groups: one exposed to images of expansive natural landscapes featuring trees and water, and a control group exposed to no images. The group viewing the natural scenery required fewer doses of pain medication and experienced less anxiety compared to the control group (Ulrich, Biophilia, Biophobia, and Natural Landscapes, 1993). In a study conducted in a Turkish hospital, it was discovered reduction of work-related stress and increased job satisfaction had a significant correlation with increased daylight exposure (three or more hours a day) (Alimoglu & Donmez, 2005). While issues such as chronic pain, illnesses, stress, and mental strain are frequently observed within healthcare settings, they are also prevalent in urban environments. Integrating biophilic design into everyday settings could serve as a natural remedy to the stressors associated with artificial urban settings and may help prevent the emergence of related issues in the future.

The urban landscapes of our cities and the sterile environments of hospitals both exhibit a pronounced disconnection from nature. This detachment, compounded by the unique stressors inherent to each setting, contributes to similar mental and physical health challenges, further diminishing the distinction between them. The convergence of these issues in urban areas suggests a critical underlying problem: our cities are becoming environments that mirror the conditions typically associated with healthcare settings. Therefore, this approach should not be limited to healthcare settings but should be incorporated into daily life, enriching the spaces where people live, work, and interact, while also alleviating the stressors of the urban environment.

2.5.2 Environment

A recurring theme in biophilic design literature suggests that enhanced connectivity to nature yields positive outcomes not only for human health but also for environmental health. The implementation of biophilic principles offers a potential solution to one of the most pressing challenges of urban environments: carbon emissions. By integrating these principles, it is possible to mitigate or even eliminate carbon emissions, thereby benefiting the natural environment as well as improving the mental and physical health and well-being of urban inhabitants (Morse, 2021). Another significant environmental concern in cities is the Urban Heat Island (UHI) effect. Urban areas with higher population densities tend to experience elevated temperatures compared to their less developed surroundings. The incorporation of natural elements such as trees and vegetation can reduce temperatures by providing shade and cooling effects, particularly during summer. This, in turn, can lead to decreased reliance on air conditioning and lower electricity consumption (EPA, 2023).

Biophilic design also aims to cultivate a robust and diverse community of natural systems that contribute to long-term environmental sustainability. A successful implementation should result in a "more productive and resilient natural environment," addressing key factors such as biological diversity, biomass production, nutrient cycling, hydrological regulation, decomposition, pollination, and other essential ecosystem services (Kellert & Calabrese, 2015).

2.5.3 Economics and Community

Biophilic design is increasingly recognized for its economic benefits across various industry sectors, one notable example includes workplaces. In the workplace, where employees spend a significant portion of their time—averaging over 43 hours per week in the U.S.—the built environment plays a crucial role in influencing productivity and employee satisfaction. Therefore, integrating natural elements into office settings is essential, as it has been demonstrated to enhance human well-being and productivity. This improvement in well-being and efficiency consequently has a positive impact on economic performance. According to recent studies, factors such as absenteeism, loss of focus, negative mood, and poor health, which are often exacerbated by suboptimal design, can be mitigated through biophilic design strategies. A case study of an administrative office building at the University of Oregon illustrates this potential. The study compared offices with varying views of natural landscapes versus built environments and found that offices overlooking green spaces yielded higher productivity and reduced absenteeism (Elzeyadi, 2011). American psychologists have identified key requirements for effective workplace design, including the need for environmental variability, control over one's environment, meaningful stimuli, personal space, and access to external views (Kellert, Heerwagen, & Mador, 2008). Addressing these needs through biophilic design can lead to substantial financial gains by increasing productivity and reducing absenteeism, a significant cost burden for employers.

In addition to enhancing workplace productivity, biophilic design has shown significant benefits in other sectors, particularly healthcare, retail, education, and community well-being. In healthcare settings, as established in the previous section, integrating natural environments into hospital spaces has been linked to reduced recovery times and improved efficiency and well-being for both patients and healthcare workers. Such design interventions contribute to a more conducive healing environment and support overall operational effectiveness. Retail environments also benefit economically from biophilic design. Stores that incorporate natural greenery and daylighting consistently achieve higher profit margins compared to those with less natural integration. Specifically, retail shops with enhanced greenery experience a competitive advantage of approximately 12%, while those utilizing quality daylighting see up to a 40% increase in profitability. In educational settings, access to daylighting has been associated with notable improvements in student performance. Research indicates that children exposed to natural light can achieve a 7-26% improvement in test scores and experience fewer school absences. Communities across the United States also stand to gain economically from biophilic design through the integration of park spaces. Such access not only promotes public health by reducing medication needs but also contributes to lower crime rates, enhancing overall community safety and cohesion (Terrapin Bright Green, 2012). Moreover, an analysis of both economically disadvantaged urban areas and affluent suburban neighborhoods reveals that communities with higher-quality environments exhibit more positive attitudes towards nature, increased neighborliness, and a stronger sense of place compared to those with lower environmental quality. These findings underscore the critical role of environmental quality in shaping community perceptions and social dynamics. Residents in areas with superior environmental conditions also report a higher quality of life, highlighting the broader societal benefits of investing in environmental improvements (Kellert, Heerwagen, & Mador, 2008). These cases demonstrate the broad societal and economic advantages of incorporating natural elements, further reinforce the importance of prioritizing environmental considerations in urban planning and community development initiatives.

CHAPTER 3

CONTEXTUAL BACKGROUND OF THE CITY OF ANKARA AND THE NEIGHBORHOOD OF CAYYOLU

This chapter will provide a comprehensive background on the developmental history of Ankara and the Çayyolu district. This will be followed by an analysis of population trends, socio-economic development, and climatic conditions in the Alacaatlı neighborhood.

3.1 Development History of Ankara

Ankara, a small town before the Republic era, has undergone substantial spatial transformations since becoming the capital city of Türkiye. Its urban development has been significantly influenced by the establishment of central government institutions and foreign embassies, which have played a pivotal role in driving its growth. Unfortunately, Ankara's urban planning has failed to keep pace with the speed of its development. Much like the rest of the country, this has led to its current state riddled with problems impacting the quality of life and the environment. A comprehensive historical analysis of Ankara's urban development, coupled with an assessment of its current situation, will guide the subsequent study of the Alacaatlı neighborhood. This analysis will be particularly valuable for decision-making and evaluation within the biophilic framework.

3.1.1 Pre-Republic Period

Ankara was founded by the Phrygian king Midas in the eighth century BC. Despite various claims about its etymology, it is known that the city has retained its name with only slight modifications since around 3000 BC and has been continuously inhabited. During the Roman Empire, Ankara, strategically located at the convergence of eight major roads, is estimated to have had a population of 100,000. Notable remnants from this period include the Temple of Augustus and the Roman Baths (Akçura, 1971).

In 395 BC, following the division of the Roman Empire, the city remained in the Eastern Roman Empire and was subsequently invaded by Arabs, Iranians, and Turks. After being captured by the Ottomans in 1356 and the Battle of Ankara in 1402 between Timur and Bayezid I, Ankara regained its population to that of 10,000-15,000 by 1522, surpassing 30,000 by the early 17th century (Akçura, 1971).

During the 16th and 17th centuries, as international trade shifted to maritime routes, Anatolia's and consequently Ankara's role in transportation declined. Until the 19th century, the city's significance persisted due to mohair production and trade but following the 1838 trade agreement, the influx of cheap textiles from the West led to the decline of the mohair industry as well (Akçura, 1971).

In 1915, Ankara experienced a catastrophic fire that ravaged a significant portion of the city over the course of three days. When it came to its surrounding districts, including Etlik, Keçiören, Ayvalı, Dikmen, Çankaya, Küçükesat, Seyran, and Kayaş, they were faring far better and were predominantly known for their vineyards and gardens, serving as summer retreats for residents. Today, many of these areas have been developed into urban landscapes, with only some place names, such as Seyranbağları, preserving their historical identity (Yavuz, Ankara’nın İmarı ve Şehirciliğimiz, 1952).

3.1.2 The Republican Era and Ankara's Emergence as the Capital

Following his arrival in Anatolia, Atatürk expressed in a letter that "Istanbul is no longer dominant over Anatolia but must remain subordinate." From December 27, 1920, Ankara began to expand its role as the administrative center. After the effective occupation of Istanbul on March 16, 1920, which incapacitated the Parliament, the Representative Assembly designated Ankara as the administrative center. The Grand National Assembly of Türkiye convened on April 23, 1920, and adopted the first Constitution on January 20, 1921. Before the formal proclamation of the Republic on October 13, 1923, Ankara was officially established as the capital, marking a significant transformation for a city previously overlooked during the Ottoman era (Akçura, 1971).

During this period, Ankara's infrastructure was notably underdeveloped, with roads becoming dusty in the summer and muddy in the winter, and much of the city marshy. Members of Parliament and government officials resided in the city's old houses and inns. With Ankara's elevation to the status of capital, property values began to increase significantly, leading to a surge in real estate transactions. By 1924, the price for one arşın (an Ottoman unit of measurement) of land had risen to 100 liras. In 1925, a 40-acre area of marshland near the railway station was successfully drained. Additionally, the period saw the acquisition of 170,000 acres for the Atatürk Forest Farm (AOÇ) and the expropriation of 680 hectares for the Çubuk Dam (ODTÜ Şehir ve Planlama Bölümü, 1986).

In 1924, Law No. 417 led to the reorganization of Ankara Municipality into the Şehremaneti (Municipal Administration). Under this law, the Şehremaneti was to be appointed by the Ministry of Interior rather than elected by the public. Beginning in 1930, pursuant to Municipal Law No. 1580, the role of Mayor was assumed by the Governor of Ankara. This system remained in place until the enactment of Law No.

5168 on February 8, 1948, which introduced new administrative provisions (ODTÜ Şehir ve Planlama Bölümü, 1986).

The direction of Ankara's development was significantly shaped by Law No. 583, enacted in 1925. This law favored the creation of a new city, Yenişehir, over the redevelopment of Old Ankara, and granted the Şehremaneti the authority to expropriate land in the area. According to the law, landowners would retain one-fourth of their land, while the remaining three-fourths would be expropriated at a valuation 15 times higher than the 1915 assessment. This legislation was pivotal not only for Ankara's growth but also for promoting structured and healthy urbanization across the country. Consequently, 500 hectares of land were expropriated (ODTÜ Şehir ve Planlama Bölümü, 1986). To address budgetary shortfalls, the sale of immovable properties was employed as a remedy, leading to the gradual disposal of much of this land and the 300 houses constructed on it over time (Yavuz, Kentsel Topraklar – Ülkemizde ve Başka Ülkelerde, 1980).

The administrators and politicians of the young Republic recognized the importance of retaining public land for the establishment of a new city and promoting healthy urbanization. However, this foresight was not consistently applied in subsequent land disposals (ODTÜ Şehir ve Planlama Bölümü, 1986).

From 1925 onwards, the construction of public buildings began in Ulus and Yenişehir. In Ulus, the Ministry of Finance, the Ministry of Customs and Monopolies, the Court of Accounts, and the Agricultural, Ottoman, and Is Banks were constructed. Meanwhile, in Yenişehir, significant structures included the Ministry of Health, the General Staff headquarters, and the Ministry of National Defense (ODTÜ Şehir ve Planlama Bölümü, 1986).

3.1.3 Lörcher Plan

Carl Christoph Lörcher was responsible for the initial developmental plans of Ankara. His plans were prepared in the form of sketches and submitted to the municipal authority along with reports. His work on the Ankara plan reflects the influences of Howard's Garden City, Camillo Sitte's Beautiful City, and Tony Garnier's Industrial City concepts. The first of Lörcher's plans was developed in 1924 at a scale of 1:2000 for the old Ankara, while the second plan was created in 1925 at a scale of 1:1000 for the new city (the administrative city: Çankaya). The development of Ankara over the subsequent five years was guided by these plans. The impact and traces of Lörcher's work can later be observed in Jansen's subsequent studies (Cengizkan, 2004).

Lörcher's plan is based on a grid road system and envisions uniform, garden-style buildings, both single and double stories. The proposed plan aims to create a modern capital characterized by a high density and compact layout, with abundant green spaces and clearly defined urban boundaries (Şenyapılı, 2004).

In Lörcher’s plan, to establish a new and exemplary capital, referred to as a Utopian City, it is essential to maintain a connection with the city's historical context, necessitating the preservation of significant sites such as the Citadel and the Temple of Augustus. Furthermore, the protection of the city’s water resources is vital, alongside the definition and development of a transportation network that incorporates modern transit systems, including railways. It is equally important to safeguard existing industries while facilitating opportunities for new industrial ventures (Cengizkan, 2004).

Furthermore, attention must be directed towards achieving a healthy and aesthetically pleasing urban environment through thoughtful structural and functional planning across various city sectors. From a contemporary perspective, the preservation and organization of open green spaces are imperative. Finally, the surrounding areas, rich in natural resources, require the protection of essential facilities, including marketplaces, hospitals, slaughterhouses, cemeteries, prisons, and vegetable gardens (Cengizkan, 2004).

3.1.4 Jansen Plan

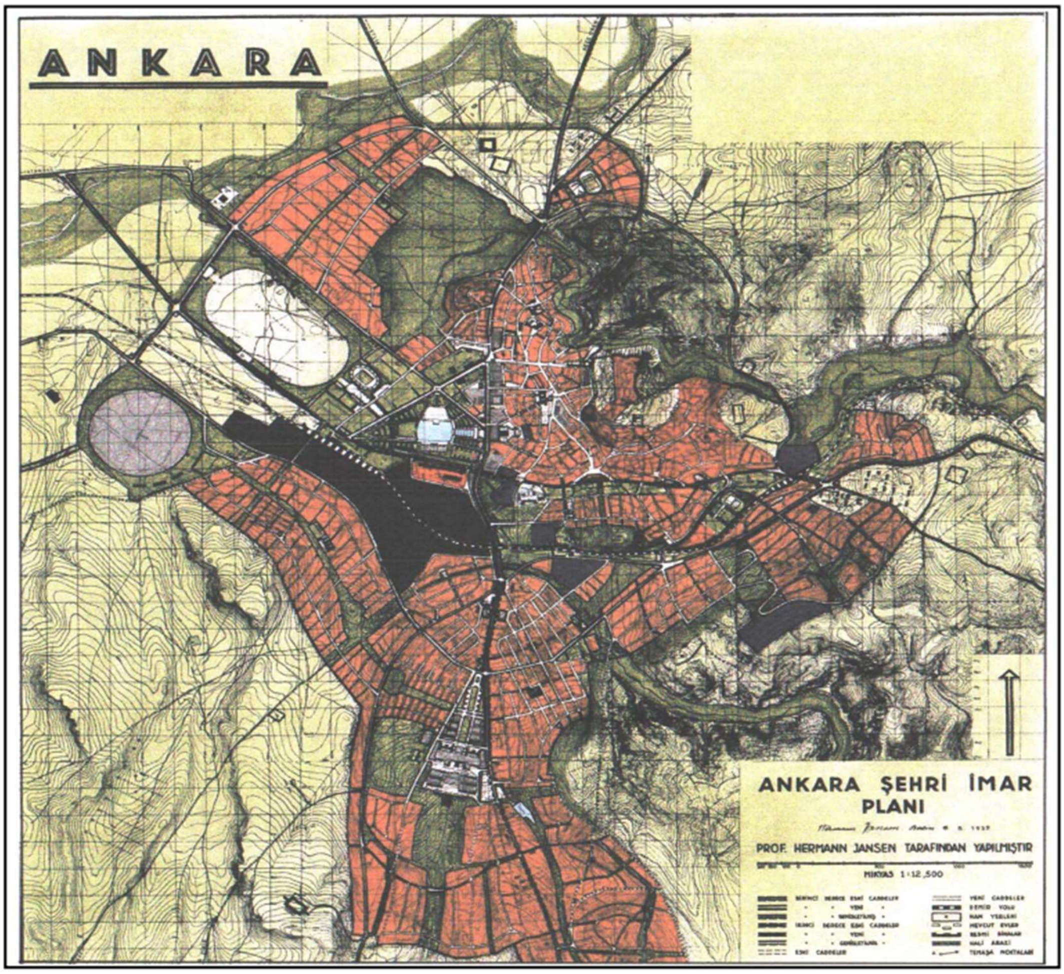

Figure 3.1: Zoning map of the Jansen Plan (T.C. Ankara Büyükşehir Belediyesi, 2023)

Originally selected through an international competition, the Jansen plan (1928-1932) displayed the strategy of developing a green axis in the east-west direction of Ankara, which was later also attempted along the north-south direction. This eventually became known as the main formation axis of Ankara. As observed in Figure 3.1, by proposing a zoning plan, the development process of the city was defined in this manner, creating various neighborhoods within the city, and developing a general plan proposal with Atatürk Boulevard as the main transportation artery (Cengizkan, 2010). This plan emphasized the role of Atatürk Boulevard in establishing the relationship between the old and new parts of the city and adopted a strategy to preserve the structure of the old city while developing Ankara Yenişehir (Kızılay). The Ankara Citadel, representing the old city, became the most significant landmark for the newly developing city (Keskinok, 2009). In this context, during the Jansen Plan period, which was characterized by preserving the old city while planning the new one, the city's core area extended from the central Citadel area to Çankaya (Keskinok, 2009).

In 1924, when Lörcher was preparing the urban plan for Ankara, the only green space in the city was the Millet Garden located in Ulus. In his plan for Yenişehir, Lörcher proposed a series of "consecutive green spaces" that followed the contours of valley floors and streams, incorporating sports and recreational areas adjacent to these green corridors (Cengizkan, 2004).

By 1928, when Jansen entered a competition, the green spaces in the developed and developing areas of Ankara were limited to the Millet Garden and the Zafer Square and Havuzbaşı areas implemented from his plan. Jansen's plan submitted for the competition in 1928, along with the final urban plan from 1932 and the explanatory report published in 1937, are crucial documents for understanding the role of green spaces in urban planning. Jansen posited that public health is a primary indicator of a nation's future. In line with this view, he selected locations considering the prevailing wind directions to shield the city from industrial smoke and dust. By emphasizing the importance of public health, he aimed to establish an infrastructure that promotes exercise and healthy living for all residents, particularly the youth, proposing artificial lakes and pools for recreational and sporting uses (Jansen, 1929).

Jansen's proposed green space structure comprises natural and artificial water surfaces, green corridors of varying widths, and various-sized sports fields, parks, and vegetable gardens interconnected by these green pathways. He also envisioned this green space structure as an alternative pedestrian pathway network to vehicular routes, facilitating pedestrian access from residential gardens to schools, sports fields, the city center, government complexes, and the airport. The fundamental characteristics and components of the green space structure suggested by Jansen in his 1928 and 1932 plans remained consistent. In the explanatory report of the 1937 Ankara Urban Plan, Jansen categorized the components of the open and green space structure into four groups: Stream Valleys, Kutrani Green Corridors, Youth Park, and Sports Fields. However, this categorization does not fully capture the diversity and richness inherent in the green space structure proposed in his plan. Below, the components of the proposed green space structure are reassessed and reclassified based on their functions and characteristics (Burat, 2011).

3.1.4.1 Green Corridors

Green corridors are linear strips designated for pedestrian access, which may be organized or used agriculturally, facilitating a continuous green space network by linking other public open and green areas. According to Jansen, one of the responsibilities of an urban planner is to create a network of green spaces that includes natural streams, lakes, forests, groves, and valleys, while protecting these green strips from construction. In this context, the most significant type of green area is the "Kutrani Green Corridors," which provide access from residential backyards to parks, sports fields, schools, recreational areas outside the city, and agricultural lands. The term "kutrani," which translates to "diagonal" in Turkish, indicates that these green strips traverse the city from one end to the other. These corridors separate vehicular and pedestrian traffic, allowing for pedestrian circulation that is unaffected by vehicle noise and pollution. Jansen emphasized the importance of "movement and rest," asserting that walking is the most affordable and effective form of recreation for the majority of society. He proposed that well-designed green corridors ("green veins") should be bordered by residential gardens on either side, allowing pedestrians to navigate the city with the same comfort as vehicles while easily accessing green spaces and recreational areas (Jansen, 1937).

3.1.4.2 Central Green Areas

The second major component of Jansen's green space structure can be defined as "central green areas." These spaces, including parks and sports fields, are designated for the recreational use of the urban population and serve as nodal points interconnected by green corridors (Burat, 2011).

3.1.4.3 Small Gardens Area

The Small Gardens Area emerged in 19th-century Germany alongside the rise of industrial and commercial cities. It was designed to enable the poor and those in need to meet their own needs and maintain their physical health, rather than relying solely on financial assistance. Over time, these gardens increased in number and became a significant part of Berlin's urban green space structure and social life (Berlin Senate Department for Urban Development website). In Jansen's 1932 plan for Ankara, Hermann Jansen designated an area adjacent to the Amele neighborhood for small gardens intended for vegetable and fruit production. He proposed that only small sheds be permitted in these gardens and suggested that they could be rented out to those interested (Burat, 2011).

3.1.4.4 Green Belt

The plan outlines a central city composed of Yenişehir, Eskişehir, and Cebeci, surrounded to the south by Çankaya and Dikmen, to the east by Samanlık Bağları and Mamak, and to the north by the garden settlements of Keçiören and Etlik, along with agricultural areas. In his correspondence, Jansen noted the presence of vineyards and orchards in the outer regions surrounding Çankaya, Dikmen, Keçiören, and Etlik, as well as in the southern part of Mamak, where he suggested that "modestly designed summer villas" could be constructed. He emphasized the need to utilize the valleys traversed by streams and rivers for vegetable production while preventing any construction in these areas. Furthermore, he recommended that the surrounding lands be protected from development and used solely for farming and grazing. The green space structure of Ankara opens to these surrounding gardens and agricultural lands, accessible via "scenic pathways." The green belt thus serves as a true agricultural/rural buffer (Osborn, 1969).

3.1.5 The Nihat Yücel and Raşit Uybadin Plan

During the Yücel-Uybadın Plan Period (1957-1970), which emerged because of a project won in an international competition held at a time when the city's population was significantly increasing, population growth became the most pressing issue. Compared to the previous Jansen Period, it was a time when construction and parceling increased around the entire city. It is believed that the Yücel-Uybadın Plan failed to implement a logical connection between the intense population growth and urban planning. Günay states that this period did not possess the form-seeking approach seen in the Jansen and Lörcher planning periods. Arguing that a capital city's growth must be given a form, Günay mentions that the Yücel-Uybadın Plan did not provide a solution for the city's future strategies. It is thought that this period, characterized by increased structural density of the city and the emergence of infrastructure and transportation problems, failed to strategically guide the development of the capital city (Günay, 2006).

The selection of the 1957 Yücel-Uybadin Plan was significantly influenced by its emphasis on the preservation of valleys. However, the designation of these valleys as "non-settlement areas" in the plan led to a perception that they could be developed for urban projects, particularly the Dikmen and Portakal Çiçeği Valleys, which should have been integral parts of urban green spaces. According to the Regulations on Planning Non-Building Areas, a non-settlement area is defined as "any area outside the boundaries of planning at any scale, including the settled areas of villages and hamlets and the surrounding regions." Günay (2006) notes that during the implementation phase of the plan, no policies were initiated to develop the valleys as open green spaces, and this allowed informal settlements to proliferate. The introduction of the amnesty law in the 1980s required the establishment of Rehabilitation Development Plans for these areas. As a result, the property rights of informal settlement occupants in non-settlement areas were consolidated, effectively opening the valleys to development (Günay, 2006).

The Yücel-Uybadin Plan disregarded the green axes, green corridors, urban open green spaces, public squares, and marketplaces emphasized in the Lörcher and Jansen Plans. It introduced proposals that disrupted the open green space system envisioned by the Jansen Plan (Uzel, 1991). Although green space uses were reflected in the plan sheets, their existence and sustainability were not adequately monitored. According to Cengizkan (2006) the Yücel-Uybadin Plan assumed that the costs of maintaining the presence and sustainability of green spaces would be low or negligible. As a result, the plan incorporated the use of open green spaces in many areas (Cengizkan, 2006).

3.1.6 Establishment of the Metropolitan Planning Office for the Ankara Metropolitan Area

In 1969, the Ministry of Public Works and Settlement established the Ankara Metropolitan Area Master Plan Office (AMANPB) to direct developments outside zoning plan boundaries and to prepare a new master plan. From 1970 to 1975, the AMANPB conducted detailed studies which culminated in the preparation of the "Ankara Metropolitan Master Plan." This plan marked a significant shift in planning paradigms. Unlike the Jansen and Uybadin plans, which were primarily implementation plans, the new master plan provided a range of guiding alternatives. The target population for 1990 was set at 3.6 million, and the 1990 Ankara Master Plan was approved on April 28, 1982. However, subsequent political pressures first diminished the Bureau's effectiveness and eventually led to its closure. The most notable innovation of this plan was the principle of directing the city's development along an east-west axis, influencing the location choices for areas like Sincan, Batıkent, and the Organized Industrial Zones (OIZ) (ODTÜ Şehir ve Planlama Bölümü, 1986).

In the 1970s, the OR-AN Joint Stock Company initiated the first mass housing project. During this period, public institutions began to select sites along the Eskişehir corridor. In 1975, the Ministry of National Defense Cartography School (Advanced Technical School for Mapping) and the Beytepe Campus area were designated, followed by the acquisition of the Batıkent area, and later the Sincan and Tuzluçayır regions including the Hacettepe Campus areas. Public institutions also began settling around Gölbaşı during this period. From 1970 to 1980, a significant number of unauthorized high-rise buildings were constructed in the Demetevler and

Yıldızevler neighborhoods, with over 22,000 units being easily sold by speculative contractors (ODTÜ Şehir ve Planlama Bölümü, 1986).

3.1.7 The Period After Becoming a Metropolitan Municipality

In July 1984, Law No. 3030 concerning the governance of metropolitan cities was enacted, followed by its associated regulation in December 1984, which was put into effect. This legislation established the Ankara Metropolitan Municipality (AMM) initially comprising the district municipalities of Altındağ, Çankaya, Keçiören, Mamak, and Yenimahalle, with later additions of Sincan, Etimesğut, and Gölbaşı. With the enactment of Zoning Law No. 3194 in 1985, the duties and powers of the AMM and district municipalities were redefined. Consequently, municipalities held jurisdiction within adjacent areas, while central administration managed areas outside these and mass housing initiatives (ODTÜ Şehir ve Planlama Bölümü, 1986).

Starting in 1984, zoning improvement efforts began under Law No. 2981, covering approximately 12,000 hectares (about 534,000 housing units or 2.4 million people), resulting in the distribution of 172,270 title deeds. However, these efforts primarily served to legalize the existing conditions, disrupting population, labor, and infrastructure balances, and necessitating future corrective measures (ODTÜ Şehir ve Planlama Bölümü, 1986).

One notable aspect of this period was the acceleration of official housing construction. Additionally, residential areas for high-level civil servants, bureaucrats, and members of parliament were developed around the Oran area. From 1983 onwards, a three-part green belt project around Ankara emerged, aiming to convert state-owned lands into forests, thus preventing their abandonment (ODTÜ Şehir ve Planlama Bölümü, 1986).

In 1980, the Batıkent project commenced, opening up a 48,588-unit residential area (1034 hectares) for settlement. Planning and preparation for the İvedik OIZ began in December 1986. In 1987, the Çayyolu mass housing area was expropriated, initiating the construction of 9,946 housing units. Some areas have been opened for settlement, with construction ongoing. In the Eryaman Mass Housing Region, established on 200 hectares, cooperatives have begun settling some of the mass housing units. Additionally, the Doğukent Project, conceived as a residential area with 20,000 units to house 100,000 people, is being developed on a 900-hectare area in Mamak district, at the foothills of Elmadağ. The identified growth corridors of the city include Esenboğa/Çubuk, Saray/Kazan, Eskişehir Road, and the area between Eskişehir and Konya Roads, with ongoing development in these directions (ODTÜ Şehir ve Planlama Bölümü, 1986).

To examine and determine the developments within Ankara's sphere of influence and to provide a basis for the Ankara Urban Transportation Project, a research team from the Department of City and Regional Planning at Middle East Technical University (METU) conducted a study in 1986, targeting the year 2015. Initially intended as research, a protocol among the Ministry of Public Works and Settlement, the Ankara Governorship, and the AMM allowed the study to be utilized for planning purposes (ODTÜ Şehir ve Planlama Bölümü, 1986).

Developments in Çayyolu, Beytepe, and Gölbaşı areas, along with the initiation of the OIZ in İvedik, disrupted the projected balances for 2015, necessitating new planning efforts. Consequently, by 1992, the preparatory work for the 2025 Master Plan was completed, envisioning Ankara as a metropolitan city with a population of 5-6 million. According to this plan, Ankara is to be considered the central hub of an international region encompassing the Middle East, Central Asia, Eastern Europe, and the Balkans (ODTÜ Şehir ve Planlama Bölümü, 1986).

Despite planning decisions focusing on biophilic concepts, such as greenbelt ideas, the creation of extensive and green public spaces, and the conservation of the city's existing natural elements, these efforts have proven insufficient for Ankara's rapidly growing and unpredictably urbanizing environment up to the present day. The urban planning activities have often fallen behind the actual developments and have failed to introduce decisions capable of effectively managing the spontaneous urban expansion.

The Çayyolu region, significantly impacted by this rapid urbanization, serves as a case in point. In the following section, we will delve into the development process of Çayyolu, examining it in greater detail. This analysis will provide more accurate assessments for the study area.

3.2 Development History of Çayyolu

The "Ankara 1990 Master Plan," approved and implemented in 1982 at a 1:50,000 scale, aimed to extend the metropolitan area's development beyond the topographical basin through a corridor approach. This plan was pivotal in outlining urban development strategies, identifying urban growth poles, and shaping expansion directions. Specifically, it targeted corridor development along the Eskişehir Road in the western corridor, incorporating public institutions and playing a significant role in forming the city's current macroform, thus marking the initial steps in the development of Çayyolu (Akin, 2007).

The tendency and speculation toward urban expansion in the southwestern corridor, primarily along the Eskişehir Road, has been a major driver of development and attraction since the late 1980s. This corridor has also been subject to the most intensive planning efforts and legal disputes concerning settlement and sprawl tendencies, as noted in the 2023 Başkent Ankara Master Zoning Plan Explanatory Report (2006) (Akin, 2007).

Planning activities in southwestern Ankara and its surroundings (including Eskişehir Road, Alacaatlı, İncek, Kızılcaşar, and Taşpınar areas) have significantly stimulated the urban land market, accelerating property transformation processes (Akin, 2007).

Since the late 1980s, Çayyolu has emerged as the most speculated and significant area of urban development in Ankara. Initially, this settlement area developed in a linear fashion parallel to the Eskişehir Road, but as the development process continued, it expanded outward in a sprawl pattern, resembling an "oil stain" spread (Akin, 2007).

The recognition that housing areas could be realized through cooperative organization led to the enactment of Mass Housing Law No. 2487 in 1981. However, the law faced criticism for excluding large capital investments from this area in its initial phase. In 1984, Law No. 2985 was introduced largely to open this area to private capital investment. Consequently, from the 1980s onward, mass housing production has been carried out through two distinct models: production by cooperatives and production by housing construction companies (Tekeli, 1995).

A significant portion of housing construction in Ankara has been undertaken by cooperatives, financed by the Mass Housing Fund. Concurrently, housing development companies have been purchasing land on the urban fringes, incorporating these lands into zoning plans, and commencing construction thereafter. A notable example of such development is the Koru Site in Çayyolu, built by the MESA company. The enactment of mass housing laws, coupled with the Ankara Metropolitan Master Plan Office's opening of the Eskişehir axis in the west to urban development, the settlement of public institutions along this corridor, the shifting of technical infrastructure to this area, and real estate market speculation have collectively made the southern side of the Eskişehir Road a preferred and thriving residential area (Eryıldız, 2003).

Çayyolu is a residential area extending from the southern side of the Eskişehir Highway, situated along the southwestern corridor of the Ankara basin. It is approximately 25 km from the city center. The area is bordered by the Alacaatlı village to the south, the Ankara Ring Road to the west, military and public institution areas to the north, and residential zones within the Bilkent University campus to the east. Development in this region began around Ümitköy in the mid-1980s, later expanding to include Koru Site and Konutkent Site (Eryıldız, 2003).

Initially, housing demand in Çayyolu was driven by upper-income groups seeking high-quality residential environments. The Koru Site emerged as a prestigious housing area featuring single-story or duplex, gardened, and multi-story homes. Interest from upper-income groups continued with the development of Beysukent, Mutluköy Site, and surrounding areas like Bilkent and Angora Houses. Meanwhile, the provision of housing for middle and upper-middle-income groups concentrated in cooperative and mass housing areas within Çayyolu (Eryıldız, 2003).

Several factors have influenced individuals' preference for this region: the ease of transportation, the expectation of a higher quality living environment, the presence of shopping centers, and the desire to escape urban issues. Initially dominated by single-story and duplex houses, the changing socio-economic structure and housing supply have led to the predominance of medium- and high-rise apartment blocks in the area’s settlement pattern (Eryıldız, 2003).

During the 1980s, Ankara's urban development expanded westward and southwestward, particularly along the southern side of the Eskişehir Road, with the implementation of the Çayyolu-Ümitköy housing projects. This period saw a surge in mass housing applications due to increased state funds and other financial resources, allowing cooperatives and large construction firms to engage in mass housing production. Luxury mass housing constructed by major construction companies, medium-standard housing developed by cooperatives, and high-rise apartments built on a land-for-flats basis all participated in the region's development despite differences in residential density, ownership of social amenities, and construction quality. Their shared characteristic was the ability to capitalize on the region’s land value and their high market values (Akin, 2007).

Key factors enhancing the area's prestige included the establishment of public institutions, governmental bodies, and universities along the Eskişehir Road. This institutional presence played a crucial role in boosting the area's desirability and land value. Concurrent with the opening of residential areas, significant commercial infrastructure, such as large shopping centers, began to emerge, further increasing the attractiveness and development potential of the region (Akin, 2007).

3.3 Analysis of Current Conditions and Trends for Future Development

In recent years, the Ankara Metropolitan Municipality has been engaged in several Environmental Development Plan (EDP) studies. However, the cancellation of the most recent EDP has left the city without an overarching strategic plan that sets high-level objectives. This absence may cause lower-scale planning efforts to be superficial and disconnected from the city's overall context. Despite a recent decline in planning efforts, the development activities in the Çayyolu district and its surrounding neighborhoods is only increasing and the continuous pressure from landowners to open undeveloped areas for construction remains a recurring issue.

Examining this scenario reveals that the absence of a long-term, high-level strategic plan and the reliance on lower-scale plans impede addressing the comprehensive problems of the region. Additionally, these lower-scale plans do not adequately allow for biophilic considerations. Despite recent efforts to promote participatory and socially inclusive planning, these parameters impose constraints on the evaluation of the area.

3.3.1 Population

Alacaatlı has emerged as a rapidly urbanizing area, especially over the past decade, driven by the increasing presence of public and private institutions along Çayyolu and Eskişehir Road, which have attracted a significant population influx.

Table 3.1: Population of Alacaatlı and Çankaya 2007-2023 (TURKSTAT, 2024)

Year	**Population**	
	Alacaatlı	Çankaya
2007	3068	792189
2008	3712	785330
2009	4806	794288
2010	6127	797109
2011	7235	813339
2012	8521	832075
2013	11854	914501
2014	14794	913715
2015	17557	922536
2016	20787	919119
2017	25603	921999
2018	30313	920890
2019	35158	944609
2020	38647	925828
2021	41522	949265
2022	42784	942553
2023	43949	937546

As observed above, in 2007, Alacaatlı constituted approximately 0.4% of Çankaya's population, whereas according to the latest census data in 2023, it now represents approximately 5%. This rapid population growth over 16 years can be attributed to the factors discussed earlier in previous sections. Furthermore, the socio-economic status of this growing population will be discussed under the same title in subsequent sections.

3.3.2 Socio-economic Development

When examining the socio-economic status of the study area, the most important data to utilize is the District Socio-Economic Development Index (SEDI) values. The district to which the study area belongs, Çankaya district, consistently ranks among the top five districts in Türkiye in these reports. Moreover, the Çayyolu region within this district is noted as the socio-economically most developed area. The preference of upper-middle-class families during the urbanization process, its isolation and distance from the city center, logically explain why individuals in this income bracket choose this area (Kalkınma Ajansları Genel Müdürlüğü, 2022).

According to the SEGE values, Çankaya district, falling below the First-Level Districts, has significantly completed its basic infrastructure, thereby scoring high in variables representing education, health, and quality of life compared to other districts in this category. In terms of education and health dimensions, all variables indicate the highest values in the First-Level Development category compared to other levels. Similarly, in variables related to quality of life, districts in the First-Level Development category generally exhibit the best scores. Except for the variable on the share of fuel stations in Türkiye, districts in the First-Level Development category rank highest in all other dimensions of quality-of-life variables. Moreover, districts ranking first in all these variables are situated within the First-Level Development category (Kalkınma Ajansları Genel Müdürlüğü, 2022).

3.3.3 Climatic Conditions

Reflecting the broader climate patterns of the Central Anatolia region, Ankara exhibits a predominantly steppe climate and is characterized by steppe vegetation. Additionally, the region is influenced by the Black Sea climate, particularly in terms of its rainfall, which affects the northern areas. Consequently, Ankara experiences cold winters and hot summers (Ankara Büyükşehir Belediyesi, 2022).

3.3.2.1 Yearly Temperature Change Çayyolu – Alacaatlı

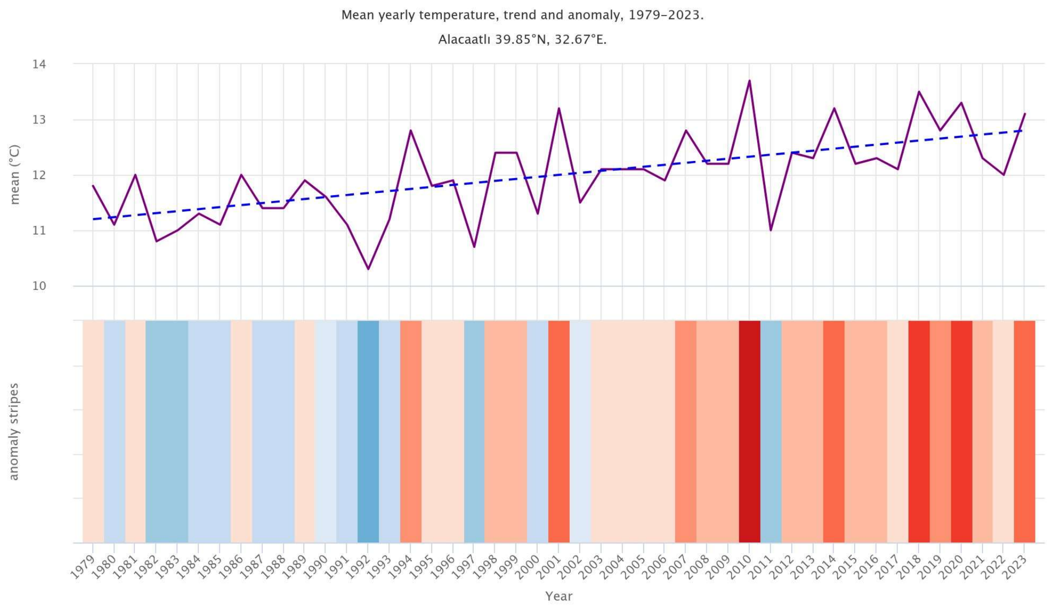

Figure 3.2: Mean Yearly Temperature, Trend and Anomaly, 1979-2023, Alacaatlı 39.85 °N, 32.67 °E (meteoblue, 2024)

The graph presented above provides an estimation of the mean annual temperature for the broader Alacaatlı region. A linear climate change trend is illustrated by the dashed blue line, which exhibits a positive slope, indicating a warming trend in the region. This upward trend suggests that the Alacaatlı region is experiencing an increase in temperature due to climate change.

The lower section of the graph features "warming stripes," a visual representation of the overall temperature trend for each year. The color-coded stripes, with blue indicating colder years and red denoting warmer years, facilitate a clear observation of the temperature fluctuations over time. Notably, the predominance of red stripes in the past decade signifies a pronounced increase in temperature, underscoring the region's susceptibility to climate change.

3.3.2.2 Yearly Precipitation Change Çayyolu – Alacaatlı

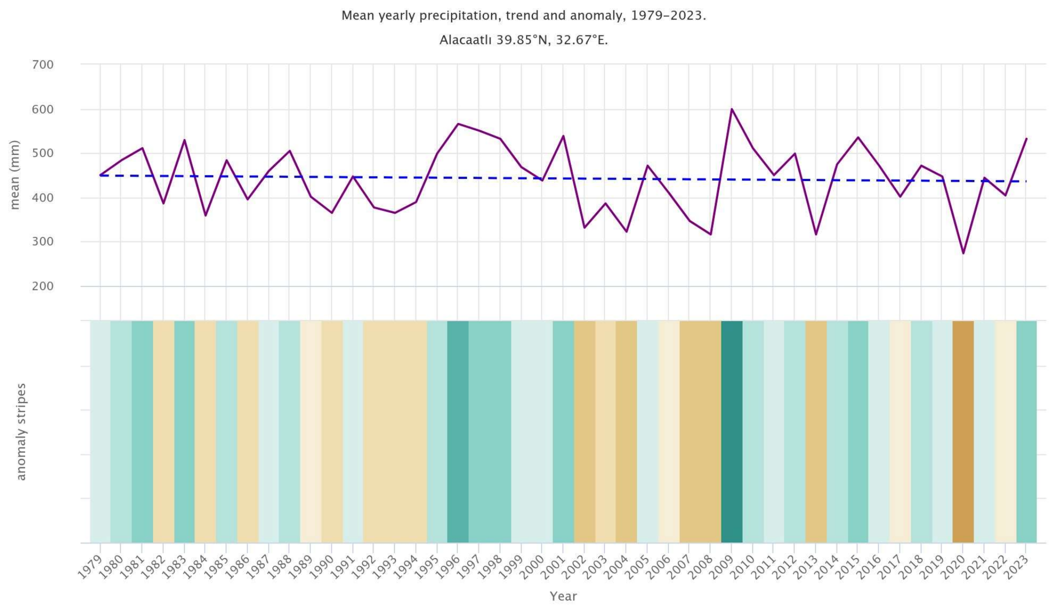

Figure 3.3: Mean Yearly Precipitation, Trend and Anomaly, 1979-2023, Alacaatlı 39.85 °N, 32.67 °E (meteoblue, 2024)

Figure 3.3 provides an estimation of the mean total precipitation for the broader Alacaatlı region. The dashed blue line represents the linear climate change trend, the negative slope indicating a decline in precipitation over time. This trend suggests the region is experiencing a shift towards drier conditions due to climate change.

The lower section of the graph features "precipitation stripes," a visual representation of the annual precipitation trend. The color-coded stripes, with green denoting wetter years and brown indicating drier years, facilitate a clear observation of the precipitation patterns over time. Notably, while the past decade exhibits a mix of both wetter and drier years, the latter half of the graph reveals a pronounced trend towards increased frequency of drier years.

3.3.2.3 Monthly Anomalies of Temperature and Precipitation - Climate Change Çayyolu-Alacaatlı

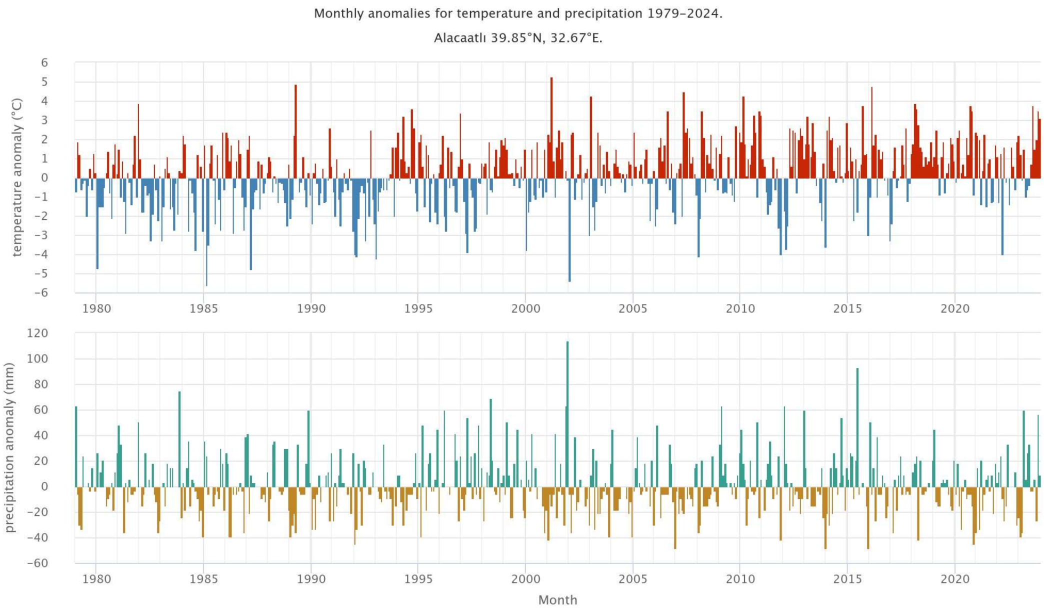

Figure 3.4: Monthly Anomalies for Temperature and Precipitation, 1979-2024, Alacaatlı 39.85 °N, 32.67 °E (meteoblue, 2024)

Figure 3.4 depicts the temperature anomaly for each month from 1979 to the present. This anomaly indicates deviations from the 30-year climate mean spanning 1980 to 2010. Red months represent temperatures that were warmer than the historical average, while blue months denote temperatures that were colder than normal. The temperature anomaly pattern depicted in this graph reveals a pronounced trend, with a predominance of red months, indicating a significant increase in warmer months over the years. This phenomenon is consistent with the expected global warming patterns associated with climate change.

The lower part of the graph illustrates the precipitation anomaly for each month from 1979 to the present. This anomaly indicates whether monthly precipitation deviated from the 30-year climate mean covering 1980 to 2010. In this context, green months signify periods with above-average precipitation, while brown months represent periods with below-average precipitation. Although the trend is less pronounced compared to the temperature anomaly, there is a notable pattern suggesting an increase in drier periods, which is consistent with the expected impacts of global warming.

3.3.2.4 Climate Change Çayyolu - Alacaatlı Temperature and precipitation anomaly for the Month of June

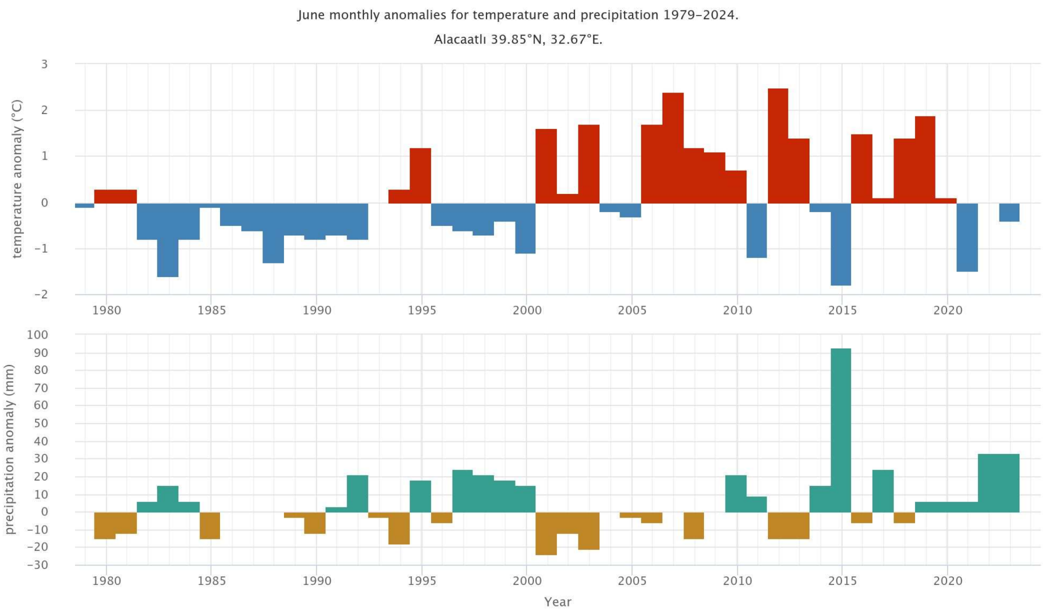

Figure 3.5: June Monthly Anomalies for Temperature and Precipitation, 1979-2024, Alacaatlı 39.85 °N, 32.67 °E (meteoblue, 2024)

This graph provides a detailed analysis of the month of June, showcasing the temperature and precipitation anomalies for each June since 1979. While the temperature anomalies reveal a similar trend to the past graphs of warmer months, the precipitation anomalies exhibit a contrasting pattern, with a notable increase in wetter periods during June.

3.3.2.5 Average Temperatures and Precipitation

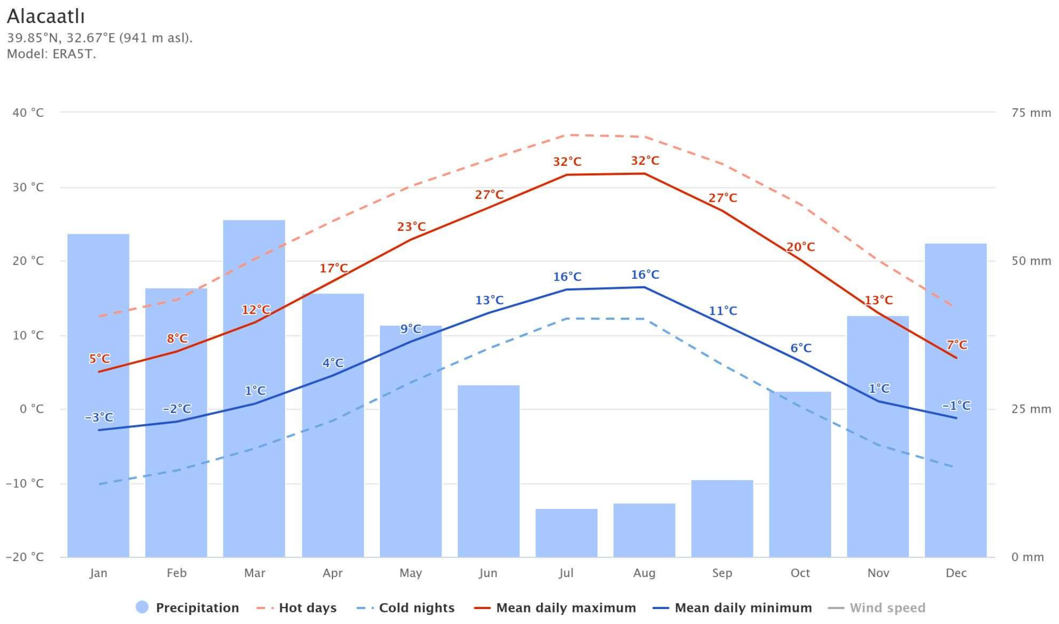

Figure 3.6: Average Temperatures and Precipitation (meteoblue, 2024)

The graph above presents a comprehensive analysis of temperature trends in Alacaatlı, with the mean daily maximum temperature (solid red line) and mean daily minimum temperature (solid blue line) representing the average maximum and minimum temperatures for each month, respectively. Additionally, the graph includes the hot days (dashed red line) and cold nights (dashed blue line), which denote the average maximum temperature of the hottest day and the average minimum temperature of the coldest night for each month over the past 30 years. The trends exhibited in this graph demonstrate typical seasonal patterns, which are consistent with the expected relationships between temperature variables. Furthermore, these trends are also consistent with the patterns observed in the previous graphs, providing a cohesive understanding of the temperature dynamics in Alacaatlı.

CHAPTER 4

METHODS AND FINDINGS

This chapter will investigate the Alacaatlı neighborhood's biophilic experience through a field study and review of its climatic data. Recommendations for the proposed biophilic plan will be discussed utilizing the information obtained through the literature review, followed by a SWOT analysis, considering feasibility and sustainability factors of these recommendations and the study area. These findings will then be further developed in the subsequent chapter to formulate biophilic design strategies aimed at enhancing the neighborhood's biophilic qualities.

This assessment utilizes the three categories of direct experience, indirect experience, and experience of space and place, as explored in Chapter 2, as its foundational framework. Field observations conducted in the Alacaatlı neighborhood will assess its biophilic experience, supplementing the data from the case study. The assessment of the biophilic experience will be documented below in paragraph form, in addition to visuals, charts, and graphs. All field observations have been conducted visually unless specified otherwise.

4.1 The Current Biophilic Experience in Alacaatlı

Figure 4.1: Maps of the Çankaya District, the Alacaatlı Neighborhood, and the study area

Note. The organization of the study area was determined by the lot separations, as demarcated by the sidewalks separating each numbered area. This approach enables a clear visual distinction between areas, as well as a functional separation of different types of land uses and building typologies. Original map images from (Google Maps, 2024).

The study area in the Alacaatlı Neighborhood encompasses six gated residential zones, comprising single-family homes and multi-family apartment buildings, situated within areas 1, 2, 3, 5, and 6. Additionally, the study area features two parks, located within areas 4 and 7, which offer a range of amenities, including basketball courts, gazebos, picnic tables, a track, exercise equipment, and aromatic farms. Despite the presence of amenities and private gardens, the public areas and most private gardens were sparsely occupied, with the exception of rare instances during early morning or evening hours. As this study was conducted during the summer season, the lack of shade is a likely contributing factor to this underutilization.

However, this chapter aims to investigate whether other factors, beyond shade, are also hindering the positive experience of the natural environment, thereby contributing to the underutilization of these spaces.

4.1.1 Direct Experience of Nature

LIGHT. Visual observations were used to record the experience of light in the Alacaatlı neighborhood. The seven designated areas on the map (Figure 4.1) were observed during the times: 8:00 and 16:00, as these times were expected to display longer, more visible shadows. Areas where sunlight would be absent due to the influence of the built environment were particularly noted. Any shadows resulting from natural elements, such as trees, were not considered.

These observations were conducted on a clear, sunny day with minimal cloud cover to ensure the most accurate representation of how the built environment influences the experience of light. The annual variations in cloud cover were excluded as a determinant affecting the biophilic experience due to it being a natural occurrence rather than an outcome attributable to the built environment.

Areas 3 and 5 were observed to have the most significant shadows, which adversely affected the experience of natural light. This was attributed to the height of the buildings in these areas, leading to the obstruction of natural light on adjacent streets, as well as within the parking and garden locations of the respective areas. While these shadows negatively impacted the natural lighting experience in these areas, they did not significantly affect the rest of the study area. Overall, there were no other major disturbances related to the obstruction of natural light within the study area, and the area moderately fulfilled the biophilic criteria. Although it is not feasible to alter the existing built environment, future developments should incorporate building orientation strategies or employ transparent materials to optimize the experience of natural light.

AIR. Natural patterns of airflow, temperature, humidity and barometric pressure were observed through field visits as well as through meteoblue.com, a website that offers detailed reports of various weather-related conditions.

The airflow was observed during field visits to the site using an anemometer to measure max wind speed. The seven designated areas on the map (Figure 4.1) were observed during 8:00, 12:00, 16:00 and 20:00. The overall wind speed readings for the general area were sourced from metoblue.com and used for comparative analysis. The precise spots selected for measuring wind speeds were determined based on areas with the highest building density, which typically experience reduced airflow due to obstruction by buildings.

Table 4.1: Wind Speeds (km/h) in Alacaatlı

Wind Speeds (km/h) in Alacaatlı				
Area	**8:00**	**12:00**	**16:00**	**20:00**
Overall	NW 6-12	WNW 12-20	WNW 15-26	NNE 11-33
1	3.9	5.5	5.9	6.8
2	3.8	6.8	13.3	4.6
3	1.4	8.4	20.7	8.1
4	4.6	10.8	8.6	12.9
5	4.2	7.3	8.1	5.1
6	4.1	4.2	9	6.4
7	6.8	6.4	6.8	6.8

Airflow. The measured windspeeds in each area were compared to the overall windspeeds at the time.

Area 1: Highest windspeeds recorded < overall windspeeds for the entire study area 100% of the time.

Area 2: Highest windspeeds recorded < overall windspeeds for the entire study area 100% of the time.

Area 3: Highest windspeeds recorded < overall windspeeds for the entire study area 75% of the time.

Area 4: Highest windspeeds recorded < overall windspeeds for the entire study area 75% of the time.

Area 5: Highest windspeeds recorded < overall windspeeds for the entire study area 100% of the time.

Area 6: Highest windspeeds recorded < overall windspeeds for the entire study area 100% of the time.

Area 7: Highest windspeeds recorded < overall windspeeds for the entire study area 75% of the time.

Based on visual observations, most areas exhibit relatively low building density compared to other neighborhoods in Ankara. This characteristic is advantageous for facilitating natural ventilation patterns, as identified in the 2021 study by Liu, Zhang, Jian, and Wang. However, the measured wind speeds suggest that the building density might still be excessive and could be impeding adequate airflow. This could also suggest other factors, such as unreliable airflow conditions during the time of measurement, or variables like building orientation and materials used. Additionally, although each area displayed distinct building densities—such as Area 7 having lower density compared to Area 2—wind speeds across all seven areas yielded similar results. It is possible that environmental obstructions from surrounding areas affected airflow patterns as well. Based on the field study and the analysis of the results, the study area did not appear to align with the biophilic definition for airflow, as the measured wind speeds were frequently lower than the average wind speeds for the neighborhood.

The overall temperature, humidity, and barometric pressure readings for the day of the field observation were sourced from metoblue.com. The following assessment will also draw upon the Chapter 3 analysis of the climatic conditions and trends, sourced from meteoblue.com, to provide additional context and input. Field observations and tools were not utilized for measuring conditions such as temperature, humidity, and barometric pressure, because these conditions do not exhibit measurable changes between the seven designated areas comparable to airflow variations.

Table 4.2: Temperature, Humidity, and Barometric Pressure Readings in Alacaatlı

Temperature, Humidity, and Barometric Pressure Readings in Alacaatlı				
	8:00	**12:00**	**16:00**	**20:00**
Temperature	25°C	32°C	34°C	29°C
Humidity	0	0	0	0
Barometric Pressure	1006 hPa	1006 hPa	1006 hPa	1006 hPa

Temperature. The Çayyolu-Alacaatlı region exhibits considerable variability in monthly temperature trends, as illustrated in Figure 3.4, particularly for the month of June (Figure 3.5) where some years record temperatures above the average while others fall below it. Nevertheless, as depicted in Figure 3.2, Alacaatlı is experiencing a discernible annual increase in temperature. This trend has potential implications for future challenges concerning the quality of life, environmental health—including impacts on flora and fauna—and the continuity of natural weather patterns. Moreover, the consistent rise in annual temperatures contributes to a reduction in temperature variability, which diverges from the principles of biophilia.

Humidity. Past precipitation trends were analyzed to assess humidity levels, revealing considerable variation in precipitation over the years, with notable peaks occurring during the winter months, as depicted in Figure 3.6. Additionally, the observed low humidity levels during the field study corresponded with the patterns typically associated with the summer months and did not pose a concern for assessing variability. No further intervention seems necessary in terms of biophilic design.

Barometric Pressure. Although the barometric pressure stayed constant throughout the day of the field observation (Table 4.2), looking at past readings does show variations correlated with different weather patterns (i.e. lower barometric pressure with rainy, cloudy weather; higher barometric pressure with sunnier, clear weather). It can be concluded that the Alacaatlı neighborhood experiences varying degrees of barometric pressure throughout the year, contributing positively to the biophilic experience and requiring no further intervention.

The introduction of additional native plants should be considered as it could enhance airflow, regulate temperature, and improve humidity levels in the study area. According to the 2020 study by Zhou, et al., increasing urban vegetation enhances air quality and mitigates UHI by regulating evaporation. This addition of native vegetation can help align the experience of air to native temperature and humidity levels and improve air quality, particularly in areas where airflow is constrained by fixed environmental factors.

WATER. No natural or man-made water sources or features were observed in the area that could incorporate an experience of water into the neighborhood. The introduction of an artificial pond to Areas 3, 4, and 7 could provide the presence of water while also serving as a rainwater collection feature, bolstering water-supply resilience as highlighted in the 2013 and 2020 studies mentioned in Chapter 2 (see 2.3.2.1).

PLANTS. As noted in previous observations regarding 'air', the area appeared lacking in a diverse array of vegetation and grass-like plants native to its steppe landscape. Out of the 116 recorded plant species, only 39 (33.6%) were native to the region, while 74 (63.8%) were non-native, and 3 (2.6%) were undefined (see

Appendix for List of Recorded Plant Species in Alacaatlı). Additionally, the ratio of built environment to plants exhibited a skew towards built elements. The sparse vegetation amidst the built environment was especially noticeable in Areas 1, 3, 5, and the transitional spaces (sidewalks, roads), contributing poorly to the biophilic experience. Introducing native vegetation in greater abundance to counterbalance the built environment, taking a page from Singapore's LRP, could enhance the biophilic experience significantly. Furthermore, the Solaris building's façade, featuring a green ribbon of vegetation, can be utilized as a vertical design solution for balancing the natural and built environments of the Alacaatlı neighborhood (Beatley, 2016). This design can be implemented through the strategic use of vegetation on the façades of multi-story buildings, as well as through community engagement by educating and encouraging residents to adopt similar approaches on their personal balconies and window sills.

ANIMALS. Based on visual observations, the study area exhibits signs of animal life such as cats, birds, and small critters, albeit very little. There were, however, some observed instances of sustained interactions between animals and residents in the form of leaving drinking water out in plastic containers. Additionally, Area 4 had small troughs connected to water pipes that replenished the water throughout the day (Figure 4.2); both cats and birds were seen drinking out of these. Through their small but consistent approach to providing drinking water to the local animals, especially during the hot summer season, both the municipality and the residents of Alacaatlı do seem to welcome sustained animal interactions in this neighborhood. The outdoor park design for local stray cats referenced in Chapter 2 (see 2.3.2.1) can be a great addition to Area 7 and can bolster the existing experience of meaningful and regular interactions with animals in the Alacaatlı neighborhood.

Figure 4.2: Small water troughs observed in the Alacaatlı neighborhood

WEATHER. There were no features observed of the built environment that significantly obstructed natural weather patterns other than the building orientation and density that impeded airflow, represented by the non-negligible differences in wind speeds observed in the previous part of this section. The current building orientation and density cannot be altered; however, any future construction should be strategically designed to accommodate dynamic weather patterns wherever possible. Smaller essential structures that provide shade, seating, or other amenities, should be dispersed to prevent clustering and be composed of material that allow for air permeability.

NATURAL LANDSCAPES AND ECOSYSTEMS. No natural landscapes and ecosystems, as defined by Kellert and Calabrese (2015), were identified in the area. Area 7 had the most favorable plant to built environment ratio, however, it was not representative of a natural formed landscape or self-sustained ecosystem. Figure 4.3

depicts the plants and trees in the area arranged in a linear fashion, typically unseen in nature, as well as above ground irrigation systems providing an artificial feel to the environment. A comparable approach to the Riparian Preserve in Gilbert, Arizona, can be applied to Area 7. Despite potential differences in size, integrating a cohesive, interconnected system of natural elements in this area can effectively cultivate the experience of natural landscapes and ecosystems. Additionally, the vegetation can include more variability to reflect the rich diversity of natural settings.

Figure 4.3: Various views of Area 7 depicting the linear arrangement of vegetation

FIRE. No fire features conducive to a biophilic experience were observed in the area. Introducing outdoor firepits strategically across the area could not only offer direct experiences with fire but also serve as communal focal points where residents can gather, socialize, and enhance their outdoor engagement.

4.1.1.1 Summary of Observations and Suggestions

Table 4.3: Direct Experiences of Nature in Alacaatlı

Direct Experiences of Nature in Alacaatlı					
#	**Attribute**	**Is it present ?**	**Does it satisfy the biophilic definition?**	**Explanation**	**Suggestions**
1	Light	Yes	Some	The study area moderately met the biophilic criteria for natural light, as the overall area exhibited no significant obstructions that would result in the absence of natural light, with the only exceptions being Areas 3 and 5. This was attributed to the height of the buildings in these areas, leading to the obstruction of natural light on adjacent streets, as well as within the parking and garden locations of the respective areas. While these shadows negatively impacted the natural lighting experience in these areas, they did not significantly affect the rest of the study area.	Building orientation strategies or use of transparent materials should be considered to maximize natural light.
2	Air	Yes	Some	Based on the field study and the analysis of the results, the study area did not appear to align with the biophilic definition for airflow, as the measured wind speeds were frequently lower than the average wind speeds for the neighborhood. The study area exhibits considerable variability in monthly temperature trends. Nevertheless, Alacaatlı is experiencing a discernible annual increase in temperature. The consistent rise in annual temperatures contributes to a reduction in temperature variability, diverging from biophilic principles, in addition to other potential challenges. Humidity and barometric pressure had regular variability that aligned with the principles of biophilic design.	The introduction of additional native plants should be considered as it could enhance airflow, regulate temperature, and improve humidity levels in the study area. It can also aid in enhancing air quality and mitigating urban heat island through regulating evaporation (Zhou, et al. 2020). This can help align the experience of air to native temperature and humidity levels and improve air quality, particularly in areas where airflow is constrained by fixed environmental factors.

3	Water	No	No	No natural or man-made water sources or features were observed in the area.	The introduction of an artificial pond to Areas 3, 4, and 7 could provide the presence of water while also serving as a rainwater collection feature, bolstering water-supply resilience.
4	Plants	Yes	Some	The area appeared lacking in abundance of vegetation native to its steppe landscape. Additionally, the ratio of built environment to plants exhibited a skew towards built elements. The sparse vegetation amidst the built environment was especially noticeable in Areas 1, 3, 5, and the transitional spaces (sidewalks, roads), contributing poorly to the biophilic experience.	Introducing native vegetation on the ground level in greater abundance to counterbalance the built environment could enhance the biophilic experience significantly. On a vertical level, the strategic use of vegetation on the façades of multi-story buildings, as well as through community engagement of residents adopting similar approaches on their personal balconies and window sills can significantly balance the natural and built environmental features.
5	Animals	Yes	Some	The area exhibits small signs of animal life and some observed instances of sustained interactions between animals and residents.	The outdoor park design for local stray cats referenced in Chapter 2 (see 2.3.2.1) should similarly be applied to Area 7 to provide avenues for meaningful and regular experiences with animals in the Alacaatlı neighborhood.
6	Weather	Yes	Yes	There were no features observed of the built environment that significantly obstructed natural weather patterns.	Any future building construction should be strategically designed to accommodate dynamic weather patterns wherever possible. Smaller essential structures that provide shade, seating, or other amenities, should be dispersed to prevent clustering and be composed of material that allow for air permeability.
7	Natural landscapes and ecosystems	No	No	No natural landscapes and ecosystems were identified in the area.	A comparable approach similar to that of the Riparian Preserve in Gilbert, Arizona applied to Area 7. Additionally, the vegetation in Area 7 should include more variability to reflect the rich diversity of natural settings.
8	Fire	No	No	No fire features conducive of a biophilic experience were observed in the area.	Introducing outdoor firepits strategically across communal areas could not only offer direct experiences with fire but also serve as communal focal points where residents can gather, socialize, and enhance their outdoor engagement.

4.1.2 Indirect Experience of Nature

IMAGES OF NATURE. No instances of natural imagery were observed within the area. Given a sufficient level of opportunities for direct natural exposure, the incorporation of natural images is deemed unnecessary. However, when deemed necessary, such images could be integrated onto building facades, park benches, backs of signage, or even sun covers to enhance the integration between the built environment and nature.

NATURAL MATERIALS. The use of natural materials such as wood and stone were present in the neighborhood, although they were limited to some signage (Figure 4.4), park benches, trashcans (Figure 4.5), gazebos (Figure 4.6), and privacy walls (Figure 4.7). This limited use of natural materials, in combination with the abundance of artificial materials like concrete and asphalt, is not conducive to a biophilic experience. Although a great portion of the built environment including buildings and concrete sidewalks cannot be modified, there are components of the built environment such as metal signage (Figure 4.8) and concrete pathways within recreational areas such as Area 4 and 7 (Figure 4.9), that can be changed to either wood or stone respectively without compromising functionality. Alternatively, gabion walls, as illustrated in Figure 2.8, can be employed as a substitute for the privacy walls depicted in Figure 4.7, thereby eliminating the need for poured concrete and yielding a more flexible and organic addition.

Figure 4.4: Wooden way-finding signage

Figure 4.5: Wood and metal combination park bench and trashcan

Figure 4.6: Wooden gazebo on top of concrete path in Area 4

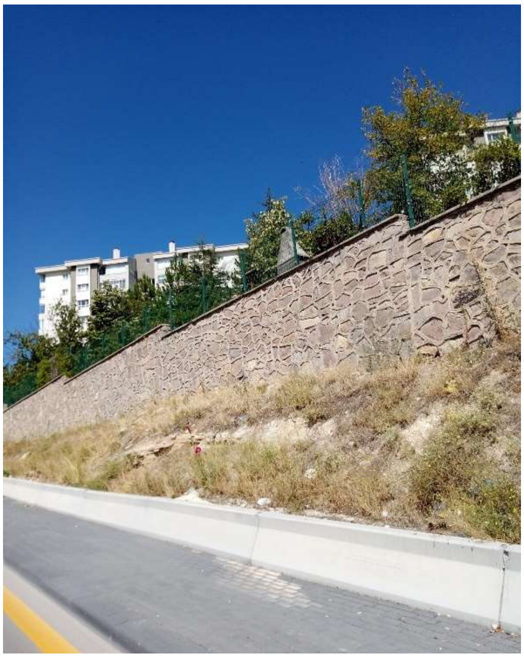

Figure 4.7: Reinforced cement stone wall

Figure 4.8: Metal way-finding signage

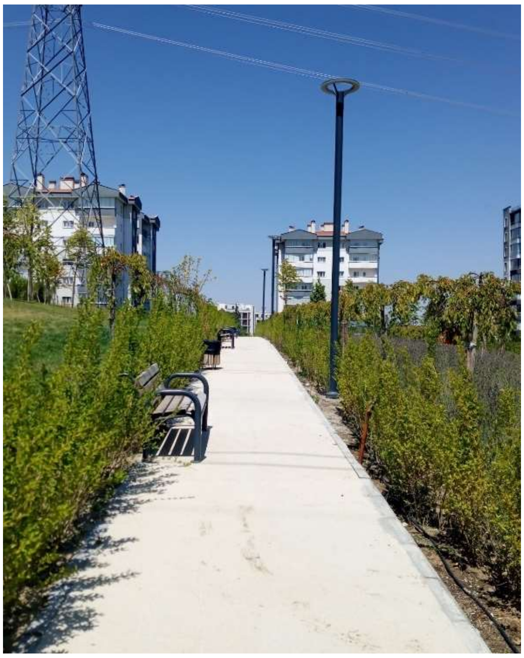

Figure 4.9: Concrete pathway in Area 7

NATURAL COLORS. Despite the presence of muted, earthy tones reminiscent of natural elements, it appeared that they were not strategically employed to portray or integrate harmoniously with the natural environment. For example, the fencing shown in Figure 4.10 is a muted, green, representative of the natural environment. However, the stark transition to the cool grey concrete below does not represent the colors and transitions one would see in nature. The same can be seen in the entrance of the residential unit in Area 3 (Figure 4.11), where multiple shades of brown simulating colors of tree trunks and soil were utilized but paired with a bold black center, giving it a more artificial touch. The problems discussed in these examples also apply to most of the buildings and other components of the built environment such as the gazebo discussed previously in Figure 4.6 that has an earthy brown shade that can be seamlessly integrated with the soil or grass beneath, but instead rest atop a layer of grey concrete. Future contributions to the built environment need to consider utilizing the surrounding natural environment's colors to create harmonious extensions of the natural elements, rather than artificial transitions. Unnatural colors should be avoided whenever possible, especially if they are disrupting transitions between natural colors and the natural environment.

Figure 4.10: Green fencing on grey concrete

Figure 4.11: Entrance sign of Area 3

SIMULATING NATURAL LIGHT AND AIR. Based on field observations, artificial lighting was subtle or nonexistent during daylight hours. During nighttime, street lighting was sparingly used in most areas and did not appear to pose significant concerns regarding wildlife disruption or environmental impact. Lighting emanating from buildings did not appear excessive and appeared largely confined within the respective plots. The color temperatures emitted by streetlamps appeared to alternate between cool and warm tones.

Certain measuring devices, such as a colorimeter for lighting temperature or a light meter for foot candles, were unavailable for this study. Therefore, it is impossible to accurately determine whether the study area fits the biophilic standards for this attribute. Currently, no design intervention seems necessary as none of the lighting sources raised noticeable concerns for the natural environment. However, future studies could consider factors such as lighting temperatures and light emission levels to create spaces that better emulate natural lighting and seasonal variations.

NATURALISTIC SHAPES AND FORMS. There were not any naturalistic shapes or forms observed in the neighborhood that promoted the biophilic experience. Future enhancements within the neighborhood should include design elements like the one illustrated in Figure 2.9. This tree column design could also be reimagined into various elements of the built environment, such as fencing, street signage, and light posts. Additionally, while existing sidewalks cannot be modified, the neighborhood includes unfinished sidewalks (Figure 4.12) that would benefit from a smoother concrete finish. Leaf impressions, as depicted in Figure 2.10, should be incorporated into these areas as they serve as an effective method for introducing natural shapes into the built environment while maintaining the functional and ergonomic qualities of concrete sidewalks.

Figure 4.12: Unfinished sidewalk near Area 4

EVOKING NATURE. The study area did not include any designs and features that deliberately evoked natural forms. However, the varying heights and widths of the buildings throughout the neighborhood was reminiscent of the vertical heterogeneity observed in forests, as discussed previously by Kellert and Calabrese (2015). The varying heights and widths are attributed to a mix of building types from high-rise apartments to single-family homes with varying stories. While no design interventions are currently required or feasible for the existing built environment, future developments, particularly substantial ones such as new buildings, could be designed to evoke natural elements. This approach would enhance the neighborhood's biophilic qualities and create a more aesthetically stimulating environment.

INFORMATION RICHNESS. The study area exhibits a moderate alignment with the biophilic concept of information richness. Notable observations included the placement of vegetation, the topography, and the design of sidewalks and pathways. Although some repetitive design elements were observed, such as the linear arrangement of vegetation in Area 7 (Figure 4.3), these patterns were not prevalent throughout the entire study area. In other regions, the vegetation appeared to be arranged in a more random and naturalistic manner that seemed more in-line with the biophilic definition. Additionally, the presence of varied topography, particularly the steep hill adjacent to Areas 3 and 4 (Figure 4.13), introduced a degree of visual and spatial diversity to the area more aligned with the biophilic definition. When it came to the sidewalks and pathways, the study area predominantly featured a uniform concrete design, characteristic of conventional urban settings. Even within the parks such as Areas 3 and 7, the pathways lacked variety in both texture and color, failing to complement the surrounding rich and diverse natural environment.

To enhance the information richness, particular attention must be directed towards the design of the sidewalks and pathways, as they are among the areas most lacking. It is recommended that the pathways incorporate greater textural variation and a more diverse color palette. In the park areas 4 and 7, incorporating a broader range of textural variations into the pathways could enhance visual and sensory engagement and better harmonize with the surrounding rich vegetation. Additionally for Area 7, the linear arrangement of vegetation needs to include more variability to reflect the rich diversity of natural settings. For sidewalks, introducing diverse color variations through staining can add aesthetic interest without compromising their functionality and accessibility. This approach would help maintain the practical usability of the sidewalks while also being a more feasible and cost-effective alternative to a complete structural redesign.

Figure 4.13: Topography map of the region and elevation changes in the study area depicted through arrows (direction of arrows displaying an increase in elevation)

Note. Original map images from (T.C. Ankara Büyükşehir Belediyesi, 2024) and (Google Maps, 2024).

AGE, CHANGE, AND THE PATINA OF TIME. The study area moderately portrayed the biophilic definition of age, change, and the patina of time. These were observed mainly through the weathering of naturally aging materials as well as the seasonal variations observed in the plant life incorporated throughout the neighborhood. The natural aging of materials were mainly present in the wooden gazebos as seen in Figure 4.14. Although this constituted a relatively small portion of the overall study area, there was potential as most of the park benches, trash bins, and some signage were also made of materials that will eventually show signs of age and weathering overtime. In contrast, plant life was abundant, with pronounced seasonal variations evident through different blooming and dormancy periods, as well as changes in leaf color (Appendix).

Efforts to strengthen the experience of age, change, and the patina of time should focus on utilizing more materials that are prone to showing signs of age and weathering. Although these materials were present in the study area, they were not prevalent enough to provide a consistent biophilic experience. This can be achieved by increasing the use of materials such as wood for signage, pathways, seating, and trash bins. Given the abundance of these items throughout the study area, this approach can enhance the experience related to age, change, and the patina of time in a subtle yet consistent manner. No changes need to be made when it comes to providing this experience through plant-life as it is sufficient in the study area.

Figure 4.14: Signs of weathering on the wooden gazebo in Area 4

NATURAL GEOMETRIES. No notable natural geometries were observed in the study area. An easy and feasible option could be to implement a honeycomb design garden or pathway (Figure 2.13) in the park areas or residential entrances. This design could be complemented using naturally aging materials, such as wood or stone, to enhance the biophilic experience. Additionally, incorporating different materials, shapes, and textures can contribute to a more aesthetically stimulating and information-rich environment.

BIOMIMICRY. The aforementioned approach also aligns with principles of biomimicry, which seeks to draw inspiration from natural forms and processes to enhance design and functionality. Given the absence of biomimicry within the study area, incorporating honeycomb-patterned gardens or pathways would serve as an effective means of demonstrating the efficiency and aesthetic appeal inherent in natural systems. This can help foster deeper connections with nature and a better understanding of the world and the experiences it offers.

4.1.2.1 Summary of Observations and Suggestions

Table 4.4: Indirect Experiences of Nature in Alacaatlı

Indirect Experiences of Nature in Alacaatlı					
#	**Attribute**	**Is it present?**	**Does it satisfy the biophilic definition?**	**Explanation**	**Suggestions**
1	Images of nature	No	No	No instances of natural imagery were observed within the area.	Given a sufficient level of opportunities for direct natural exposure, the incorporation of natural images is deemed unnecessary. When deemed necessary, such images could be integrated onto building facades, park benches, backs of signage, or even sun covers to enhance the integration between the built environment and nature.
2	Natural materials	Yes	No	The use of the natural materials of woods and stones were limited and did not offset the abundant use of artificial materials.	Although a great portion of the built environment including buildings and concrete sidewalks cannot be modified, metal signage and concrete pathways within recreational areas such as Areas 4 and 7, can be changed to either wood or stone respectively without compromising functionality. Additionally, gabion walls can be utilized in lieu of the poured concrete and stone privacy walls, offering more flexible and organic structures to the neighborhood.
3	Natural colors	Yes	No	Despite the presence of muted, earthy tones reminiscent of natural elements, it appeared that they were not strategically employed to portray or integrate harmoniously with the natural environment.	Future contributions to the built environment need to consider utilizing the surrounding natural environment's colors to create harmonious extensions of the natural elements, rather than artificial transitions. Unnatural colors should be avoided whenever possible, especially if they are disrupting transitions between natural colors and the natural environment.

4	Simulating natural light and air	Indeterminable	Indeterminable	Based on visual observations, the simulated lighting was not excessive and did not appear to pose significant concerns regarding wildlife disruption or environmental impact. However, the unavailability of accurate measuring devices such as a colorimeter for lighting temperature or a light meter for foot candles, makes it impossible to accurately determine the presence and biophilic satisfaction of this attribute.	Currently, no design intervention seems necessary. Future studies could consider lighting temperatures and light emission levels to create spaces that better emulate natural lighting and seasonal variations.
5	Naturalistic shapes and forms	No	No	There were not any naturalistic shapes or forms observed in the neighborhood that promoted the biophilic experience.	The tree column design in Figure 2.9 could be reimagined into various elements of the built environment, such as fencing, street signage, and light posts. Additionally, while existing sidewalks cannot be modified, the neighborhood includes unfinished sidewalks (Figure 4.12) that would benefit from a smoother concrete finish. Leaf impressions, as depicted in Figure 2.10, should be incorporated into these areas as they serve as an effective method for introducing natural shapes into the built environment while maintaining the functional and ergonomic qualities of concrete sidewalks.
6	Evoking nature	Yes	Some	The study area did not include any designs and features that deliberately evoked natural forms. However, the varying heights and widths of the buildings throughout the neighborhood were reminiscent of the vertical heterogeneity observed in forests (Kellert & Calabrese, 2015)	While no design interventions are currently required or feasible for the existing built environment, future developments, particularly substantial ones such as new buildings, could be designed to evoke natural elements. This approach would enhance the neighborhood's biophilic qualities and create a more aesthetically stimulating environment.
7	Information richness	Yes	Some	The study area exhibits a moderate alignment with the biophilic concept of information richness. Notable observations included the placement of vegetation, the topography, and the design of sidewalks and pathways. Of these, the sidewalk and pathway design seemed to be the most lacking and in need of improvement.	It is recommended that the pathways incorporate greater textural variation and a more diverse color palette. In the park areas 4 and 7, incorporating a broader range of textural variations into the pathways could enhance visual and sensory engagement and better harmonize with the surrounding rich vegetation. Additionally for Area 7, the linear arrangement of vegetation needs to include more variability to reflect the rich diversity of natural settings. For sidewalks, introducing diverse color variations through staining can add aesthetic interest without compromising their functionality and accessibility. This approach would help maintain the practical usability of the

					sidewalks while also being a more feasible and cost-effective alternative to a complete structural redesign.
8	Age, change, and the patina of time	Yes	Some	The study area moderately portrayed the biophilic definition of age, change, and the patina of time. These were observed mainly through the weathering of naturally aging materials as well as the seasonal variations observed in the plant life incorporated throughout the neighborhood. The use of naturally aging materials was present but not sufficient for a consistent biophilic experience. In contrast, plant life was abundant, with pronounced seasonal variations evident through different blooming and dormancy periods, as well as changes in leaf color.	Efforts to strengthen the experience of age, change, and the patina of time should focus on utilizing more materials that are prone to showing signs of age and weathering. This can be achieved by increasing the use of materials such as wood for signage, pathways, seating, and trash bins. Given the abundance of these items throughout the study area, this approach can enhance the experience related to age, change, and the patina of time in a subtle yet consistent manner.
9	Natural geometries	No	No	No notable natural geometries were observed in the study area.	An easy and feasible option could be to implement a honeycomb design garden or pathway (Figure 2.13) in the park areas or residential entrances. This design could be complemented using naturally aging materials, such as wood or stone, to enhance the biophilic experience. Additionally, incorporating different materials, shapes, and textures can contribute to a more aesthetically stimulating and information-rich environment.
10	Biomimicry	No	No	The area was absent of biomimicry.	Incorporating honeycomb-patterned gardens or pathways (Figure 2.13) would serve as an effective means of demonstrating the efficiency and aesthetic appeal inherent in natural systems. This can help foster deeper connections with nature and a better understanding of the world and the experiences it offers.

4.1.3 Experience of Space and Place

PROSPECT AND REFUGE. Regarding prospect, most of the areas appeared to align somewhat with the biophilic definition. Since most of these areas are situated at higher elevations, the visibility of the surrounding landscape was not affected significantly by trees, signage, or other structures. Area 7 was the only location that exhibited reduced visibility of the neighborhood due to its lower elevation compared to the other areas. Within the areas themselves, Areas 1, 2, and 6 exhibited notable issues with achieving unobstructed and clear views due to building height and density, whereas Area 7 did through various elevation changes. The other areas only had minor obstructions either related to buildings or minor elevations changes. Given that the primary obstructions are related to buildings or elevation changes, it is not possible to determine feasible solutions at this time to improve the experience of prospect.

Refuge was similar to that of prospect in that it somewhat satisfied the biophilic definition. Certain residential areas, such as Areas 1 and 2 effectively employed fencing in combination with Virginia Creeper plants and similar vegetation to create natural barriers (Figure 4.15). These elements provided visual privacy and noise separation, enhancing the sense of refuge. On the other hand, the rest of the residential areas (3, 5, and 6) appeared to fall short in this regard; the use of fencing alone, without accompanying vegetation, failed to achieve a comparable effect (Figure 4.16). Although not present entirely, Areas 4 and 7 did display an effective biophilic experience of refuge. This effect was largely confined to the interior sections, which were abundant in trees and vegetation, in contrast to the peripheral areas adjacent to busy streets and sidewalks. The interior portion featured natural vegetation that served as buffers, enhancing immersion within the park's natural paths and seating areas (Figure 4.17). In contrast, the exterior areas felt more exposed and were subject to greater external stimuli. As all residential areas possess the same green fencing throughout their property lines, it is recommended that Areas 3, 5, and 6 follow the lead of Areas 1 and 2 in terms of pairing vegetation with this fencing to improve the experience of refuge within their respective area. The recreational park areas of 4 and 7 do not have this green fencing and instead should utilize vegetation such as bushes or trees to create a better experience of refuge. This approach will enhance the sense of security and separation from adjacent streets and passing vehicles, while maintaining an open and accessible atmosphere without the use of traditional fencing.

Figure 4.15: Fencing + vegetation privacy walls in Areas 1 and 2

Figure 4.16: Fencing lacking vegetation in Areas 3, 5, and 6

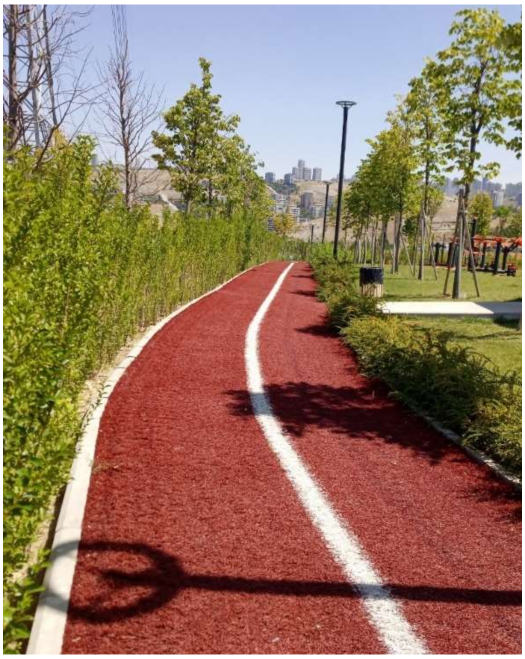

Figure 4.17: The track surrounded by vegetation in Area 7

ORGANIZED COMPLEXITY. The definition of organized complexity was portrayed quite well within the individual areas, with almost a balanced ratio of the built and natural environment. However, the transitional spaces between them, such as sidewalks and streets, relied more heavily on built features. While this provided a sense of order and comprehension, it also lacked the nuance and unpredictability that is often observed in natural environments. Additionally, these areas were observed to be underutilized relative to the outdoor activities and engagement seen within residential and park areas. Although transitional spaces are not specifically designed for social gatherings or extensive recreational activities, they still offer valuable opportunities for daily leisure strolls and social interactions. Such use could enhance the sense of community and foster connections among the smaller communities within the residential areas. It is recommended to incorporate more natural elements into the transitional spaces, such as trees, vegetation, and natural materials, textures, and colors. This approach would enhance visual and tactile interest to be more consistent with the other areas, thereby enriching the overall complexity and engagement within the neighborhood.

INTEGRATION OF PARTS TO WHOLES. Other than Area 4 and 7 that serve as recreational park areas and focal points for the neighborhood community, there were no other notable elements that seemed to unify the various residential areas of Alacaatlı. The honeycomb design implemented by OFL Architects (Figure 2.13) incorporates the honeycomb structure to develop matching seating areas and planters. Integrating similar designs throughout the neighborhood instead of conventional pathways, bench seating, planters, or trash bins, can establish a cohesive theme for the neighborhood tying back to a larger display employed in the park areas. It will also reinforce a unifying theme through the use of wood, which will also be utilized in the wayfinding signage (Table 4.4 items 2 and 8).

TRANSITIONAL SPACES. As discussed in the “Organized Complexity” portion of this section, the transitional spaces within the study area were identified as a point of concern regarding adhering to the biophilic ideology. Although these spaces are indeed present, connecting various residential and park areas through sidewalks and roads, their mere existence does not fulfill the requirements of biophilic design. The transitional areas predominantly utilize artificial materials such as concrete, asphalt, and refined metals, with minimal incorporation of trees, vegetation, or natural materials and textures. While these transitional spaces provide clear pathways and facilitate navigation between the various residential and park areas, the sudden shift to a flat, artificial environment does not support a seamless, thematic transition. This lack of continuity hinders the creation of a cohesive and connected experience between the spaces. These transitional spaces should incorporate natural elements characteristic of the main areas they connect, in addition to unique, identifying design features such as the previously mentioned honeycomb pattern. This approach will help ensure that the transitional spaces function as a seamless extension of the adjacent areas rather than as disconnected or disparate environments.

MOBILITY AND WAYFINDING. The study area exemplified effective mobility and wayfinding, in alignment with biophilic principles. The allocated spaces for both pedestrians and vehicles were adequately designed to facilitate unrestricted movement. Furthermore, the pathways were unobstructed and featured clear, ample signage throughout. No further design interventions are deemed necessary for the study area.

CULTURAL AND ECOLOGICAL ATTACHMENT TO PLACE. The neighborhood lacked notable designs, features, or historical landmarks that distinctly reflected its cultural identity. However, the area possessed unique ecological features, such as herbal farms, which can contribute to fostering a sense of community and attachment. This feature was present in Area 7, which included lavender, rosemary, and lemon balm farms (Figure 4.18), in addition to a couple of fruit trees. These farms not only contributed to the local landscape and cultivating a sense of community, but also offered sensory experiences through their visual appeal and aromatic qualities. More urban farms can be strategically integrated throughout the neighborhood to establish a cohesive identity. This approach can not only strengthen communal bonds but also deepen residents' connection to their environment by instilling a sense of responsibility for engaging with and maintaining these agricultural spaces. The most optimal location for expanding the urban farms is Area 4. However, fruit trees can be strategically planted along sidewalks, and edible or aromatic gardens can be incorporated within residential areas to further enhance the neighborhood's agricultural landscape theme and identity.

Figure 4.18: Lavender, Rosemary, and Lemon Balm farms in Area 7

4.1.3.1 Summary of Observations and Suggestions

Table 4.5: Experience of Space and Place in Alacaatlı

Experience of Space and Place in Alacaatlı					
#	**Attribute**	**Is it present?**	**Does it satisfy the biophilic definition?**	**Explanation**	**Suggestions**
1	Prospect and refuge	Yes	Some	Prospect somewhat satisfied the biophilic definition. Since most of the areas are situated at higher elevations, the visibility of the surrounding landscape was not affected significantly by trees, signage, or other structures. Area 7 was the only location that exhibited reduced visibility of the neighborhood due to its lower elevation compared to the other areas. Within the areas themselves, Areas 1, 2, and 6 exhibited notable issues with achieving unobstructed and clear views due to building height and density, whereas Area 7 did through various elevation changes. The other areas only had minor obstructions either related to buildings or minor elevations changes. Refuge somewhat satisfied the biophilic definition. Areas 1 and 2 effectively employed fencing in combination with Virginia Creeper plants and similar vegetation to create natural barriers to provided visual privacy and noise separation, enhancing the sense of refuge. Areas 3, 5, and 6 utilized fencing alone, without accompanying vegetation, and failed to achieve a comparable effect. The park areas of 4 and 7 was more successful in providing a sense of refuge on the interior portions but failed to do so on the periphery where it felt exposed to the adjacent streets and sidewalks.	Prospect: Given that the primary obstructions are related to buildings or elevation changes, it is not possible to determine feasible solutions at this time to improve the experience of prospect. Refuge: As all residential areas possess the same green fencing throughout their property lines, it is recommended that Areas 3, 5, and 6 follow the lead of Areas 1 and 2 in terms of pairing vegetation with this fencing (Figure 4.15). The recreational park areas of 4 and 7 should utilize vegetation such as bushes or trees to create a better experience of refuge. This approach will enhance the sense of security and separation from adjacent streets and passing vehicles, while maintaining an open and accessible atmosphere without the use of traditional fencing."

2	Organized complexity	Yes	Some	The definition of organized complexity was portrayed quite well within the individual areas, with almost a balanced ratio of the built and natural environment. However, the transitional spaces between them, such as sidewalks and streets, relied more heavily on built features. While this provided a sense of order and comprehension, it also lacked the nuance and unpredictability that is often observed in natural environments. Additionally, these areas were observed to be underutilized relative to the outdoor activities and engagement seen within residential and park areas.	It is recommended to incorporate more natural elements into the transitional spaces, such as trees, vegetation, and natural materials, textures, and colors. This approach would enhance visual and tactile interest to be more consistent with the other areas, thereby enriching the overall complexity and engagement within the neighborhood.
3	Integration of parts to wholes	Yes	Some	Other than Area 4 and 7 that serve as recreational park areas for the neighborhood community, there were no other notable elements that seemed to unify the various residential areas of Alacaatlı.	The honeycomb design implemented by OFL Architects (Figure 2.13) incorporates the honeycomb structure to develop matching seating areas and planters. Integrating similar designs throughout the neighborhood instead of conventional pathways, bench seating, planters, or trash bins, can establish a cohesive theme for the neighborhood tying back to a larger display employed in the park areas. It will also reinforce a unifying theme through the use of wood, which will also be utilized in the wayfinding signage (Table 4.4 items 2 and 8).
4	Transitional spaces	Yes	Some	The transitional spaces within the study area are a point of concern regarding adhering to the biophilic ideology. Although these spaces are indeed present, connecting various residential and park areas through sidewalks and roads, their mere existence does not fulfill the requirements of biophilic design. The transitional areas predominantly utilize artificial materials such as concrete, asphalt, and refined metals, with minimal incorporation of trees, vegetation, or natural materials and textures. While these transitional spaces provide clear pathways and facilitate navigation between the various residential and park areas, the sudden shift to a flat, artificial environment does not support a seamless, thematic transition. This lack of continuity hinders the creation of a cohesive and connected experience between the spaces.	These transitional spaces should incorporate natural elements characteristic of the main areas they connect, in addition to unique, identifying design features such as the previously mentioned honeycomb pattern. This approach will help ensure that the transitional spaces function as a seamless extension of the adjacent areas rather than as disconnected or disparate environments.
5	Mobility and wayfinding	Yes	Yes	The study area exemplified effective mobility and wayfinding, in alignment with biophilic principles. The allocated spaces for both pedestrians and vehicles were adequately designed to facilitate unrestricted movement. Furthermore, the pathways were unobstructed and featured clear, ample signage throughout.	No further design interventions are deemed necessary for the study area.

6	Cultural and ecological attachment to place	Yes	Some	The neighborhood lacked notable designs, features, or historical landmarks that distinctly reflected its cultural identity. However, the area possessed unique ecological features, such as herbal farms, which can contribute to fostering a sense of community and attachment. This feature was present in Area 7, which included lavender, rosemary, and lemon balm farms.	More urban farms can be strategically integrated throughout the neighborhood to establish a cohesive identity. This approach can not only strengthen communal bonds but also deepen residents' connection to their environment by instilling a sense of responsibility for engaging with and maintaining these agricultural spaces. The most optimal location for expanding the urban farms is Area 4. However, fruit trees can be strategically planted along sidewalks, and edible or aromatic gardens can be incorporated within residential areas to further enhance the neighborhood's agricultural landscape theme and identity.

4.2 SWOT Analysis

STRENGHTS.

1. There is plenty of room for new biophilic design additions as the neighborhood is new and still evolving (see 3.2).
2. The study area has an ample natural light source with mostly minimal interference from buildings (see item 1 in Table 4.3).
3. There were no features observed of the built environment that significantly obstructed natural weather patterns other (see item 6 in Table 4.3).
4. Although not deliberately employed, the varying heights and widths of the buildings throughout the neighborhood were reminiscent of the vertical heterogeneity observed in forests (see item 6 in Table 4.4). This is a great characteristic of the existing built environment that aligns with biophilic principles of evoking nature.
5. The study area exemplified effective mobility and wayfinding, in alignment with biophilic principles (see item 5 in Table 4.5).

WEAKNESSES.

1. Existing and approved plans in the study area limit the implementation of various biophilic concepts and uses of the vacant land (see 3.2).
2. The study area has no existing natural or man-made water features (see item 3 in Table 4.3) and the implementation of such features would entail a considerable expense.
3. The study area consists of mostly non-native plant species, with only 33.6% being native to the region (see item 4 in Table 4.3 and Appendix).
4. No natural landscapes and ecosystems were identified in the area (see item 7 in Table 4.3). Given that most trees and vegetation in the area are non-native

species, implementing natural landscapes and ecosystems would incur significant costs and labor.

5. The varying elevations of the study area present problems in surveillance of the surrounding landscape (see item 1 in Table 4.5).
6. Due to the increasing rate of temperatures, the introduction of large bodies of water, such as ponds, suggested in item 3 of Table 4.3, would be deemed unsustainable and ill-suited for the current climate (see Figure 3.2 and 3.6).
7. Although there were no noticeable decreases in precipitation throughout the years, the overall levels of precipitation are insufficient to support the introduction of large bodies of water, such as ponds, suggested in item 3 of Table 4.3, as it would be deemed unsustainable and ill-suited for the current climate (see Figure 3.3 and 3.6).

OPPORTUNITIES.

1. The average residents' upper-middle-class status enables them to afford biophilic design enhancements (see 3.2).
2. The area exhibits small signs of animal life and some observed instances of sustained interactions between animals and residents (see item 5 in Table 4.3). This presents an excellent opportunity to explore improved methods for enhancing the current experience.
3. Although the use of the natural materials of woods and stones were limited (see item 2 and 8 in Table 4.4), the area did incorporate these materials in certain locations (Figures 4.4, 4.5, 4.6, 4.7). This provides a valuable framework for guiding future additions.
4. The presence of natural colors, despite being minimal and not strategically utilized, provides a good foundation and color scheme for future additions (see item 3 in Table 4.4).

5. All residential areas have identical green fencing throughout their perimeter, with some utilizing plants in combination with the fencing to create a form of natural barrier, enhancing the experience of refuge (see item 1 in Table 4.5). This existing and effective form of visual and sound privacy can be recreated in the areas that are lacking this feature, to create a cohesive look with minimal effort and disruption to the built environment.
6. The existing structures within the study area present an opportunity to repurpose natural materials, such as the stone used in the privacy walls (Figure 4.7), and integrate them into the design of new features, like gabion walls (Figure 2.8). This approach can contribute to a more sustainable and cost-effective design solution, while also enhancing the biophilic qualities of the space.

THREATS.

1. According to annual reports (Figure 3.2), there is a rising trend in average temperatures, which has a detrimental impact on the natural environment.
2. Due to the rapid increase in population in the last 16 years in the Alacaatlı neighborhood (Table 3.1), it will be difficult to plan and implement biophilic strategies with the current rate of urban expansion (see 3.2).

CHAPTER 5

PROPOSAL AND CONCLUSION

This chapter will present the proposed biophilic design strategies and vision for Alacaatlı to highlight the biophilic potential of the neighborhood.

5.1 Proposed Biophilic Design Strategies for Alacaatlı

This section will propose biophilic design strategies for the study area based on the findings from the literature review, contextual background, field study, and the SWOT analysis.

Table 5.1: Strategies to Improve the Direct Experiences of Nature in Alacaatlı

Strategies to Improve the Direct Experiences of Nature in Alacaatlı					
#	**ID**	**Attribute**	**Can be improved?**	**Biophilic Design Strategy**	**Explanation**
1	D1	Light	No	N/A	Building orientation strategies or use of transparent materials cannot be utilized as existing buildings cannot be modified.
2	D2	Air	Yes	1. Addition of more native plants to the entire study area.	This will create natural ventilation patterns, temperature, and humidity levels more akin to the natural landscape. It will also help mitigate the negative impacts associated with the rising trend in average temperatures in the study area.
3	D3	Water	Yes	1. Addition of aesthetic dry detention basins to Areas 3, 4, and 7 similar to the design concepts illustrated in Figures 2.1 and 2.2. 2. Addition of gullies adjacent to sidewalks connecting to the parks and dry detention basins wherever possible. Similar design concepts illustrated in Figures 2.3 and 2.4 can be utilized. 3. Addition of stormwater planters, as shown in Figure 2.5, to existing network of rain gutters (rain gutter to be added to each building if not existing). If feasible, stormwater planters shall be integrated to the network of gullies and dry detention basins.	These solutions will provide a presence of water currently lacking in the study area, while also serving as a rainwater collection feature, bolstering water-supply resilience. Additionally, the interconnected network of these systems will facilitate a cohesive theme throughout the neighborhood, while also providing a more engaging and immersive water experience. Note: These solutions are more suitable than the previous suggestion of adding ponds (item 3 of Table 4.3) as they operate in tandem with the region's natural precipitation patterns, thereby yielding a more sustainable solution that is reflective of the current climate (see SWOT analysis Weaknesses Items 6 and 7).
4	D4	Plants	Yes	1. Introducing native vegetation to the entire study area in greater abundance to counterbalance the built environment on a ground level. 2. The strategic use of vegetation on the façades of multi-story buildings, as well as through community engagement of residents adopting similar approaches on their personal balconies and window sills, to introduce vegetation on a vertical level. Note: Plant selection should prioritize species that are hypoallergenic and pest-repellent. In the cases of applications within the dry detention basins, stormwater planters, or any other water-related feature, water purifying plant species shall be prioritized.	The addition of native vegetation to the study area will provide an experience more akin to its steppe landscape. The increased addition of vegetation will provide a more biophilic experience that helps counterbalance the built environment.

5	D5	Animals	Yes	1. The outdoor park design for local stray cats referenced in chapter 2 (see 2.3.2.1) applied to Area 7.	Animal and human interactions already occur within the study area; this addition will enhance these interactions, fostering more regular and meaningful experiences with the stray animal population.
6	D6	Weather	No	N/A	No further intervention is necessary at this time. Any future additions to the study area should not interfere with natural weather patterns as per biophilic design principles.
7	D7	Natural landscapes and ecosystems	Yes	1. A comparable approach similar to that of the Riparian Preserve in Gilbert, Arizona applied to Area 7. 2. The vegetation in Area 7 to include more variability to reflect the rich diversity of natural settings. Note: Ensure same variability for the addition of new vegetation in other areas.	This will offer the experience of natural landscapes and ecosystems that would otherwise be unavailable in an urban environment.
8	D8	Fire	Yes	1. Introducing outdoor firepits throughout communal areas.	This will offer direct experiences with fire and serve as communal focal points where residents can gather, socialize, and enhance their outdoor engagement.

Table 5.2: Strategies to Improve the Indirect Experiences of Nature in Alacaatlı

Strategies to Improve the Indirect Experiences of Nature in Alacaatlı					
#	**ID**	**Attribute**	**Can be improved?**	**Biophilic Design Strategy**	**Explanation**
1	I1	Images of nature	No	N/A	Given a sufficient level of opportunities for direct natural exposure, the incorporation of natural images is deemed unnecessary. Should any direct natural properties be considered inadequate in future scenarios and cannot be incorporated, this method may be employed. Such images could be integrated onto building facades, park benches, backs of signage, or even sun covers to enhance the integration between the built environment and nature.

2	I2	Natural materials	Yes	1. Modifying the concrete pathways within the recreational park areas 4 and 7 to utilize either wood or stone, while ensuring that functionality is maintained. 2. Replacing the metal signage throughout with a composition predominantly made of natural wood. Ensure these materials match the existing natural woods and stones already present in the area (see SWOT analysis Opportunities Item 3). 3. Repurpose the stone from the existing privacy walls (Figure 4.7) for the addition of new gabion walls in those areas (see SWOT analysis Opportunities Item 6).	These changes will increase the use of natural materials within the study area without significant intervention and the reliance on a large quantity of new materials.
3	I3	Natural colors	Yes	1. Staining the concrete sidewalks, pavements, and walls throughout the neighborhood with an earthy, light brown hue that incorporates subtle variations resembling soil.	The predominant unnatural color scheme in the study area arises from the solid, cool gray concrete sidewalks, pavements, and walls, which lack the variability found in natural environments and do not align with the warmer hues of the surrounding landscape. Implementing these changes will improve the integration of the built environment with its natural surroundings while maintaining overall uniformity. Furthermore, staining the concrete is a more cost-effective and feasible option compared to completely replacing the concrete features.
4	I4	Simulating natural light and air	No	N/A	Currently, no design intervention seems necessary as the simulated lighting was not excessive and did not appear to pose significant concerns regarding wildlife disruption or environmental impact. Should future intervention be required, an analysis of lighting temperatures and light emission levels should be conducted to develop spaces that effectively emulate natural lighting conditions and seasonal variations.
5	I5	Naturalistic shapes and forms	Yes	1. Incorporating the tree column design in Figure 2.9 into various elements of the built environment, such as fencing, street signage, and light posts as deemed suitable. 2. Finishing the incomplete sidewalk (Figure 4.12) with natural leaf impressions (Figure 2.10). Incorporate these leaf impressions to new pathways to be added or modified if deemed suitable.	These methods represent the most cost-effective and feasible solutions for incorporating more naturalistic shapes and forms into the existing built environment.

6	I6	Evoking nature	No	N/A	While no design interventions are currently required or feasible for the existing built environment, future developments, particularly substantial ones such as new buildings, should be designed to evoke natural elements. This approach would enhance the neighborhood's biophilic qualities and create a more aesthetically stimulating environment.
7	I7	Information richness	Yes	1. Incorporating a broader range of textural variations into the pathways in Areas 4 and 7. 2. Staining the concrete sidewalks throughout the neighborhood with an earthy, light brown hue that incorporates subtle variations (mentioned in item 3 of this table). 3. Enhancing the diversity and arrangement of vegetation in Area 7 to reflect the variability found in natural environments. Note: Ensure same variability for the addition of new vegetation in other areas.	Incorporating a broader range of textural variations into the pathways will enhance visual and sensory engagement and better harmonize with the surrounding rich vegetation abundant in those areas. For sidewalks, introducing diverse color variations through staining will add aesthetic interest without compromising their functionality and accessibility. This approach would help maintain the practical usability of the sidewalks while also being a more feasible and cost-effective alternative to a complete structural redesign. Creating a more diverse arrangement of vegetation will match the information richness found in nature.
8	I8	Age, change, and the patina of time	Yes	1. Increasing the use of materials prone to aging and weathering, such as wood, for signage, pathways, seating, and trash bins.	Given the abundance of these items throughout the study area, this approach can enhance the experience related to age, change, and the patina of time in a subtle yet consistent manner.
9	I9	Natural geometries	Yes	1. Implement a honeycomb design garden or pathway (Figure 2.13) in Areas 4 and 7. This design should be complemented using naturally aging materials, such as wood or stone, to enhance the biophilic experience. Incorporate this design to new pathways to be added or modified if deemed suitable. Note: The use of the hexagon shape found in the honeycomb design can be substituted for other natural geometric shape as long as it is conducive to a biophilic experience.	In addition to providing forms of natural geometries, incorporating different materials, shapes, and textures will contribute to a more aesthetically stimulating and information-rich environment.
10	I10	Biomimicry	Yes	1. Implement a honeycomb design garden or pathway (mentioned in item 9 of this table) in Areas 4 and 7. Incorporate this design to new pathways to be added or modified if deemed suitable. Note: The use of the hexagon shape found in the honeycomb design can be substituted for other natural geometric shape as long as it is conducive to a biophilic experience.	This is an effective means of demonstrating the efficiency and aesthetic appeal inherent in natural systems. It will help foster deeper connections with nature and a better understanding of the world and the experiences it offers.

Table 5.3: Strategies to Improve the Experience of Space and Place in Alacaatlı

Strategies to Improve the Experience of Space and Place in Alacaatlı					
#	**ID**	**Attribute**	**Can be improved?**	**Biophilic Design Strategy**	**Explanation**
1	SP1	Prospect and refuge	Yes	Prospect: N/A Refuge: 1. Areas 3, 5, and 6 utilize the same strategy of Areas 1 and 2 in terms of pairing vegetation with this fencing (Figure 4.15). 2. The recreational park areas of 4 and 7 should utilize vegetation such as bushes or trees to create a better experience of refuge.	Prospect: Given that the primary obstructions are related to buildings or elevation changes, it is not possible to determine feasible solutions at this time to improve the experience of prospect. Refuge: For the residential areas 3, 5, and 6, this approach will create natural barriers to provided visual privacy and noise separation, enhancing the sense of refuge. For the recreational park areas 4 and 7, the approach will enhance the sense of security and separation from adjacent streets and passing vehicles, while maintaining an open and accessible atmosphere without the use of traditional fencing.
2	SP2	Organized complexity	Yes	1. Incorporating more natural elements into the transitional spaces, such as trees, vegetation, and natural materials, textures, and colors.	This approach would enhance visual and tactile interest to be more consistent with the other areas, thereby enriching the overall complexity and engagement within the neighborhood.
3	SP3	Integration of parts to wholes	Yes	1. Incorporating a honeycomb design inspired by Zighizaghi (Figure 2.13) to the pathways, bench seating, planters, and trash bins. <u>Note:</u> The use of the hexagon shape found in the honeycomb design can be substituted for other natural geometric shape as long as it is conducive to a biophilic experience. 2. Creating an interconnected network of dry detention basins, gullies, and stormwater planters (also mentioned in item 3 of Table 5.1). 3. Ensure all vegetation is integrated in a cohesive manner	1. This will establish a cohesive theme for the neighborhood tying back to a larger display employed in the park areas. It will also reinforce a unifying theme through the use of wood, which will also be utilized in the wayfinding signage (see Table 5.2 items 2 and 8). 2. This will establish a cohesive theme for the neighborhood, characterized by dynamic water experiences that establish visual and functional connections between different areas. 3. This approach will facilitate a more holistic and interconnected landscape design, establishing unified aesthetic qualities between the various areas.

				throughout the various areas, rather than being isolated as standalone elements.	
4	SP4	Transitional spaces	Yes	1. Incorporating a honeycomb design inspired by Zighizaghi (Figure 2.13) to the transitional spaces connecting various residential and park areas. This should be done in the form of archways representing the entry and exit points of an area. Natural elements from the areas they connect should be integrated into the design. Note: The use of the hexagon shape found in the honeycomb design can be substituted for other natural geometric shape as long as it is conducive to a biophilic experience.	This approach will help ensure that the transitional spaces function as a seamless extension of the adjacent areas rather than as distinct or disparate environments. It will also reinforce the unifying themes present in the design of the archways.
5	SP5	Mobility and wayfinding	No	N/A	The study area exemplified effective mobility and wayfinding, in alignment with biophilic principles. The allocated spaces for both pedestrians and vehicles were adequately designed to facilitate unrestricted movement. Furthermore, the pathways were unobstructed and featured clear, ample signage throughout.
6	SP6	Cultural and ecological attachment to place	Yes	1. Incorporating more urban farms throughout the neighborhood; edible farms in Area 4 and aromatic farms along sidewalks.	Urban farms help establish a cohesive identity in addition to fostering a sense of community. This approach will not only strengthen communal bonds but also deepen residents' connection to their environment by instilling a sense of responsibility for engaging with and maintaining these agricultural spaces.

5.2 Plan and Renderings for the Proposed Biophilic Design Strategies for Alacaatlı

This section will illustrate the biophilic design strategies proposed in Section 5.1 to the study area in a visual format. Figure 5.1 will illustrate the strategies that can be depicted in the neighborhood plan view, while the subsequent figures will provide detailed representations of designs requiring further elaboration.

Note. The use of the hexagon shape found in the subsequent designs can be substituted for other natural geometric shape as long as it is conducive to a biophilic experience. The consistent application of the hexagonal pattern is attributed to its enhanced comprehensibility and legibility, as well as its role in establishing a cohesive theme and aesthetic within this work.

Figure 5.1 Neighborhood Plan Illustrating Proposed Biophilic Design Strategies for Alacaatlı

Note. Original map image from (Google Maps, 2024)

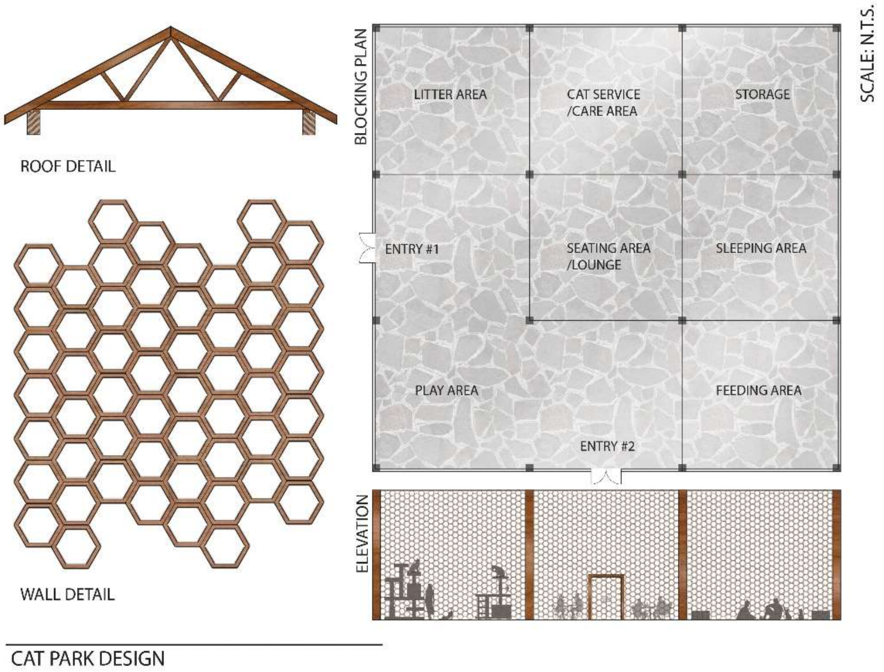

Figure 5.2 Cat Park Design

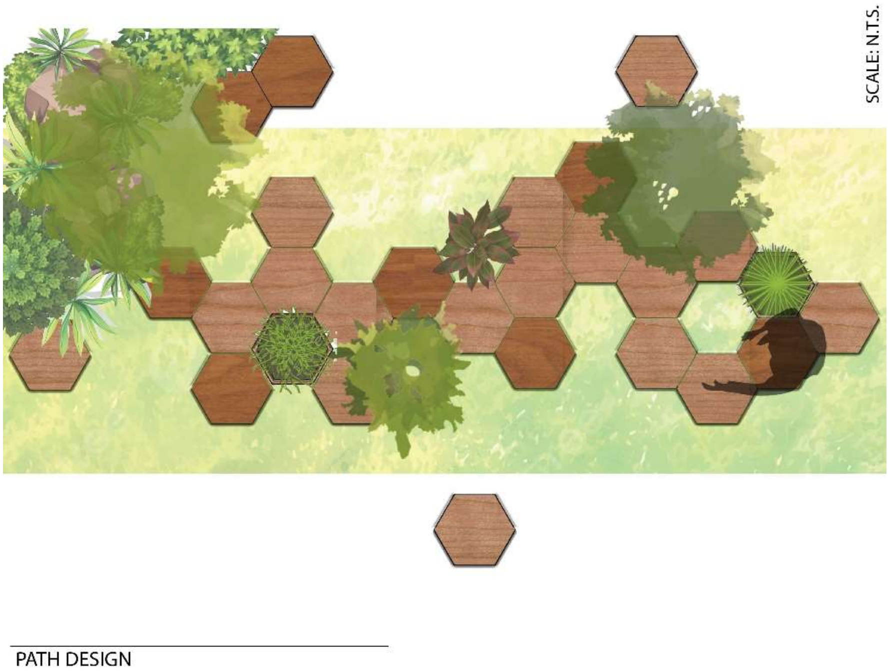

Figure 5.3 Path Design

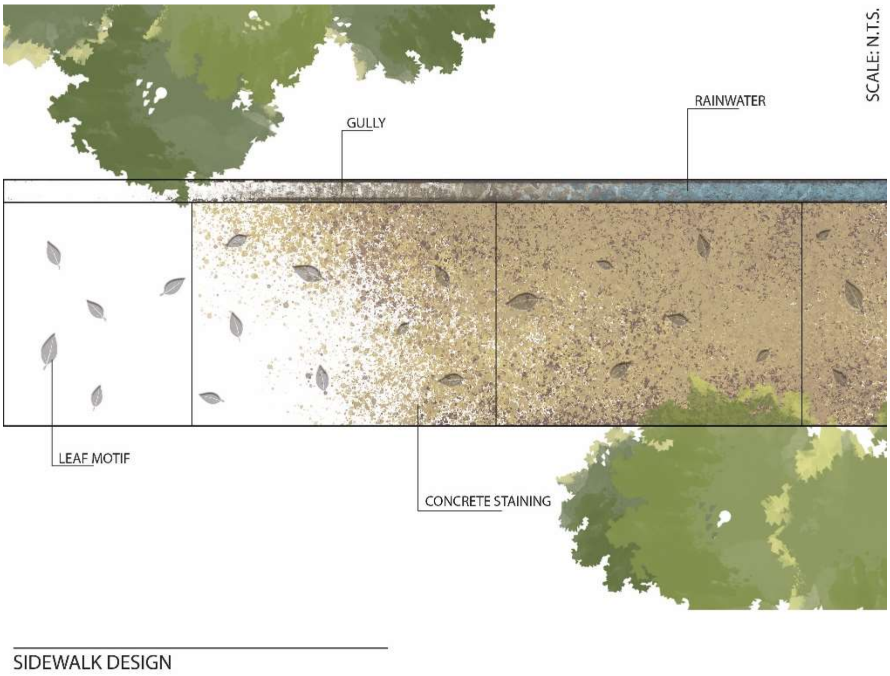

Figure 5.4 Sidewalk Design

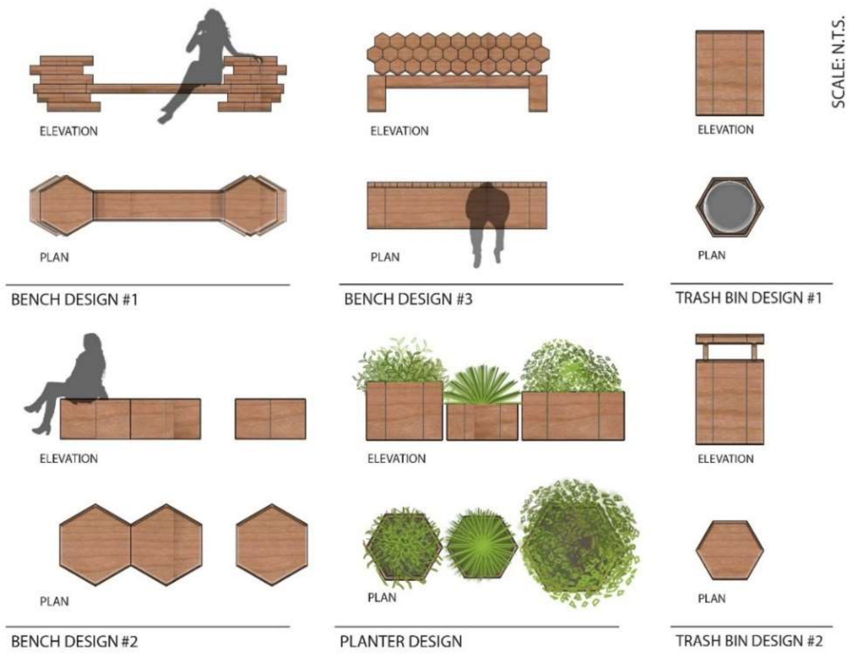

Figure 5.5 Bench, Planter, and Trash Bin Designs

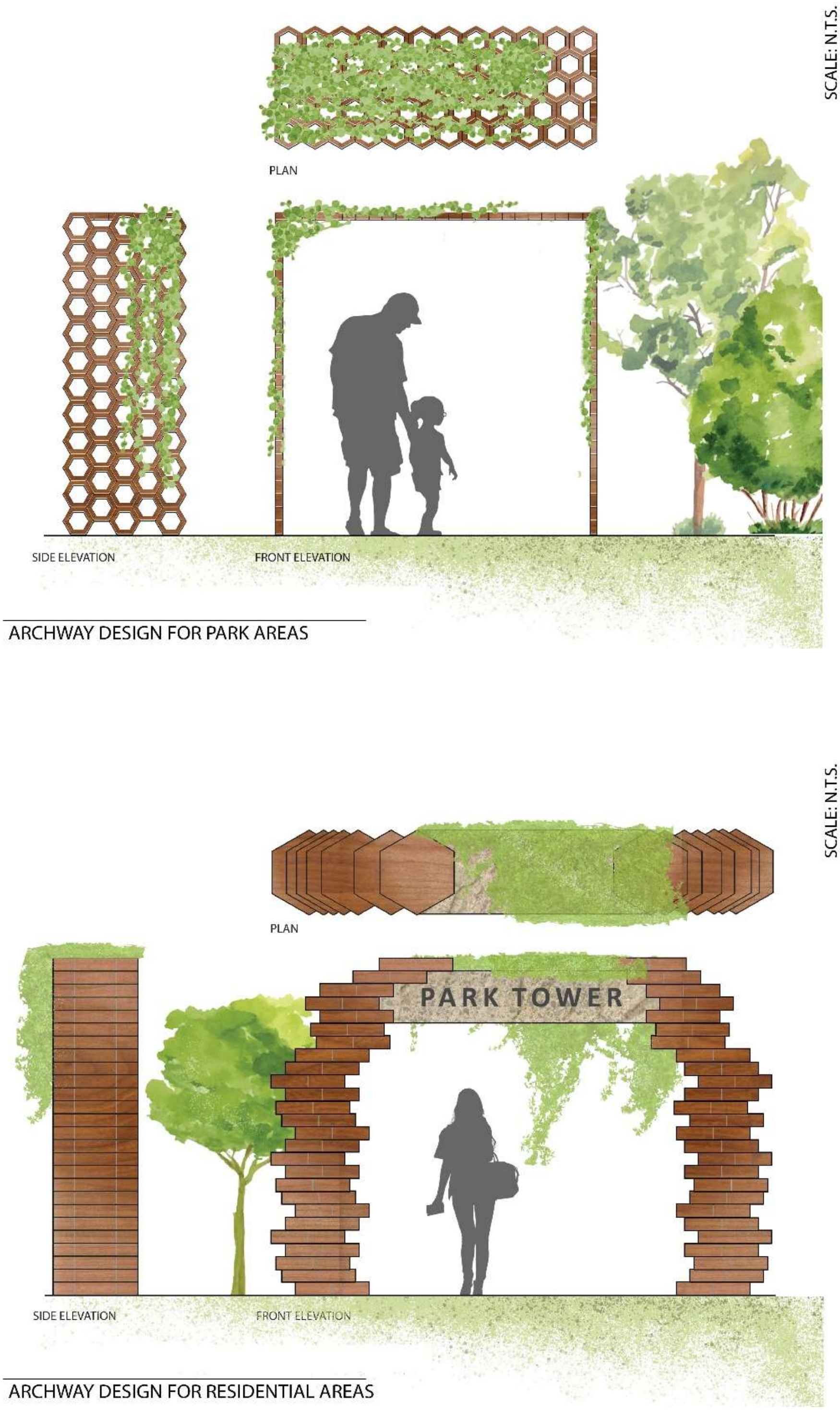

Figure 5.6 Archway Designs

5.3 Concluding Thoughts

"The 21st century will not be dominated by America or China, Brazil or India, but by the city" writes Parag Khanna in *Foreign Policy* (Khanna, 2010). Considering the United Nations' forecast that nearly 70% of the global population will reside in urban areas by 2050, it prompts the question: why not ensure these urban environments embrace biophilia? Singapore stands as a prime example, demonstrating that dense urban settings can foster a deep connection to nature while still preserving their necessary qualities and functions. Milwaukee is another example of incorporating biophilic design and providing solutions to problems attributable to urban environments. As urban areas expand and population density increases, problems will inevitably arise. It's imperative to not only prioritize biophilic solutions but also to elevate biophilic design to the forefront of urban development. With its multifaceted attributes, biophilic design stands as an indispensable component in our lives as biological beings amidst the evolving urban landscape.

The selection of the study area in the Alacaatlı neighborhood was made with this objective in mind. Alacaatlı, along with other neighborhoods in the Çayyolu District, exemplifies the newer developments in Ankara. The aim is to integrate biophilic design into the initial planning process and increase its prevalence through the development of new areas and the revitalization of existing ones. The study area in Alacaatlı served as an ideal pilot location for testing this approach. The area's recent construction resulted in a relatively simple and plain built environment, typical of new developments. However, there were still unique characteristics of the neighborhood that presented the challenge of incorporating biophilic principles in an existing environment. This study emphasizes that while existing built environments can be transformed into more biophilic spaces, it is crucial to acknowledge that not all biophilic principles can be fully integrated to achieve a truly comprehensive biophilic experience. This underscores the necessity of incorporating biophilic design principles from the outset of urban planning and development, rather than as an afterthought.

Furthermore, the study area's higher socio-economic population groups provided a unique opportunity to explore the implementation of biophilic design. While access to natural environments should ultimately be available to all, initiating such projects in areas with higher socio-economic status can help build the necessary momentum, allowing the benefits of biophilic design to expand and eventually reach lower socio-economic communities.

5.3.1 Notes on Limitations and Future Studies

While the case study section of this thesis provided a comprehensive overview over a longer period, the field observations were limited to a shorter timeframe during the summer season. It is essential to conduct a year-round analysis covering full seasonal patterns, alongside other unique site-specific experiences and conditions. This could be addressed and enhanced in future studies, enabling the implementation of more tailored biophilic design strategies. This study limitation also underscores the challenges posed by rapid urbanization in Ankara, where insufficient timeframes hinder comprehensive development plans and designs for the area. While rapid urbanization may initially fulfill housing and development requirements, it often leads to compromised long-term sustainability and quality of life stemming from the inadequate planning for the inevitable challenges of urbanization.

Another limitation worth mentioning is the unavailability of tools such as colorimeters or light meters to observe street lighting in Alacaatlı, which would have been a beneficial addition to the study (see 4.1.2). If this study is replicated in other locations or utilized in real construction scenarios, employing these tools is strongly recommended to ensure that street lighting and other forms of urban lighting harmonize effectively with the natural environment.

A final and crucial limitation of this study is regarding resource utilization and cost implications associated with implementing biophilic design principles. Although this study acknowledged the importance of reusing existing materials and avoiding costly design solutions, a more in-depth examination of these factors is necessary to assess the practicality and sustainability of development projects.

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APPENDIX

List of Recorded Plant Species in Alacaatlı					
#	**Common Name / Scientific Name**	**Native**	**Seasonal Changes**	**Leaf Color**	**Area(s)**
1	Alfalfa *(Medicago sativa)*	No	Bloom Time: Summer / Dormancy: Winter	Green, Blue, Yellow, Bronze	4, 6
2	American Basswood *(Tilia americana)*	No	Bloom Time: Late Spring, Summer / Dormancy: Winter	Green	4, 7
3	American Redbud *(Cercis canadensis 'JN2')*	No	Bloom Time: Spring / Dormancy: Winter	Green, Yellow, Red	7
4	Annual Bluegrass *(Poa annua)*	Yes	Bloom Time: Spring, Early Summer, Mid-Summer, Late Winter / Dormancy: Winter	Green	4
5	Apple *(Malus pumila)*	No	Bloom Time: Mid-Spring / Dormancy: Winter	Green	2
6	Apricot *(Prunus armeniaca)*	No	Bloom Time: Spring / Dormancy: Winter	Green	2
7	Arborvitae *(Thuja occidentalis)*	No	Bloom Time: Spring, Late Winter / Dormancy: Winter	Green, Yellow	2, 3
8	August Lily *(Hosta plantaginea)*	No	Bloom Time: Summer, Fall / Dormancy: Winter	Green	3
9	Bermuda Grass *(Cynodon dactylon)*	No	Bloom Time: Summer, Fall / Dormancy: Winter	Green, Gray, Silver	7
10	Black Locust *(Robinia pseudoacacia)*	No	Bloom Time: Mid-Spring, Late-Spring, Early Summer / Dormancy: Winter	Green, Blue, Yellow	4, 5
11	Black Mulberry *(Morus nigra)*	No	Bloom Time: Spring, Summer / Dormancy: Winter	Green, Yellow	2, 5, 6
12	Blue Fescue *(Festuca glauca)*	No	Bloom Time: Summer, Fall / Dormancy: Winter	Green, Blue	3
13	Box Elder *(Acer negundo)*	No	Bloom Time: Spring / Dormancy: Winter	Green, Yellow	2, 3, 5, 6
14	Butter-and-eggs *(Linaria vulgaris)*	Yes	Bloom Time: Summer, Early Fall, Mid-Fall / Dormancy: Winter	Green	6

16	California Fescue *(Festuca californica)*	No	Bloom Time: Summer, Fall / Dormancy: Winter	Green, Blue, Gray	3
17	California Privet *(Ligustrum ovalifolium)*	No	Bloom Time: Mid-Spring, Late-Spring, Early Summer / Dormancy: Winter	Green, Yellow	7
15	Caper Bush *(Capparis spinosa)*	Yes	Bloom Time: Late-Spring, Summer, Fall / Dormancy: N/A	Green	6
18	Cedar of Lebanon *(Cedrus libani)*	Yes	Bloom Time: Summer, Fall / Dormancy: N/A	Green, Silver, Blue, Gray	4
19	Cherry Plum *(Prunus cerasifera)*	Yes	Bloom Time: Spring / Dormancy: Winter	Green, Red, Yellow, Purple	1, 3, 4, 5, 6
20	Chinese Wisteria *(Wisteria sinensis)*	No	Bloom Time: Mid-Spring, Late-Spring, Early Summer, Fall / Dormancy: Winter	Green	6
21	Common Brighteyes *(Reichardia picroides)*	Yes	Bloom Time: Spring, Summer / Dormancy: N/A	N/A	3
22	Common Daisy *(Bellis perennis)*	Yes	Bloom Time: Spring, Early Summer, Mid-Summer / Dormancy: Winter	Green	2, 3, 4, 5, 7
23	Common Dandelion *(Taraxacum officinale)*	Yes	Bloom Time: Spring, Early Summer, Mid-Summer / Dormancy: Winter	Green	1, 2, 3, 4, 5, 6, 7
24	Common Fig *(Ficus carica)*	Yes	Bloom Time: Mid-Summer / Dormancy: Winter	Green	3
25	Common Hornbeam *(Carpinus betulus)*	Yes	Bloom Time: Spring, Fall / Dormancy: N/A	Green, Yellow, Orange	4, 7
26	Common Juniper *(Juniperus communis)*	Yes	Bloom Time: Late-Spring, Early Summer, Mid-Summer / Dormancy: Winter	Green, Blue, Gray, Silver	3, 7
27	Common Pear *(Pyrus communis)*	Yes	Bloom Time: Early Spring, Mid-Spring / Dormancy: Winter	Green, Red, Orange	4
28	Common Purslane *(Portulaca oleracea)*	Yes	Bloom Time: Mid-Spring, Late-Spring, Summer, Fall / Dormancy: Winter	Green, Red, Purple	2
29	Coralberry *(Symphoricarpos orbiculatus)*	No	Bloom Time: Summer / Dormancy: N/A	Green, Blue	7
30	Crepe Myrtle *(Lagerstroemia indica)*	No	Bloom Time: Mid-Summer, Late-Summer, Early Fall, Mid-Fall / Dormancy: Winter	Green, Yellow, Orange, Bronze	7
31	Curly Dock *(Rumex crispus)*	Yes	Bloom Time: Summer / Dormancy: Winter	Green, Yellow, Red	3, 7
32	Curry Plant *(Helichrysum italicum)*	Yes	Bloom Time: Summer, Early Fall / Dormancy: Winter	Silver, Gray	3

33	Dawn Redwood *(Metasequoia glyptostrobodides)*	No	Bloom Time: Early Spring, Mid-Spring, Late-Winter / Dormancy: Winter	Green, Yellow	3
34	Deodar Cedar *(Cedrus deodara)*	No	Bloom Time: Fall / Dormancy: Winter	Green, Blue, Gray	3, 6
35	Dyer's Weed *(Reseda luteola)*	Yes	Bloom Time: Summer / Dormancy: N/A	Green, Yellow, Bronze	3
36	Empress Tree *(Paulownia tomentosa)*	No	Bloom Time: Spring / Dormancy: Winter	Green	7
37	English Ivy *(Hedera helix)*	Yes	Bloom Time: Summer, Fall / Dormancy: Winter	Green, White, Yellow, Variegated	2
38	English Lavender *(Lavandula angustifolia)*	No	Bloom Time: Mid-Spring, Late-Spring, Summer / Dormancy: Winter	Green, Gray, Silver	5, 7
39	English Walnut *(Juglans regia)*	Yes	Bloom Time: Mid-Spring, Late-Spring, Early Summer / Dormancy: Winter	Green	2
40	European Plum *(Prunus domestica)*	No	Bloom Time: Early Spring, Mid-Spring / Dormancy: Winter	Green	2
41	Evergreen Rose *(Rosa sempervirens)*	Yes	Bloom Time: Summer / Dormancy: N/A	Green	6
42	Field Bindweed *(Convolvulus arvensis)*	Yes	Bloom Time: Summer, Fall / Dormancy: Winter	Green	4
43	Field pumpkin *(Cucurbita pepo)*	No	Bloom Time: Summer, Early Fall / Dormancy: Winter	Green	2
44	Flaxleaf Fleabane *(Erigeron bonariensis)*	No	Bloom Time: Mid-Summer, Late-Summer, Fall / Dormancy: Winter	Green, Gray, Silver	6
45	Franchet's Cotoneaster *(Cotoneaster franchetii)*	No	Bloom Time: Summer / Dormancy: N/A	Green, Silver	7
46	Fringed Rue *(Ruta chalepensis)*	No	Bloom Time: Summer / Dormancy: Winter	Green, Blue	2
47	Garden Sorrel *(Rumex acetosella)*	Yes	Bloom Time: Summer, Fall / Dormancy: Winter	Green	4
48	Giant Reed *(Arundo donax)*	Yes	Bloom Time: Summer, Fall, Early Winter / Dormancy: Winter	Green, Blue, White, Gray, Silver, Variegated	7
49	Green Ash *(Fraxinus pennysylvanica)*	No	Bloom Time: Spring / Dormancy: Winter	Green	5
50	Heartleaf Bergenia *(Bergenia crassifolia)*	No	Bloom Time: Spring, Summer, Fall / Dormancy: N/A	Green, Red	4

51	Hinoki Cypress *(Chamaecyparis obstusa)*	No	Bloom Time: Spring / Dormancy: Winter	Green, Yellow	3, 5
52	Hooked Bristlegrass *(Setaria verticillata)*	No	Bloom Time: Summer, Early Fall / Dormancy: N/A	N/A	1, 2, 3, 4, 5, 6, 7
53	Horseweed *(Erigeron canadensis)*	No	Bloom Time: Summer, Fall / Dormancy: Winter	Green	3
54	Italian Buckthorn *(Rhamnus alaternus)*	Yes	Bloom Time: Early Spring, Late-Spring, Early Summer, Late-Winter / Dormancy: N/A	Green, White, Silver	7
55	Italian Stone Pine *(Pinus pinea)*	Yes	Bloom Time: Spring, Early Summer / Dormancy: N/A	Green	3, 6
56	Japanese Cherry *(Prunus serrulata)*	No	Bloom Time: Spring / Dormancy: Winter	Green	2, 7
57	Japanese Honeysuckle *(Lonicera japonica)*	No	Bloom Time: Mid-Spring, Late-Spring, Summer / Dormancy: Winter	Green	3, 6
58	Judas Tree *(Cercis siliquastrum)*	No	Bloom Time: Spring, Early Summer / Dormancy: N/A	Green, Yellow, Bronze	7
59	Kikuyu Grass *(Cenchrus clandestinus)*	No	Bloom Time: Spring, Late-Summer, Fall, Winter / Dormancy: Winter	N/A	3
60	Large-leaved Lime *(Tilia platyphyllos)*	No	Bloom Time: Late-Spring, Summer / Dormancy: N/A	Green, Yellow	4
61	Lawson's Cypress *(Chamaecyparis lawsoniana)*	No	Bloom Time: Spring / Dormancy: Winter	Green, Blue, Yellow	4
62	Lemon Balm *(Melissa officinalis)*	No	Bloom Time: Late-Spring, Summer, Early Fall, Mid-Fall / Dormancy: Winter	Green	7
63	Lesser Burdock *(Arctium minus)*	No	Bloom Time: Summer, Early Fall / Dormancy: Winter	Green, White	7
64	Martitime Pine *(Pinus pinaster)*	No	Bloom Time: Spring / Dormancy: N/A	Green	6
65	Mediterranean Cypress *(Cupressus sempervirens)*	Yes	Bloom Time: Spring, Mid-Winter, Late-Winter / Dormancy: N/A	Green	1, 2, 3, 4, 5, 7
66	Milkflower Cotoneaster *(Cotoneaster coriaceus)*	No	Bloom Time: Summer / Dormancy: Winter	Green, White, Gray	4, 7
67	Mirror Plant *(Coprosma repens)*	No	Bloom Time: Spring, Summer / Dormancy: N/A	Green	3
68	Mother of Millions *(Kalanchoe tubiflora)*	N/A	Bloom Time: Spring, Winter / Dormancy: Summer	Green, Red, Silver, Gray, Brown	3

69	Mulberry *(Morus alba)*	Yes	Bloom Time: Spring / Dormancy: Winter	Green	3, 6
70	Narrow-leaved Ash *(Fraxinus angustifolia)*	No	Bloom Time: Spring / Dormancy: Winter	Green, Yellow, Red, Gold, Purple	7
71	Narrow-leaved Ragwort *(Senecio inaequidens)*	No	Bloom Time: Summer, Fall / Dormancy: N/A	N/A	6
72	Old Man's Beard *(Clematis vitalba)*	Yes	Bloom Time: Summer, Fall / Dormancy: N/A	Green	6
73	Orange Wattle *(Acacia saligna)*	No	Bloom Time: Spring, Late-Winter / Dormancy: N/A	Green	4
74	Oriental Arborvitae *(Platycladus orientalis)*	No	Bloom Time: Spring / Dormancy: Winter	Green, Blue, Yellow	5
75	Panicle Hydrangea *(Hydrangea paniculata)*	No	Bloom Time: Summer, Fall / Dormancy: Winter	Green	7
76	Perennial Ryegrass *(Lolium perenne)*	Yes	Bloom Time: Late-Spring, Summer, Early Fall / Dormancy: Summer	Green	1, 2, 3, 4, 5, 6, 7
77	Perennial Wall-rocket *(Diplotaxis tenuifolia)*	Yes	Bloom Time: Spring, Summer, Fall / Dormancy: Winter	Green	2, 3, 4
78	Plumleaf Crab Apple *(Malus prunifolia)*	No	Bloom Time: Spring / Dormancy: Winter	Green	7
79	Prickly Lettuce *(Lactuca serriola)*	Yes	Bloom Time: Summer, Fall / Dormancy: Winter	Green	3
80	Purple Loosestrife *(Lythrum salicaria)*	Yes	Bloom Time: Summer / Dormancy: Winter	Green	7
81	Purple Toadflax *(Linaria purpurea)*	No	Bloom Time: Late-Spring, Summer, Fall / Dormancy: Winter	Green, Gray, Silver	3
82	Red Clover *(Trifolium pratense)*	No	Bloom Time: Late-Spring, Summer / Dormancy: Winter	Green, Blue	4
83	Red Osier Dogwood *(Cornus sericea)*	No	Bloom Time: Summer / Dormancy: Winter	Green, Yellow	7
84	Redroot Amaranth *(Amaranthus retroflexus)*	No	Bloom Time: Summer, Fall / Dormancy: Winter	Green	4
85	Ribwort Plantain *(Plantago lanceolata)*	Yes	Bloom Time: Mid-Spring, Late-Spring, Summer / Dormancy: Winter	Green	3, 4
86	Rockspray Cotoneaster *(Cotoneaster horizontalis)*	No	Bloom Time: Mid-Spring, Late-Spring, Early Summer, Mid-Summer / Dormancy: Winter	Green, Red, Orange	7

87	Rose of Sharon *(*Hibiscus syriacus)	No	Bloom Time: Mid-Summer, Late-Summer, Fall / Dormancy: Winter	Green	4
88	Rosemary *(Salvia rosmarinus)*	No	Bloom Time: Late-Spring, Summer, Fall / Dormancy: Winter	Green, Gray	7
89	Rough Hawkbit *(Leontodon hispidus)*	No	Bloom Time: Spring, Summer, Fall / Dormancy: N/A	Green	4
90	Rough Horsetail *(Equisetum hyemale)*	No	Bloom Time: Mid-Spring, Late-Spring, Early Summer / Dormancy: Winter	Green	6
91	Russian Sage *(Perovskia atriplicifolia)*	No	Bloom Time: Summer, Fall / Dormancy: Winter	Green, Gray, Silver	3
92	Savin Juniper *(Juniperus sabina)*	Yes	Bloom Time: Mid-Spring / Dormancy: N/A	Green	3, 7
93	Sessile Oak *(Quercus petraea)*	Yes	Bloom Time: Spring, Early Summer / Dormancy: N/A	Green, Orange, Brown	7
94	Shepherd's Purse *(Capsella bursa-pastoris)*	No	Bloom Time: Spring, Early Summer, Mid-Summer / Dormancy: Winter	Green	3
95	Shortpod Mustard *(Hirschfeldia incana)*	Yes	Bloom Time: Spring, Summer, Fall / Dormancy: Winter	Green	3
96	Siberian Dogwood *(Cornus alba)*	No	Bloom Time: Spring, Early Summer, Mid-Summer / Dormancy: N/A	Green, Yellow, White, Variegated	7
97	Siberian Elm *(Ulmus pumila)*	No	Bloom Time: Spring / Dormancy: Winter	Green, Blue, Yellow	4, 6
98	Silver Birch *(Betula pendula)*	No	Bloom Time: Spring / Dormancy: Winter	Green, Yellow	5, 6
99	Silver Maple *(Acer saccharinum)*	No	Bloom Time: Spring / Dormancy: Winter	Green, Yellow, Red, Gray, Silver	7
100	Slender Sowthistle *(Sonchus tenerrimus)*	No	Bloom Time: Spring, Summer / Dormancy: N/A	N/A	3
101	Small-leaved Elm *(Ulmus minor subsp. minor)*	Yes	Bloom Time: Late-Spring, Early Summer / Dormancy: N/A	Green	5
102	Small-leaved Lime *(Tilia cordata)*	No	Bloom Time: Late-Spring, Summer / Dormancy: Winter	Green, Yellow	7
103	Sweet Cherry *(Prunus avium)*	Yes	Bloom Time: Early Spring, Mid-Spring / Dormancy: Winter	Green, Orange, Red	2
104	Sweet Chestnut *(Castanea sativa)*	Yes	Bloom Time: Spring, Summer / Dormancy: Winter	Green, Variegated	2
105	Sycamore *(Acer pseudoplatanus)*	No	Bloom Time: Spring, Early Summer / Dormancy: N/A	Green, Yellow	7

106	Tatarian Honeysuckle *(Lonicera tatarica)*	No	Bloom Time: Spring, Early Summer / Dormancy: Winter	Green, Blue	7
107	Tea Rose *(Rosa hybrida)*	N/A	Bloom Time: Late-Spring, Summer, Early Fall / Dormancy: Winter	Green, Gold	1, 2, 6
108	Teak *(Tectona grandis)*	No	Bloom Time: Summer / Dormancy: N/A	Green	7
109	Tomato (*Solanum lycopersicum)*	No	Bloom Time: Summer, Fall / Dormancy: Winter	Green	2
110	Tree of Heaven *(Ailanthus altissima)*	No	Bloom Time: Late-Spring, Early Summer / Dormancy: Winter	Green, Red	1, 2, 3
111	Virginia Creeper *(Parthenocissus quinquefolia)*	No	Bloom Time: Early Summer, Mid-Summer / Dormancy: Winter	Green, Red, Orange	1, 2, 6
112	White Campion *(Silene latifolia)*	No	Bloom Time: Summer, Fall / Dormancy: Winter	Green	4
113	White Clover *(Trifolium repens)*	Yes	Bloom Time: Late-Spring, Summer / Dormancy: Winter	Green, White, Variegated	7
114	White Mulberry 'Pendula' *(Morus alba 'Pendula')*	N/A	Bloom Time: N/A / Dormancy: Winter	Green	2, 5
115	White Stonecrop *(Sedum album)*	No	Bloom Time: Spring, Summer / Dormancy: Winter	Green, Red	3
116	Wine grape *(Vitis vinifera)*	No	Bloom Time: Mid-Spring, Late-Spring, Early Summer / Dormancy: Winter	Green	2, 5

Note. The plant data utilized in this study was gathered through the mobile applications 'Picture This' and 'PlantIn', which was subsequently validated by cross-referencing with the online database of Glority LLC, PlantIn, and official documents obtained from the Ankara Metropolitan Municipality. (Glority LLC, 2017) (PlantIn, 2020) (Güleç & Çevre ve Peyzaj Akademisi) (Orman Bakanlığı DKMP Biyoçeşitlilik Dairesi, 2014) (T.C. Ankara Büyükşehir Belediyesi, n.d.)