Landscape Research

III

Editors

Öner DEMİREL

Ertan DÜZGÜNEŞ

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Landscape Research III

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PREFACE

Dear Professors, Colleagues

We are once again, for the third time, happy to realize the Landscape Research-III (English) and Landscape Research-III (Turkish) books, which we have edited together with Assoc. Prof. Dr. Ertan DÜZGÜNEŞ, with your academic contributions and support.

The achievements of the Turkish Journal of Landscape Research (PEYAD), which we have brought to the academic portfolio of landscape architecture and which has been going on for 6 years, created a driving and encouraging force for us to prepare the edited books we named "Landscape Research-I/II" and "Landscape Research-I/II" in 2021 and 2022. This year, we are happy to realize the third edition of both books.

In 2023, "Landscape Research-III" in English and "Landscape Research-III" in Turkish will be available both as e-books and in print (for a fee-color/colorless) and the printed book will be delivered to those who request it. Our professors who sent their academic studies/book chapters to both books as book chapters sent their book chapters by choosing Landscape Research-III in English or Landscape Research-III in Turkish according to their own wishes. Both books were published by the French publishing house "Livre de Lyon" and we have shared with you the information conveyed to us by the publishing house (indexes scanned, having contents and competencies covering academic applications in the academic sense / compliance with the Application Criteria for Doctorate and Academic Incentive Applications).

Landscape Research-III book with 12 chapters and Landscape Research-II book with 16 chapters were published. We are proud to have reached these numbers with your contributions and support.

We wish to continue this process that we have started in the coming years. Thus, we will ensure the continuity of Landscape Research (English) and Landscape Research (Turkish) books with successive issues.

We would like to thank the editorial board who contributed to the editorial process, the SEKİZGEN Academic Platform and Livre de Lyon Publishing House and its officers who followed the process successfully. The biggest thank you goes to you, our esteemed book chapter authors, for sharing your qualified and valuable works with us.

September 2023

Editors
Prof. Dr. Öner DEMİREL
Assoc. Prof. Dr. Ertan DÜZGÜNEŞ

Prof.Dr.Öner DEMİREL, Landscape Architect, T.C. Kırıkkale University Head of Department of Landscape Architecture, Faculty of Fine Arts

• He was born in Ardahan in 1964. He graduated from Ege University Faculty of Agriculture, Department of Landscape Architecture in 1985. In 1988, he completed his Master's Degree in Landscape Architecture at Ege University Institute of Science and Sciences. and in 1997, he completed his PhD in Landscape Architecture at K.T.U. Science Institute.

• Between 1987 and 1992, he worked at the T.C Ministry of Forestry. Between 1992 and 2017, he served as an academician at Karadeniz Technical University. He was appointed Assistant Professor in 1998, Associate Professor in 2000 and Professor in 2007.

• Between 1990-91, he received the CIHEAM Scholarship, Montpellier (France) and from 1991-92 he received the CIHEAM Scholarship and the Saragosa (Spain) Scholarship. He was granted three Belgian Government scholarships in 1994, 1996 and 2000. Ağustos Between 2001 and June 2002, he conducted research at Arizona State University. Between August 2011 and February 2012, he conducted research at Northern Arizona University with the support of the Research Abroad Project. In 2015, he was granted a 1-year TUBITAK Postdoctoral Research Fellowship (Purdue University/USA).

• In addition to environmental and nature protection organizations, he also served voluntarily in non-governmental organizations and served as of various non-governmental organizations president ***(President of Belediyespor Tennis Club, TEMA Provincial Representative, TMMOB Trabzon Chamber of Landscape Architects Provincial Representative, Head of Mountain Protection Platform)***.

• In addition to the research projects supported by Corporate organizations, TUBITAK, Universities and various research Institutions, which he has managed and completed with wide participation at home and abroad as director and researcher, there are books and book chapters that he has edited and he also serves on the editorial board in scientific journals published at home and abroad. He has served on the scientific committees of international and national conferences, congresses and symposiums, and has published articles in indexed journals and numerous papers presented abroad and at home.

- Öner Demirel has been serving as head of the Department of Landscape Architecture at The Faculty of Fine Arts, Kırıkkale University since January 2018. He speaks fluent English and French and is married with two children.

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He was born in Ankara in 1982. After completion of his elementary, middle and high school education in Trabzon, he got his Bachelors degree from Karadeniz Technical University, School of Forestry, Landscape Architecture Department in 2005. In 2007, he was appointed as a research assistant at the Department of Landscape Architecture at the Faculty of Forestry of K.T.U. In the same year, he worked on "Contradictions Strategy in Protected Areas" and "Negative Effects of Tourism on Highland Areas" for six months at Bodenculture University (Vienna-AUSTRIA) with the ERASMUS program. Then, he got his Masters degree in 2009 and Ph.D. degree in 2015 from Karadeniz Technical University, Institute of Natural and Applied Sciences. He is now working as Assoc. Prof. at Karadeniz Technical University in Trabzon since 2018. He has several studies and papers published in various academic journals in English and in Turkish on his primary research interests, which are including nature conservation, protected areas, national parks, visitor management in national parks, conflict strategies, participatory approach, tourism and recreation planning, alternative tourism.

REFEREES

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CHAPTER I

USE OF STREET FURNITURE IN CAMPUS LANDSCAPE

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1. Introduction

Since the beginning of human existence, humans have felt a special sense of space for themselves due to the need for protection from the negative effects of nature. Over time, spaces have emerged that meet personal needs and vary depending on the socio-economic and cultural structures of societies. These spaces are called public spaces, and they are the places where people carry out functions such as living, working, resting, having fun, and transportation.

Cities are made up of different spaces that come together, including private spaces (land, plot, garden, etc.), semi-private spaces (front and side yards in houses with gardens, balconies in apartment layouts, etc.), public spaces (squares, streets, parks, avenues, etc.), and semi-public spaces (courtyards, shared gardens, parking lots, stairwells, etc.). The commercial, industrial, educational, business and healthcare areas that make up this whole are the areas that society frequently interacts with, and they are the places where all activities of collective life are carried out (Sisman and Gültürk, 2016).

Public spaces are where urban residents encounter each other and communicate, and the important functions provided by public spaces can be summarized as follows (Akyol, 2006):

1- Meeting Psychological and Sensory Needs: Boredom, pleasure, imagination, exploration, travel, being intertwined or isolated in a crowd, silence or movement, speed or slowness, recognition of places, symbols of communal life.

2- Facilitating Social Relationships: Spontaneous or individual and communal initiatives, planned encounters, chance encounters, exchange of information, trust, waiting, aimless wandering, culture, performances, different types of communication, educational and recreational activities.

3- Facilitating Economic Exchange: Services, trade, business, facilitating economic exchange in each sector with specific conditions that do not have the same relationships as shared spaces.

4- Providing Useful Transportation: Comfortable conditions for adapting to every mode of transportation, including pedestrians, vehicles, baby carriages, disabled persons' transportation, bicycles, motorcycles, public transportation, buses, etc.

The needs of urban dwellers in public spaces are met through street furniture (Ozaydın et al., 1991). Street furniture is important in defining the space it is located in, establishing a relationship between the past and future of the city, adding visual appeal and identity to the city, contributing to the urban ecology, balancing the relationship between urban dwellers and nature, improving the quality of life of urban dwellers, and creating livable spaces (Sakal, 2007; Bayraktar et al., 2008).

Street furniture is defined as a system consisting of products that aim to meet the evolving needs of users through specific processes in conjunction with the concept of the city (Hacıhasanoglu, 1991). According to Basal (2000), it must possess certain characteristics such as aesthetic appeal, functionality, ease of application, durability, compliance with standards, ergonomics, ease of maintenance, portability, resistance to vandalism, and ease of assembly and finding spare parts. Akyol (2006) suggests that it should be placed in accordance with the needs of the people using the area in which they will be located and should support social relations among users.

2. Classification of Street Furniture

Yıldızcı (2001) classified the street furniture into the following categories:

- Paving materials (concrete, stone, wood, asphalt, brick etc.),
- Seating facilities (benches, group seating),
- Outdoor lighting (road and area lighting elements),
- Signage and information boards (direction and location markers, information communication boards),
- Border elements (fencing, parapets, walls),
- Water features (ornamental pools, fountains),
- Canopies (stops, canopies, pergolas),
- Sales stands (kiosks, food truck, newspaper stands),
- Art objects (sculptures, memorials),
- Children's play equipments,
- Other elements (waste bins, plant pots, bicycle parking areas, clock towers, flagpoles, fire hydrants etc.).

Paving material refers to the horizontal two-dimensional plane of space that carries the use of a public area, and when covered with a paving material according to its intended use, it is evaluated as paving. In other words, paving is a hard surface that is consciously designed with a natural or artificial material in line with the design purposes of the ground level (Booth, 1983). Paving materials should be non-slip and not create a tripping hazard and should not reflect light. Concrete pavement blocks and paving stones used on sidewalks should be made of materials that can be removed and replaced with new ones. Also, care should be taken to avoid surfaces with holes that high heels can get caught in, as well as any protrusions such as iron studs, concrete, or any other bump that may cause tripping hazards, especially in pedestrian areas (Uzun, 2002). Paving materials are used in crowded areas where people can form lines, such as main roads, squares, dining areas, bus stops, train stations, cinema and theater exits, and around vending machines (Evyapan and Toklu, 2000). Concrete, asphalt, gravel, natural stone, base brick, interlocking paving stones, concrete cube stones, concrete slab stones, andesite, travertine stone, wood, epoxy, and rubber paving are commonly used outdoor paving materials (Figure 1).

Figure 1: Paving materials samples (Source: URL-1, 2021)

Seating facilities are used in public spaces to meet the need for activities such as resting, chatting, waiting for someone, or simply spending time, to create social spaces in the city, to bring people to a desired place, and to create communities (Akyol, 2006). They should be designed in accordance with anthropometric measurements, visually pleasing and compatible with both the environment and other urban elements (Kentsel Tasarım Kılavuzu Calısma Grubu, 1992). Their types include fixed and movable, with or without backrests and armrests, with steel, concrete, or cast-iron frameworks, and with concrete or other material legs. Materials such as concrete, metal alloys, wood, and plastic are frequently used to make them permanent and durable in outdoor spaces (Figure 2).

Figure 2: Seating facilities samples (Lodz-Polond; Wroclaw-Polond)
(Source: Kurt Konakoglu Archive)

Outdoor lighting is used in public spaces to enable us to perceive spaces and objects therein in their true size and natural colors by projecting light onto them with natural and artificial light sources (Isık, 2003). The main purpose of lighting is not to achieve a certain level of brightness, but rather to ensure visual comfort (Ünver, 2001). Outdoor lighting is the most prominent elements that affect the character of urban spaces (Haris and Dines, 1988). Its dimentions should be 3-4 m in height for pedestrian walkways, 4.5-6 m for streets, 7.5-9 m for avenues, and 10-12 m for main roads or bypasses. It should be visually accessible, has the most appropriate brightness level, and be in the most appropriate position (Serefhanoglu, 1991; Uzun, 2002) (Figure 3).

Figure 3: Outdoor lightings samples (Source: URL-1, 2021)

Signage and information boards are the elements that facilitate communication in public spaces, regulate the relationship between people and their surroundings, and organize the flow of information through signs (Alpagut, 2005). It is important for signage and information boards to be close to human scale, meaning that they should be neither too large nor too small in relation to the size of humans. They can be made from various materials such as neon, stone, wood, glass, aluminum, steel, ceramic, and cast metal (Akyol, 2006; Celik, 2015; Kurdoglu and Celik, 2016) (Figure 4).

Figure 4: Signage and information board samples (Wroclaw-Polond; Atlanta-ABD) (Source: Kurt Konakoglu Archive)

Border elements ensure the control of people's relationships with their surroundings in public spaces. There is a need for privacy and protection for both physical and technical aspects of a person's relationship with the environment. The main purpose of border elements in public spaces is to provide privacy, safety, security, aesthetics, boundary definition, speed, and circulation control. It is important for them to be close to human scale and not exceed 180 cm. They can be made of inert materials such as stone, brick, concrete, block, wood, metal, plastic, as well as living materials like plants (Akyol, 2006; Celik, 2015) (Figure 5).

Figure 5: Border element samples (Chicago-ABD; Antalya-Turkey) (Source: Kurt Konakoglu Archive)

The water features are used in public spaces to provide people with a sense of peace and relaxation. Water features are classified into still water elements, such as ornamental pools, artificial ponds, and marsh gardens, and moving water elements, such as fountains (Booth, 1983). The use of water elements is influenced by factors such as landscaping, lighting, sound and light displays, and enrichment with artistic objects (Akyol, 2006; Celik, 2015; Kurdoglu and Celik, 2016) (Figure 6).

Figure 6: Water features samples (Milenyum Park, Chicago-ABD; Paley Park, New York-ABD) (Source: Kurt Konakoglu Archive)

Canopies are used in urban pedestrian areas, parks, and recreational areas to reduce the effects of sun and wind in seating and picnic areas. They are suitable for covering large areas, creating bright spaces, developing new forms in architecture, and providing spaces with a different appearance or color. They are usually designed in conjunction with seating units (Akyol, 2006; Celik, 2015). Canopies have functions such as shading, emphasizing, creating viewing spaces, connecting, providing seating and resting areas, creating protected spaces, and adding a three-dimensional aspect to spaces. They are frequently used in bus stops, sports facilities, amusement parks, botanical gardens, public buildings, fairs, exhibitions, and shopping centers. Structural elements such as pergolas, awnings, and umbrellas can be used as canopy elements, as well as vegetative elements. In addition, hanging and tension systems such as tarpaulins, awnings, and space frame systems are also used to cover large openings. While their widths vary depending on their intended use, they are usually adjusted according to the angle of the sun's rays (Akyol, 2006; Celik, 2015; Percin and Kaymaz, 2020) (Figure 7).

Figure 7: Canopies samples (Source: URL-1, 2021)

Sales stands are urban infrastructure elements where newspapers, magazines, books, food, and drinks that people would want to access immediately are sold, placed in locations with high pedestrian traffic such as intersection points, bus stops, train and metro stations, ferry terminals, and suitable corners in parks. They can be classified as kiosks, ATMs, and modular cabin units (Zülfikar, 1998) (Figure 8).

Figure 8: Sales stands samples (Amasya-Turkey; Zakopane-Polond; Floransa-Italy) (Source: Kurt Konakoglu Archive)

Art objects are three-dimensional works of art, sculptures, carvings or plastic objects created by sculpting, casting, or molding materials such as stone, bronze, clay, iron, gypsum, wood, or ivory, which are used in public spaces. Art objects are positioned to create a focal point, attract attention, or convey a message to people (Booth, 1983). The relationship between the object and the background is important in the positioning of an art object. In situations where the details of an art object are important and especially when they are

intended to be highlighted, the object can be placed on a plain background and illuminated. In addition, plant elements can also be used to emphasize the object (Akyol, 2006; Celik, 2015) (Figure 9).

Figure 9: Art objects samples (New York-ABD; Chicago-ABD) (Source: Kurt Konakoglu Archive)

Children's play equipments provide children with the opportunity to play in safe and healthy environments that meet their physical and climatic needs in public spaces (Aslanboga, 1990). They should allow children to develop their imagination and be functional and durable in a way that captures their interest. Since each children's play equipments unique designs, there is no ideal prototype design for playground elements (Akyol, 2006; Celik, 2015) (Figure 10).

Figure 10: Children's play equipments samples (Source: URL-1, 2021)

Waste bins provide a way for people to dispose of waste in public spaces and protect them until they can be collected and transported using appropriate means. Their size is related to the frequency of emptying (Mukodo, 1989). When

designing the wasste bins, not only daytime but also nighttime use should be considered, and the emptying frequency should be considered when determining the placement. They should be able to not only retain the waste but also conceal them properly. They should be durable against environmental conditions and made of non-flammable materials. They should be designed to be of sufficient width, waterproof, and prevent the scattering of waste (Yücel, 2006; Bayraktar et al., 2008). In addition to being environmentally friendly, the waste bins should also be ergonomically suitable for people (Zülfikar, 1998). Their heighs should be between 60-100 cm (Onder et al., 2012). They come in different types, including open-mouthed, half-open-mouthed, and hinged-lid models. They are made of materials such as galvanized steel, reinforced concrete, enamel-coated steel, polyethylene-coated steel, galvanized wire baskets, heavy alloy wire baskets, galvanized stainless steel, low-density polyethylene plastic, and wood, which are resistant to hard and rough usage (Celik, 2015; Kurdoglu and Celik, 2016). The waste bins should be placed at regular intervals along walking paths where users are concentrated, at intersections and pedestrian crossings. They should be placed in suitable locations, especially where users eat, drink, and sit, and not obstruct seating units (Anonim, 2013) (Figure 11).

Figure 11: Waste bins samples (Central Park, New York-ABD; Bryant Park, New York-ABD; Erzincan-Turkey) (Source: Kurt Konakoglu Archive)

Plant pots are used in public spaces to break the cold image of concrete and to add aesthetic value to the space when plants cannot be directly grown in the soil. They can be combined with other street furniture such as seating, water features, and lighting fixtures to create various compositions in the spaces where they are used (Akyol, 2006; Celik, 2015). When placing the plant pots, the needs of the plants such as light, temperature, and sun should be taken into account, and they should be placed in a way that will not be affected by harmful smoke, excessive winds, and misuse, or at least be affected at a minimum level (Yıldızcı, 2001). The plant pots should be large, deep, and heavy enough to accommodate seasonal flowers and shrubs, and to provide drainage. The depth should be at least 15-30 cm for ground cover plants, 50-100 cm for medium-sized ornamental plants, and 100-150 cm for large plants. Materials that are resistant to decay and rust, such as concrete, baked clay, fiberglass, and wood, are used in outdoor areas (Akyol, 2006; Celik, 2015) (Figure 12).

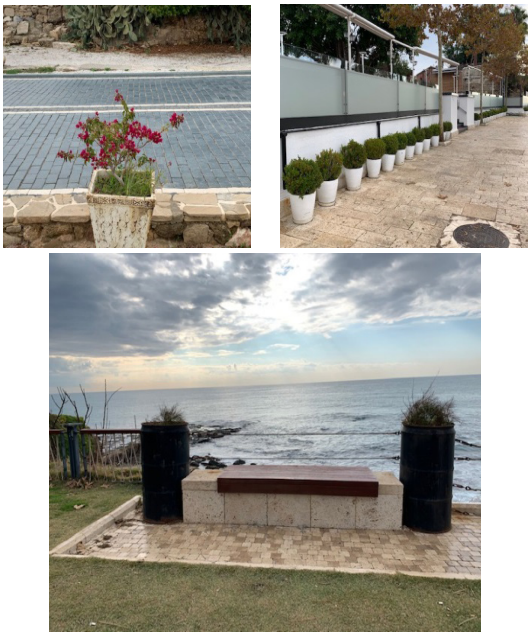

Figure 12: Plant pots samples (Antalya-Turkey)
(Source: Kurt Konakoglu Archive)

Bicycle parking areas are designed spaces in public areas for bicycle users to easily park their bicycles. Without these areas, bicycles are left on roads or sidewalks, causing chaos and negatively affecting pedestrian and vehicle traffic

(Kentsel Tasarım Kılavuzu Calısma Grubu, 1992). Bicycle parking areas should be placed in areas near buildings that are easily visible to users. If they are placed along a wall, they should be arranged in a linear fashion. If they are placed in a flower bed, around a tree, or a similar area, they should be arranged radially (Akyol, 2006; Celik, 2015; Kurdoglu and Celik, 2016) (Figure 13).

Figure 13: Bicycle parking area samples (Source: URL-1, 2021)

Clock towers are used in public spaces not only to remind people of the time but also to add aesthetic value to the environment. Clock towers are typically located in train and metro stations, bus stops, airports, pedestrian walkways, squares, and parks. They, along with other urban furniture such as water features and plastic objects, often serve as meeting points for people in areas with heavy pedestrian and vehicle traffic. For this reason, the location of these elements is important from both a functional and aesthetic perspective (Zülfikar, 1998). Materials such as wood, aluminum, and stainless steel are used to construct clock towers (Akyol, 2006) (Figure 14).

Figure 14: Clock towers samples (Times Square, New York-ABD; Old Town, Prague-Czech Republic; Freiburg-Germany) (Source: Kurt Konakoglu Archive)

Flagpoles are used in public spaces for the purpose of hanging flags. They are produced in different sizes depending on the size of the flags used in their respective areas of use, generally ranging from 4 to 25 meters. Depending on the intended use, different materials such as stainless steel and chrome are used in their production (URL-2, 2022) (Figure 15).

Figure 15: Flagpoles samples (Source: URL-3, 2022)

Fire hydrant is a type of water valve that is installed in various locations in public areas and buildings, for the purpose of being used by firefighters by attaching a hose during a fire. There are two types of fire hydrants: dry and wet. Dry fire hydrants are used in places where freezing can occur during the winter months. All parts of the hydrant, including the covers, barrels, and valves, are made of cast iron. However, the working parts are made of bronze and the valve covers can be made of rubber, leather, or a combination of materials (URL-4, 2021) (Figure 16).

Figure 16: Fire hydrant samples (Source: URL-4, 2021)

3. Use of Street Furniture in Campus Landscape

Street furniture meeting the needs of urban dwellers in public spaces plays an important role in landscape design to ensure the usability of these spaces. University campuses considered as small urban models are also important public spaces playing a crucial role in the social, cultural, and economic development of cities. Universities contribute to the constant development of society by producing new knowledge and transmitting it to future generations. Due to the rapid increase in population, industrialization, and technological developments, there has been an increasing demand for scientific research and vocational education activities. Therefore, universities have evolved from being mere educational structures to small settlements that also cater to social activities and housing needs.

The term campus started to be used with the development and expansion of universities to broader areas. A campus is a multifunctional educational area including university education structures, student dormitories, faculty residences, social facilities, as well as vehicle and pedestrian paths connecting these units, green areas, inner courtyards, and squares (Turner, 1995). University campuses provide functions such as education and training, research, accommodation, transportation, application, healthcare, leisure, and recreation. As small city models, university campuses influence the spatial development of the city and have an impact on the city's identity with their locations, sizes, and open-green areas that constitute shared usage (Erkman, 1990; Türeyen, 2002). University campuses undergoing development and transformation over time are dynamic structures (Tuna, 2006). According to Türeyen (2002), the need for creating campuses arose due to the increasing academic functions and interdisciplinary relations of universities, requiring the units that constitute campuses to be near each other.

The spatial character of university campuses is composed of vehicle and pedestrian paths, parking areas, urban infrastructure elements, social spaces, as well as educational and administrative buildings, while the landscape character is formed by open-green areas. The university landscape is a combination of both the spatial character and the landscape character.

In university campuses, in addition to educational units, there are structures providing facilities for central libraries, health units, research and development centers, social and cultural activities, shopping and individual needs, and various outdoor usages (Karakas, 1999). In the design of outdoor space in university campuses, materials such as plants, plastic elements, water

features, seating units, outdoor lighting, garbage cans, signage and information boards, and plant pots are used to create the elements that make up the campus landscape (Dober, 2000). These materials are the components that make up the campus landscape, and there are also sports areas where sports activities can be done, education areas where outdoor discussions, work, and learning activities can be carried out, and seating areas for dining, resting, chatting, and watching (Aydın and Ter, 2008; Yılmaz, 2015). Campus landscaping provides opportunities for university students to socialize, establish new friendships, provide mental calmness, engage in various physical activities, develop a sense of belonging, and reduce stress (Yılmaz, 2015). Thereby, when designing the campus landscape, a relationship should be established between the structural elements and the open green areas within the campus, taking into account the number of users and building functions, circulation and accessibility, vehicle and pedestrian path widths, parking area capacity, the size of sports and recreation areas, the type, number, and size of urban equipment elements, and the planting design of the campus (Türeyen, 2002; Irgatoglu, 2011; Büyüksahin Sıramkaya and Cınar, 2012; Yılmaz, 2015).

4. Discussion and Conclusion

University campuses considered as small city models direct the spatial development of the city they are in and have an impact on the city's identity, with their locations, sizes, and open-green spaces that create common uses. University campuses are successful to the extent that they provide educational, research, housing, transportation, application, health, leisure, recreation, and shopping functions to both academic and administrative staff and students. Thus, university campuses and campus landscaping should be in line with certain planning and design principles.

Campus landscaping provides spaces that allow university students to socialize, provide psychological tranquility, engage in various physical activities, and develop a sense of belonging. Consequently, when designing campus landscaping, relationships should be established between the vehicle and pedestrian paths, parking areas, urban equipment elements, social areas, educational and administrative buildings making up the spatial character of the campus, and the open-green areas making up the landscape character. Considering the number of users and building functions of the campus, decisions should be made on circulation and accessibility status, widths of vehicle and pedestrian paths, capacity of parking areas, size of sports and recreation areas,

type, number, and size of street furniture. Street furniture defining spaces within campus landscaping should be designed in a functional and aesthetic way that meets the needs of campus users and allows students to socialize. Furthermore, it should be made of materials being compatible with the campus identity and suitable for the city climate.

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CHAPTER II

CHANGING COLORS OF LEAVES: AUTUMN COLORATION OF BROADLEAF TREES AND SHRUBS

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1. Introduction

As the steadily increasing length of night during autumn, the weather begins to cool. In response to the shortening days and declining intensity of sunlight, leaves begin the processes leading up to their fall. As a result, the veins that carry fluids into and out of the leaf gradually close off, which clogged veins trap sugars in the leaf. However, these complex biophysiochemical transactions cause leaves which are ready to discoloration and finally fall. This phenomenon is generally called senescence, which is the last developmental phase of plant growth (Clatterbuck, 1999; Lee and et al., 2003; Hoch, 2019).

The color change from green to yellow, reddish or brownish is a visual indicator due to the loss of the pigment of chlorophyll (Lee and Masclaux-Daubresse 2021). However, when the sugar production is complete, other coloration pigments have more marked effects on the color of leaves, which are present all year round but are masked by chlorophyll. Therefore, the coloration of leaves rather than green, such as shades of red, yellow or brown, are one of the side effects of leaf senescence (Archetti et al., 2009).

Besides sunny and warm days which cause high chlorophyll concentration, bring green color to leaves, plant coloration may be controlled by multiple genetic and environmental factors and pH, soil moisture, temperature, co-pigmentation are some of the most important variations. But in autumn, rather than chlorophyll, other pigments (e.g., carotenoids, flavonoids, xanthophylls, and anthocyanins) become visible because of the breakdown of chlorophyll into colorless metabolites (Archetti et al., 2009).

When senescence is in progress, certain broadleaf trees, shrubs and perennial plants have begun to change to various shades of colors. This is mainly due to the changes in foliar pigment content associated with autumn phenology (Feild et al., 2001; Junker and Ensminger 2016). In landscape design practices, numerous leaves in the species impact visual aesthetic quality, primarily displaying color changes that vary, like green, yellow, blue, red, withered yellow, withered red, brown and gray. In this sense, parks, open green spaces and the immediate surroundings of landscape elements are some of the design places in which plant coloration could be considered (Elmore et al., 2012; Mu et al., 2022; Luo et al., 2023).

Due to countless combinations of factors in the plant environment, autumn coloration of certain species from year to year, seems to be more intense in some regions. Therefore, autumn color is not very predictable, especially in the long term (Clatterbuck, 1999; Elmore, et al., 2012; Bozdoğan, 2016; Hoch, 2019; Harvard Forest, 2023). But it generally starts in September and ends in late November in many parts of northern temperate regions. However, autumn leaf colors of certain species are impressive to visitors. Some places in the world, people would argue that the autumn colors in their forests are the most colorful. Because special color intensity and timing may be economically interesting, they could be a huge tourist draw, worth millions of dollars in revenues every year (Harvard Forest, 2023).

2. The Role of Pigments for Autumn Colortions

The autumn coloration of plants is still a phenomenon. Although leaf colors range within the same family or genus of trees, which may be somewhat similar, color evaluation could be subjective and plant color variations during autumn and over many years may limit the applicability of the results. For decades, plant scientists have worked to understand the changes that occur in trees and shrubs during autumn. In these studies, many valuable results and experimental findings

have been reported. However, three factors have been consistently reported to influence autumn leaf coloration. These are (Clatterbuck, 1999; Hoch, 2019; Harvard Forest, 2023);

- Type and quantity of leaf pigments,
- Length of night,
- Weather conditions.

Although it is unclear what effects pigments on leaf function, it has already been understood that mainly three types of pigments (Chlorophyll, Carotenoids and Anthocyanin) are involved in autumn colorations (Chiba et al., 1996; Feild et al., 2001; Archetti et al., 2009; Junker and Ensminger 2016).

Chlorophyll: It is a very important pigment for photosynthesis, which is the chemical reaction that enables plants to use sunlight to manufacture sugars for food. During the vegetation period, chlorophyll is continually being produced and broken down, leaves are seen green. When night length increases in the autumn, chlorophyll production slows down and then stops and eventually all the chlorophyll is destroyed. As a result of these transactions, other main pigments of carotenoids and anthocyanin that are present in the leaf are then unmasked and show their colors (Chiba et al., 1996; Clatterbuck 1999; Hoch, 2019).

Carotenoids: These pigments are present in the chloroplasts of leaf cells throughout the growing season. It mainly produces the yellow, orange, and brown colors of leaves (Clatterbuck 1999; Archetti et al., 2009).

Anthocyanin: These are produced in the autumn, in response to these red color and excess plant sugars within leaf cells. They are water soluble and appear in the watery liquid of leaf cells. However, those are not present in summer green leaves, and appear primarily in the vacuoles of palisade parenchyma cells (Feild et al., 2001).

Figure 1 summarizes the pigments, their functions, and chemical properties with some examples.

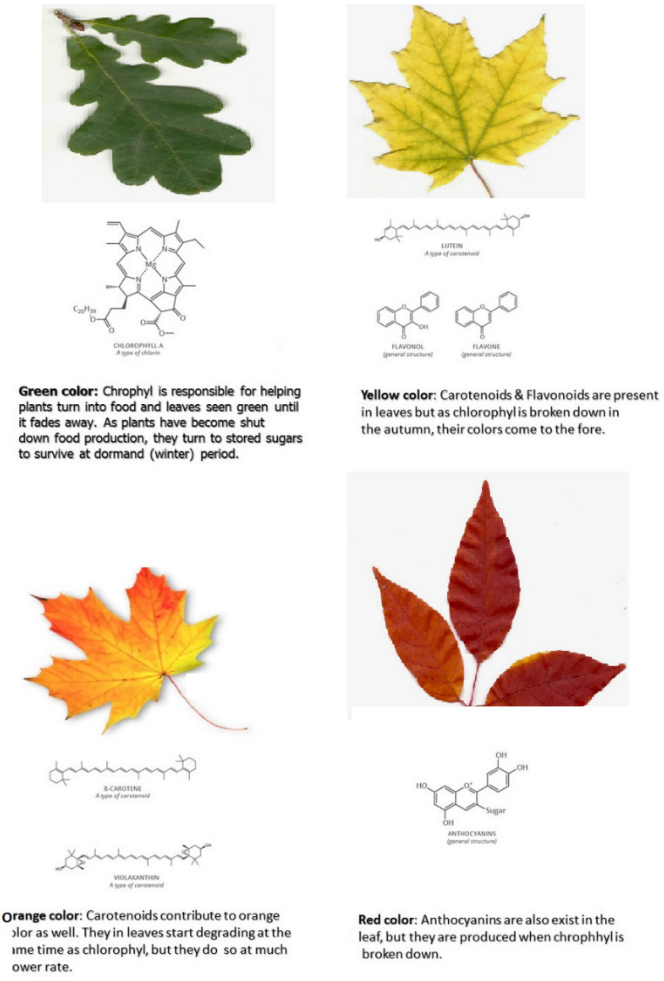

Figure 1. The main pigments effects on autumn colorations

3. Autumn Coloration of Broadleaf Trees and Shrubs

Nature is a perfect starting point to create and define the harmony of color in the landscape. However, deciduous trees potentially carry a higher aesthetic quality than evergreen trees when their foliage is discolored in the autumn, where foliated scenery is preferred by landscape designers. However, in the temperate zone, compared with the evergreens, the color changes of broadleaf tree species are more obvious and diverse, changing from green, to a variety of shades of colors (Chiba et al., 1996; Clatterbuck 1999; Archetti et al., 2009; Hoch, 2019).

Since color is a character and identity, landscape architecture is used to obtain a perception of space, the appropriate use of color is essential. The colors of objects are known to affect emotions and have psychological effects on the mind. It has already well proposed by researchers that color has a basic and instinctive visual appeal while it is one of the most rewarding elements of the landscape (Chiba et al., 1996; Clatterbuck 1999; Archetti et al., 2009; Bozdoğan, 2016; Hoch, 2019).

The theory of color is extremely complex. In simplicity, colors can be basically divided to warm and cool colors according to their impact on users. However, red, orange and yellow have been considered to be warm colors which impact strong emotions (for example, red as a sign of danger or orange with joy), while cool colors such as blue, purple and green induce feelings of peace and relaxation (Santamouris et al., 2011; Zhang, 2013). In design practices, warm colors may tend to draw attention more to the landscape, while cool colors, being more neutral and undefined, can create a homogeneous landscape that gives more sense of unity and depth to space (Hansen and Alvarez 2010; Ender et al., 2016). Therefore, autumn colors, mainly warm, are very important functions for landscape applications. But, the further diverse spectacular combinations of yellow, orange, red, purple, blue, and green could be attracted by users and create an internal sense of order, a balance in the visual experience (Hansen and Alvarez 2010; Santamouris et al., 2011; Zhang, 2013; Ender et al., 2016).

Although the timing of the color change varies by species, monitoring different stages is very important for visual evaluation and aesthetic quality of discolorations. However, to track fall discoloration, the following observation periods may be divided into different discoloration periods. One example which is divided into five different periods is given below (Mu et al., 2022).

- Pre-discoloration period (mid May to late September),
- Early to middle period (early to mid-October),
- Middle period (late October),
- Late period (early to mid-November),
- Final period (late November).

With regard to foliage color, in certain species, coloration is more intense in autumn and then turns brown in winter. However, various shades of leaf color can be visible in parks and woodlands, in the cities, countryside, and mountains at certain period of year. But regardless of the mode of inheritance, environmental

conditions could also affect gene expression of coloration of foliage (Clatterbuck 1999; Hansen and Alvarez 2010; Santamouris et al., 2011; Zhang, 2013; Ender et al., 2016; Hoch, 2019). Figure 2 shows some species monitored for autumn coloration from May to the end of November, in Isparta-Turkiye.

Figure 2. Changes in colors of selected species from spring to autumn discoloration periods at Isparta-Turkiye. (A: *Robinia pseudoacacia*, B: *Fraxinus excelsa*, C: *Parthenocissus quinquefolia*, D: *Tilia tomentosa*, E: *Platanus orientalis*, F: *Sorbus torminalis*).

However, along with brown, which indicates cell death, other color making compounds present in the leaves (e.g., carotenoid-yellow and anthocyanin-red) contribute shades of colors (Chiba et al., 1996). Certain colors could be

characteristic of particular species, such as, Hickory like golden bronze, Aspen as golden yellow, Dogwood as purplish red as even the same genus of leaves (i.e., maples) differ by species such as; Red maple as brilliant scarlet, Sugar maple as orange-red, Black maple as glowing yellow (USDA, 2023). In most cases, exact assessment of color characteristics of plants is very difficult and includes many complicated side effects. Table 1 summarizes the classification of some distinctly changing colors of species during autumn.

Table 1. Foliage colors of some broadleaf trees during autumn (Clatterbuck, 1999).

	Botanical Name	**Common Name**		**Botanical Name**	**Common Name**
Trees with Little or no Color	*Acer saccharinum*	Silver Maple	**Trees with Green to Dull Yellow Color**	*Aesculus* spp.	Buckeyes Northern
	Alnus spp.	Alders		*Catalpa speciosa*	Catalpa
	Juglans nigra	Black Walnut		*Celtis* spp.	Hackberry
	Platanus occidentalis	Sycamore		*Diospyros virginiana*	Persimmon
	Populus spp.	Cottonwood		*Gymnocladus dioicus*	Kentucky Coffeetree
	Quercus spp.	Willow Oaks		*Salix nigra*	Black Willow
	Robinia pseudoacacia	Black Locust		*Tilia americana*	American Linden
				Ulmus spp.	Elms
Trees with Bright Yellow to Orange Color	*Acer nigrum*	Black Maple	**Trees with Red and Purple Colors**	*Acer rubrum*	Red Maple
	Acer saccharum	Sugar Maple		*Liquidambar styraciflua*	Sweetgum
	Betula spp.	Birches		*Nyssa sylvatica*	Blackgum
	Carya spp.	Hickories		*Quercus spp.*	Red Oaks
	Fagus grandifolia	American Beech		*Taxodium distichum*	Bald Cypress
	Fraxinus spp.	Green, White Ash		*Cotinus coggygria*	Smokebush
	Ginkgo biloba	Ginkgo		*Ilex verticillata*	Winterberries
	Gleditsia triacanthos	Honeylocust		*Pistacia chinensis*	Chinese Pistache
	Liquidambar styraciflua	Sweetgum		*Acer griseum*	Paperbark Maple
	Sassafras albidum	Sassafras		*Amelanchier laevis*	Serviceberry

3.1. Autumn Color Properties

Pavements, urban furniture, fences, and other design elements may be the choice of designers that reflect the personality and desires of the users. The color combinations of both plants and other elements can have a harmonious effect, or be a set of contrasting tones, generating changes in a design environment (Santamouris et al., 2011; Mu et al., 2022; Luo et al., 2023). But these are primarily based on red, yellow and green color information generally used for assessing the process of senescence or autumn phenology (Hoch, 2019; Harvard Forest, 2023; USDA, 2023). Due to the breakdown of chlorophyll in autumn, certain shrubs and trees are reported to produce varying amounts of anthocyanins (red color) and carotenoid pigments (yellow color) during senescence (Chiba et al., 1996; Clatterbuck 1999; Archetti et al., 2009; Hoch, 2019). Colors in the plant kingdom can be used in landscaping to achieve many effects (Archetti et al., 2009; Santamouris et al., 2011; Zhang, 2013; Mu et al., 2022;). Some examples are:

- Colored plants may provide visual interest and highlight some design elements (e.g., sports fields, gateways, paths, etc.),
- Colored plants can attract fauna (e.g., birds, butterflies, etc.),
- Different colors of plants could balance the designs of a open space,
- Colors can create a certain mood and can be given a sense of order to the landscape.

A number of researchers have studied the color of objects and plants. There are 3 basic colors (red, blue and yellow) from the mixture of which secondary colors (green, purple and orange) and tertiary colors are derived (Santamouris et al., 2011; Zhang, 2013). Many color models (standards) have already been developed to be supposed to be able to accurately represent every single color the human eye can perceive. The CIE L*a*b* (1976), CIE XYZ (1931), Digital images, ASTM and ISO standards have been reported to be some of the most useful methods for describing autumn coloration of plant species (Lee et al., 2003; Santamouris et al., 2011; Smith, 2014; Zhang, 2013; Junker and Ensminger, 2016; Mu et al., 2022, Zhang et al., 2022).

4. Conclusion

Plants and their physical properties are important design elements for the landscape architecture discipline. Various types of plants, such as trees,

shrubs, perennials and flowers are intensively used to utilize their advantageous properties, including balancing the environment, aesthetical appearance, creating focal points and supplying unity on the field.

The autumn coloration of certain plants has an element that attracts the attention of human beings which affects them physiologically and sociologically. However, the choice of colors to design a landscape is in a similar way to selecting clothes that we are going to wear, the shades that we select to paint our house, or the hue that we choose to decorate buildings, restaurants or commercial places. Therefore, correct handling of color both in the treatment of natural landscapes and in urban landscapes can be provided emphasis, provide on their aesthetic and functional properties. In this regard, autumn coloration could be an important feature in determining human and landscape relations.

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CHAPTER III

GREEN HOSPITALS IN THE CONTEXT OF SUSTAINABILITY

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1. Introduction

The environment is defined as the physical, biological, social, economic, and cultural setting in which living beings pursue their relationships and interact with each other throughout their lives. Interactions that are compatible with the natural environment for a period of time, with the differentiation of human needs over time, the advancement of technology, and the intense use of all kinds of resources, have resulted in the deterioration of the environment (Gökşen et al., 2017). As a result of the deterioration of the environment, changes have occurred in ecosystems. These changes are many ecological and climatic hitches such as the gradually increasing global warming, rising sea levels, erosion of coastlines, shrinking of lakes, occurrence of forest fires, drying up of rivers, and melting of glaciers (Hoşgör, 2014). In addition, with industrialization, there has been a significant increase in the amount of harmful gases released into the atmosphere. Since no measures were taken in time, the atmosphere and the environment were touched by intense pollution and deterioration. As a consequence of the rapid increase in the population, excessive energy consumption and the usage of fossil fuels, unconscious subversion of the soil, and the increase in human-induced activities in areas such as developing trade and transportation, the negative effects of humans on the environment have reached high levels (Çilhoroz and Işık, 2018). In order to prevent these damages to the environment, the concept of sustainability has come to the fore. The concept of sustainability began to emerge with the book named Silent Spring (Carson, 1962) written in 1962, which deals with the damage caused by industrialization to the environment. Recognizing the seriousness and urgency

of global problems, the United Nations (UN) organized summit meetings open to the participation of all countries in order to remind them of common responsibilities. In the first of these summit meetings,, it was emphasized that environmental problems were mutual problems, with the slogan “Only One Earth” in Stockholm in 1972 (Özçuhadar and Öncel 2012). The International Union for Conservation of Nature and Natural Resources (IUCN) prepared a document called “World Conservation Strategy” in 1980. In this document, it is stated that the regulations made to be sustainable will help to protect the earth (Özbek, 2021), and this situation inspired the Brundtland Report prepared by the UN World Commission on Environment and Development in 1987. Thus, the principles of sustainable development were defined. Sustainability in the Bruntland Report; defines it as development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Andersson, 2006; Harris et al., 2009).This concept, which is based on three main economic, social and environmental components (Mateus and Bragança, 2011; Sahamir and Zakaria, 2014), has many different definitions due to its interdisciplinary nature. The economical, regenerative use of renewable resources by Bozlağan (2002); In another definition, it is defined and appears as *“environmental sustainability in terms of minimizing the consumption of resources and minimizing all environmental negatives, including all emissions and wastes; Ecological sustainability in terms of protection and development of natural resources is expressed as economic sustainability in terms of acceptable costs and serving all sectors of the society, and an understanding that can be made according to the characteristics and capacities of societies, participatory plans and programs and social sustainability are complementary to each other”* (Palabıyık, 2001).

Solid waste management is one of the application areas of sustainability (Akdoğan and Güleç, 2007). Natural resources in the world are rapidly consumed for the use of industrial raw materials and for other needs of people. In the countries of the world that understand the importance of the issue, attempts to “re-avail” or “reuse” the waste, tend to become widespread (Kocataş, 2006). In recent years, especially in the industries of developed countries that have understood the importance of the concept of sustainability, there has been a transformation from the environmentalist approach of the 1970s which focused on the disposal of wastes by categorizing them as solid, liquid, and gas, towards services and products that will not cause waste in the first place (Özçuhadar and Öncel 2012)

The ecological (holistic) perspective has started to spread in many branches of science since the 1960s when human beings realized that they were killing nature and were drifting towards an irreversible abyss (Özyaral, 2013). Under these circumstances, it has been brought to the agenda that, the construction of environmentally friendly green buildings in the construction sector, consumes a significant amount of energy and is the primary work area of policies aimed at increasing energy efficiency and decelerating climate change (Özyaral, 2013).

In this study, the concept of green building, which is called environmentally friendly buildings, has been examined. The certification systems required for the evaluation and measurement of the environmental performance of buildings are explained. Finally, the concept of green hospital, which is the main subject of the study, was examined and the study was concluded by mentioning the points that should be considered for a building to be a green hospital.

2. The Concept of Green Building

When we look at the built environment, it is seen that it increases resource consumption and greenhouse gas formation, consumes 50% of the world's energy and 42% of water, 50% of greenhouse gas emissions and 24% of air pollution are created by non-green buildings (Gültekin and Bulut, 2015) and cause irreversible effects on the natural environment (Liu and Lin, 2016).

Unlike conventional (non-green) buildings, green buildings that use recycled materials, minimize waste generation and decompose waste, use renewable energy sources and rainwater, and minimize maintenance costs, have come to the fore as environmentally friendly buildings (Erdede et al., 2014; Darko and Chan 2016). The green building approach, unlike the conventional building approach, aims to design, construct and operate a building with minimal resource use (Darko and Chan 2016).

In the definition made by Aliagha et al. (2013); A green building represents the most efficient and least destructive use of land, water, energy, and resources throughout its operational and construction life, and is called the building that provides the healthiest possible environment. According to Yudelson's (2008) standpoint, a green building is a high-performance building with minimal impact on human health and the environment. He also stated that a green building is not only designed to pay regard to and reduce its life cycle environmental impacts but also considers water and energy consumption.

This technique that has been developed during the world energy crisis in the 1970s, has been used ever since. In 1992, the concept of "green building"

was officially suggested and proposed at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, stating that buildings should meet the needs of the occupants for a comfortable living environment without compromising their ability to save energy (Wang et al., 2005). Studies have shown that, these buildings, which are seen to have economic benefits in the construction and operation stages, reducing the operating costs by 8-9%, increasing the value of the building by 7.5% and increasing the rental rate by 3% (Wood et al., 2015). Towards the end of the 20th century, the use of 40% of the total material in the world, 12.2% of the total water consumption, and 40% of the total energy have made green buildings popular throughout the world (Hoffman and Henn 2008).

Green Building Rating Systems have been developed to evaluate and measure the environmental performance of green buildings, which are understood to have positive effects on the environment, economy, and people. The first of these systems is the BREEAM (Building Research Establishment's Environmental Assessment Method), which arose in England. Then, those evaluation systems in 1998, the LEED (Leadership in Environmental and Energy Design) (Aliagha et al., 2013; Miller et al., 2015; Wood et al., 2015) in the USA and subsequently the GREEN STAR in Australia, and many others, the certification system has been developed. In these systems, buildings are evaluated by giving points in areas such as water efficiency, energy efficiency, use of innovative materials, and indoor quality (Portalatin et al., 2010; Sahamir and Zakaria, 2014; Miller et al., 2015).

2.1. BREEAM Certification System

BREEAM is a method that was created in 1990 and developed over the years, in order to evaluate and reduce the effects of a building on the environment in a simple and economical way (Palteki, 2013). Sustainable environmental development is one of the main starting points of BREEAM. It evaluates buildings in terms of energy consumption, water use, health and comfort, and indoor air quality (Gökçen, 2020).

BREEAM, which evaluates the environmental performance of existing and new buildings, has versions for building types. These versions are for existing residences (Ekohouses), newly built residences, service systems and housing stock management of existing residences, multiple residences such as student dormitories, nursing homes, industrial buildings, warehouses and warehouses, office buildings, shopping structures, medical service places, and hospitals. It is evaluated as primary and secondary education structures, colleges, schools

providing vocational practice, justice structures, correctional houses, and prisons (Gökçen, 2020).

According to the BREEAM certification system, green building management is examined in nine categories: health and well-being, energy, water, land use and ecology, transportation, materials, wastes, and pollution. Each main title is scored according to the conditions of the country or geography they are in (Palteki, 2013). The total BREEAM score is 100. The project passes according to the score it receives from the main and sub-titles stipulated by BREEAM, and certificates are received at the levels of good, very good, excellent, and extraordinary (Table 1) (Gökçen, 2020).

Table 1. Scoring System

Certification Level	Score
Pass	30-45
Good	45-55
Great	55-70
Excellent	70-85
Extraordinary	85+

2.2. LEED Certification System

Leadership in Energy and Environmental Design (LEED) is a list of criteria developed by the World Green Building Council in the USA. Its aim is to change the materials and methods used in the construction industry today, by considering the sustainability principles, and to ensure that buildings that cause the merest damage to nature, are built (Palteki, 2013).

LEED; It is the world's leading green building project and performance management system that provides an extensive framework for green building design, construction, operation, and performance. This certification system (LEED, 2023);

- Material selection of a building meticulously focuses on human comfort, air quality, and human health, and gives priority to the building's most important asset, humans.
- It focuses specifically on social equity, ensuring that buildings are not considered separately from their communities, giving priority to access for all.
- It ensures that a building is resistant to natural and unnatural effects.

In the LEED scoring system, there are certain stages in terms of certification of the buildings. In order to obtain the certificate, the requirements that are not included in the scoring called "prerequisite" must be fulfilled first. After the requirements are met, the criteria called "credit" come to the fore as the point value. With the rating credit system, buildings are scored with certain criteria and the certificate level is determined by the total score. The total score of the criteria in LEED certification systems has been determined as 110. After fulfilling the conditions, buildings with at least 40 points are entitled to a certificate (Yılmaz and Atik, 2022).

According to the score obtained from the criteria, the certificate levels are as below (Table 2); (Yılmaz and Atik, 2022);

Table 2. LEED Scoring System

Certification Level	Score
Certified	40-49
Silver	50-59
Gold	60-79
Platinium	80+

LEED certification; It shows that an apartment, detached house, workplace, institution or organization is designed and built with methods that will achieve high performance in key points concerning human and environmental health (sustainable settlement development, water saving, energy efficiency, material selection, and indoor environment quality). It has been revealed that a green building with a LEED certificate, uses 25-50% less energy on average, consumes 40% less water, produces 70% less solid waste, and emits 35% less greenhouse gases into the air (Terekli et al., 2013).

2.3. GREEN STAR Certification System

Green Star is an evaluation system developed by the Green Building Council of Australia (GBCA) in 2003 for the environmental design and construction of buildings. The Green Star certification system was created to create a common language in the environmental assessment of buildings and to increase social awareness for pioneering sustainable design. The criteria determined for the evaluation of buildings are given below (Anbarcı et al., 2012).

- Energy,
- Oscillation,
- Material,
- Management,
- Indoor Environmental Quality,
- Land Use and Ecology,
- Water,
- Transport,

Points given for these determined criteria and the conditions of the region where the building to be evaluated are taken into consideration, the total score is consulted at the end of the evaluation. The points earned in this certification system are given in Table 3 (Anbarcı et al., 2012).

Table 3. GREEN STAR scoring system

Star	Score	Status
1	10-19	Low
2	20-29	Average
3	30-44	Good
4	45-59	Excellent
5	60-74	Australia's Best
6	75-100	World's Best

3. Sustainable Buildings: Green Hospitals

Hospitals are among the most complex and energy-intensive facilities in countries where uninterrupted health services are provided throughout the day, complex biomedical technologies are used, weather conditions, cooling, generator systems (Hoşgör, 2014), and medical equipment have a very important part in the provision of health services (Albrecht and Petrin, 2010).

Therefore, it causes greenhouse gas emissions and hence, climate change. It also constitutes one of the most important sources of many wastes, some of which are toxic. Consequently, the health sector contributes to the problem while trying to solve the problem (Wittmann, 2010). There is a misconception that a large part of hospital waste is generally a clinical (medical) waste. However, only 15% of the medical waste produced by hospitals is harmful to health. The

remaining 85% consists of papers, plastic materials, food, and other materials. It consists of Reduce (reduction), Reuse (reuse), and Recycle (recycle) types. In addition, medical wastes constituting 15% are not included in the scope of "Reduce, Reuse, Recycle", known as the 3R strategy (Burger and Newman, 2013).

Hospitals, which are a part of the construction industry, have been influenced by the green building movement that has emerged in many parts of the world, and they have taken steps towards becoming a green hospital by getting rid of their traditional structure. The reasons that push hospitals to join the green building movement are that, just like other buildings, hospitals have become structures that use a lot of energy and water, generate waste, use too many materials, and have insufficient indoor quality (Çilhoroz and Işık, 2018). In this respect, the purpose of green hospitals can be listed as ensuring more efficient use of energy and water, eliminating all waste, and making a positive contribution to the health level of society by providing environmentally friendly building designs (Kılıç and Gütük, 2018).

Green hospitals using sustainable technologies, energy-saving systems and recyclable or renewable resources and materials (Gudiene et al., 2013; Wood et al., 2015) are evaluated according to some international certification systems, as in other green buildings. The most important of these are BREEAM For Healthcare, LEED For Healthcare, and GREENSTAR Healthcare systems. All of these systems enable hospitals to improve management, sustainability, energy and water efficiency, waste management, material selection, innovation in design and indoor quality, etc. It evaluates its fields and certifies it at different scoring and certification levels. For example, a score of 70 and above in BREEAM For Healthcare is certified at the Excellent level, a score of 80 and above in LEED For Healthcare is certified at the Platinum level, and a score of 75-100 in GREENSTAR Healthcare is certified at the World Leader level. Thanks to green hospital certificates, hospitals can realize improvements in construction processes, sustainable design processes, performance measurement and decision-making processes (Sahamir and Zakaria 2014). The number of green hospital buildings designed in accordance with the criteria determined by certificate programs is increasing day by day. These buildings often have distinctive "green" features with window shades, good daylight illumination, green (greened) roofs, or natural ventilation (Terekli et al., 2013).

There are primary subjects that distinguish green hospitals from traditional hospitals. At the same time, these are the components of green hospitals and their

benefits to the environment and economy. According to Environment Science Center (2003), these components are; hazardous materials, waste management, energy management, water management, air emissions, and purchasing eco-friendly products.

3.1. Dangerous Substances

The definition and classification of dangerous substances vary all around the world. However, in any case of the classification, the management of these substances is of great importance for hospitals. The process from the release of these substances to their destruction is a part of the daily activities of hospitals. Potential hazards for both employees, patients and the environment should be prevented by establishing appropriate recording and use procedures (Environment Science Center 2003; Palteki, 2013; Terekli et al., 2013).

Potentially hazardous materials used in hospitals; organic compounds such as solvents, inorganic compounds, corrosive substances such as acids and bases, prescription drugs, disinfectants or other compounds containing carcinogenic substances. Since the use or formation of dangerous substances is inevitable for hospitals, the management of these substances is of great importance for hospitals (Environment Science Center, 2003).

3.2. Waste Management

Hospitals, which are institutions that work 24 hours a day, 365 days a year, generate large amounts of waste and consume energy. Until the last few years, the disposal of hospital hazardous waste is among the top causes of dioxin and mercury pollution in the United States (Harris et al., 2009). To ensure the management of waste in green hospitals; There are some rules to be followed, such as waste avoidance, waste reuse and recycling and disposal.

In terms of avoiding waste, the products used in hospitals should be evaluated in terms of whether they are environmentally friendly or not. Some products may be unnecessary to use or can be replaced with another product that produces less waste. For example, precautions should be taken such as using unnecessary packaging, changing dressings less frequently when there is no risk of infection, purchasing laboratory chemicals in low quantities to meet urgent needs, and reducing chemical wastes (Environment Science Center, 2003).

On the reuse and recycling of wastes; Recyclable materials such as paper and cardboard, glass, plastics, metals, office supplies, organic waste, food waste, fabrics, electronic waste, and radioactive chemicals should be laid up. They

must then be transported to the central storage area, where they will be picked up. If hazardous materials are stored, the necessary special conditions regarding the storage area should be provided (Environment Science Center, 2003).

Wastes Required to be Disposed: Infectious wastes, chemical wastes, radioactive wastes, and waste types such as mercury thermometers and steam lamps generated as a result of use in hospitals require special disposal. It should be ensured that this type of waste is disposed of in accordance with local regulations (Terekli et al., 2013).

3.3. Energy Management

Hospitals are institutions that work full-time and have the highest energy consumption. The energy consumption in hospitals is more than 2.5 times the energy consumption of a commercial enterprise. These hospitals, by controlling costs with energy management; can save money to raise the level of patient care and enable expensive medical and technological advances. Some of the strategies that hospitals can implement to save energy are listed below (Terekli et al., 2013);

- Using solar panels to generate solar energy.
- Using lighting elements that will save energy.
- Using films or heat-protective glasses on windows to prevent heat loss.
- Using natural ventilation in addition to the mechanical ventilation option.
- Creating a building automation system.
- Using more than one boiler.
- Establishing an insulation system for the building.

3.4. Water Management

Proper use of water, which is a limited resource every living needs, is very important in terms of resource management. Amount of water used in sections where excessive water is thought to be used should be determined and strategies should be developed to reduce unnecessary water consumption (Environment Science Center, 2003). For example, strategies can be summarized as including sterilizable bubble pieces in the water flow, creating automatic water volume control to measure water consumption amounts, saving water with systems such as low smart showers and thermostats, and creating cisterns to store rainwater (Terekli et al., 2013).

3.5. Air Emissions

Air emissions; is the mass expression of the sum of emissions obtained by multiplying annual activity data and emission factors for certain pollutants (Ministry of Environment, Urbanization and Climate Change, 2023). Hospitals can cause air pollution with high energy consumption, chemicals they use, anesthetic gases and toxic gases formed as a result of the destruction of medical wastes. Hospitals need to plan their heat and energy consumption to minimize CO2 emissions. Hospitals should adopt some strategies for situations that increase air emissions other than energy consumption (Terekli et al., 2013). According to the Environment Science Center (2003), these strategies are summarized below;

- Should use maskless anesthesia; If a mask is required, a double mask should be used.
- Devices and their connections should be checked regularly for leaks.
- Anesthesia devices should be checked after each cleaning and hose replacement.
- Room concentrations should be measured regularly for excessive emissions.
- Technical air units should be monitored regularly to ensure they are working properly.

3.6. Purchasing Eco-Friendly Products

Some healthcare products used in hospitals contain PBT (Polybutylene Terephthalate) or may produce PBT or release it into the environment when they are produced, used, disposed of, incinerated or recycled. In order to prevent this situation, it is necessary to know the effects of the area or the products used on the environment and to evaluate the life cycle of all products (Environment Science Center, 2003).

Purchasing representatives in hospitals should be trained on this topic and a procedure should be in place for preferred products and services. Hospitals should try to purchase products that do not contain toxins or PBTs that are persistent (never spoiled), excreted or metabolized (Environment Science Center, 2003).

These components that make up green hospitals are among the most important steps taken by hospital structures towards sustainability. It is important to help protect the environment by getting rid of the harmful effects of water

pollution and waste, to contribute to the economy by consuming less energy and using less materials, and to create more livable spaces for patients, employees and society by providing healthier indoor environments (Çilhoroz and Işık, 2018). In addition, green hospitals will be accepted more easily by the society and will provide confidence in financial investments (Yudelson 2008).

4. Conclusion

The concept of green appears in many areas of life. When considered at the scale of people, buildings and the environment, it is seen that they have positive effects on three of them. The effects of green on people's physical and mental health have been evocated by studies. For example, it is obvious that being in a green field, reduces mortality rates, reduces drug use and positively affects the general health. The use of green in buildings has gained importance in terms of sustainability. For a healthier environment, as well as increasing green fields, buildings should be built or arranged in accordance with the green concept.

Recently, people are trying to minimize the damage caused by them and at the same time, they place emphasis to the fact that their homes or workplaces are environmentally friendly and suitable for human health. Therefore, when the concept of green building is mentioned, energy saving, effective and efficient use of resources, recycling of waste, etc. it is seen that the awareness of the society is increasing both at the individual and the institutional level.

Constructing hospitals as green hospitals or renovating them as green buildings, which are one of the institutions with high energy and water expenditures, will make an important contribution in social and economic terms. Also, lower carbon emissions, effective waste management and reduced water consumption etc. will contribute to the provision of many positive features. For all these aspects, green hospitals should be expanded and the states should be pioneers and support them.

Compared to a hospital that was built in a traditional structure and continues to function in this way, the effects of green hospitals on the environment and human health are quite high. That's why existing hospitals take steps to become green hospitals; It is important that the newly built hospitals are created by adopting the green concept. Considering the practices on green hospitals, it has been determined that only two hospitals in Turkey are green hospitals, but there are studies on this. The fact that the Ministry of Health is also working on this issue is an indication that this concept will become widespread in the future. It is necessary to increase the studies on the subject in order to announce the concept of green hospital to more masses and to increase the awareness of people.

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CHAPTER IV

URBAN DESIGN THEORY AND DEVELOPMENT PROCESS IN TÜRKİYE

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1. Introduction

The century 1900-2000 is the century of the "urban revolution" (UN, 1980). 3% of the world's population in the 1800s, 14% in the 1900s, 47% in 2000, 60% in 2030, and 72% in 2050 are expected to live in cities. According to the World Population Prospects Report revised by the United Nations in 2017, the world population, which was 7.5 billion in 2017, is estimated to reach 9.8 billion in 2050 (UN, 2017).

As a result of the rapid urbanization that has continued since the 1950s in Türkiye, the proportion of the population living in cities, which was 25% in 1950, increased to 44% in 1980, 65% in 2000 and 77% in 2012. As of 2022, 57% of the world's population lives in cities (World Bank, 2023), 82.7% of Türkiye's population lives in dense and medium-density cities (TUİK, 2023a). With the first Metropolitan Municipality Law adopted in 1984, Istanbul, Ankara and Izmir were declared as Metropolitan Municipality. The number of metropolitan municipalities increased to 8 in the first ten years and to 16 in the next twenty years, and as of 2016, it increased to 30 within the scope of the Law No. 6360, and the urbanization rate reached 88% with the villages gaining the neighborhood status. With the transformation of 16.220 villages in 30 metropolitan cities into neighborhoods, the number of villages in Türkiye decreased from 34.434 to 18.214. In other words, approximately 50% of the villages have been converted into neighborhoods (T.R. Ministry of Environment and Urbanization, 2017). It is reported that Türkiye will be the 19th most populous country in the world in 2050 with 96 million people according to UN population projections (UN, 2017). The world population is estimated to be 8 billion as of 2022. Türkiye is the 18th most populous country in the world with a population of 85.279 553 people (TUİK, 2023b).

The phenomenon of the city is a dynamic concept that shows a constant change depending on the geography, culture and interactions it has been in throughout the historical process (Topal, 2004). The city is defined as the space of differences and the physical space organization with demographic-political-economic and sociological dimensions. Urbanization is defined as the multi-sectoral and multidimensional population accumulation process and the growth and development of living spaces due to economic, political, technological and socio-economic reasons (Mutlu et al., 2016; Atmaca and Yılmaz, 2021).

Global economic changes underlie the ongoing changes in the role of cities. In the past fifty years, with the industrialization and subsequent urbanization practices, most of the cities in developing countries have grown (Sassen, 1998), and today's cities cover 2% of the world's surface but consume 75% of the world's resources (Wieman, 1996). As a result of the solution of the problem of sheltering and housing, which are the basic human needs that emerged in the 20th century, through squatting and concretization in the mentioned cities, irregular and unplanned urbanization, urban infrastructure and urban environmental problems have emerged.

The challenge of the century we live in will be to improve the environmental conditions of cities on the one hand, and to reduce their pressure on limited resources on the other hand. The fact that more than 2/3 of Europe's population

lives in urban areas today demonstrates the perception of urban environmental quality as a key element of the economic renewal of European cities (COST, 1997). Today, it has become very important to provide sustainable solutions and "create livable environments" against negative developments such as the increasing negative impact of urbanization on natural values and the increasing effects of environmental pollution due to urbanization on human health (Kiper et al., 2017). This pushes all interest groups that make up the city to think and question multidimensionally on the concept of "ecological urban renewal and livable healthy city" (Karadağ, 2009) and forces them to work together and produce solutions together.

Today, it is emphasized by scientists and experts that the urban-rural balance is dramatically developing and differentiating against natural areas-rural areas, a large part of the planet is being shaped by human hands with increasing population and global economic mobility, and cities will move away from being livable environments due to global climate change in the near future (Demirel and Oruçkaptan, 2018). For this reason, with the emphasis on the necessity of re-establishing the relationship of cities with nature, planning and design approaches based on ecology and nature have become a necessity for cities (Demirel and Oruçkaptan, 2018; Topal, 2022). This situation becomes even more evident when the rights of citizens are handled and questioned at the international level. This process, which started with the 1st Habitat Conference (1976, Vancouver), has been discussed in an increasingly important dimension with the Quito Declaration on "Cities for All" (17-20 October 2016, Quito, Ecuador). Thus, in a period of 40 years, great distances have been covered for the livability of cities. With the Quito Declaration (2016), which has the vision of "Environmental sustainability", urbanization is considered as the engine of sustainable and inclusive economic development, social and cultural development, nature and environmental protection, and sustainable development.

The aim of this study is to discuss the legal and administrative dimension of urban design in our country by emphasizing the use of the Urban Design phenomenon in Türkiye as a powerful tool in the ecological renewal of our country's cities and in the air conditioning of the city.

2. Eco-City Criteria and Performance Indicators

At the end of the 19th and early 20th centuries, urban planners, writers and thinkers, who pointed out that urban pollution threatened human life, feared that cities would eventually destroy themselves. Today, not only inhumane living conditions, but also unsustainable resource use pose a threat to cities.

For sustainable urbanization, urban performance indicators and metrics are defined and various indexes and design guides are prepared (Mimar Sinan Fine Arts University and T.R. Ministry of Environment and Urbanization, 2016). Urban Sustainability Indicators are designed as a framework consisting of environmental, economic and social elements and are used as a tool for evaluating the sustainability performances of cities (Pınarcıklıoğlu and Kanbak, 2020).

The first step in this regard was taken at the 1994 Aalborg Conference. The Urban Sustainability Indicators, which use the "European Charter for Sustainable Cities and Towns" developed by Mega and Peterson within the framework of a study conducted by the European Foundation, are the first example. The feature of these criteria is that they do not only limit the measurement of the sustainability of the city with environmental indicators, but also include social and economic dimensions. This system, which consists of a total of 16 main indicator titles, includes 9 environmental indicators (air quality, acidification, clean, transportation, solid waste management, etc.), six social indicators (social justice, housing quality, urban security, public participation, etc.) and one covers the number of economic indicators (Yazar, 2005, quoted from Işıldar, 2012).

According to the "International Ecocity Framework & Standards" document (IEFS) prepared by "Eco City Builders", which was established in 1992 and gathers many related organizations (national and international) under its umbrella, cities have evolved from "unhealthy" cities to "gaia" cities that claim that the world is actually like a living organism. Accordingly, cities are named as unhealthy cities, green cities, eco-cities and gaia cities, respectively, and cities are listed under these headings according to certain conditions and criteria (Işıldar, 2012; Karahan, 2018).

Another performance criterion is the European Green City Index, prepared by Siemens with the Economist Intelligence Unit (EIU), based on the view that cities are responsible for climate change. This index is a scale to measure both the current environmental performance of a city and the importance it attaches to reducing its future environmental impact through the initiatives and targets it pursues (Işıldar, 2012).

The Urban Paradigm Shift with the Quito Declaration on "Cities for All" (17-20 October 2016, Quito, Ecuador) highlights a Nature-Based city scenario. In this context, it is predicted that cities, which are the places of differences, will be settlements that protect the ecosystem, water, natural habitats, biological diversity and support sustainable consumption and production forms.

The New Urban Agenda is the first step to implement sustainable development in integration and coordination at the global, regional, national,

sub-national and local levels. By preparing an action-oriented roadmap for implementation, the New Urban Agenda will promote the realization of the Sustainable Development Agenda 2030. In addition, Goal 11 will encourage cities and human settlements to become inclusive, safe, resilient and sustainable places and the achievement of other goals across the Sustainable Development Goals.

A-Transformative Commitments to Sustainable Urban Development

I. Leaving No One Behind, Urban Justice and Eradication of Poverty

II. Sustainable and Inclusive Urban Wealth/Opportunities for All

III. Promoting Ecological and Resilient Cities/Human Settlements

B- Effective Application

I. Building Urban Structure: Establishing a Supportive National, Sub-national and Local Framework

II. Planning and Managing the Spatial Development of the City

III. Developing Tools for Implementation of the New Urban Agenda: Financing and Other Implementation Tools

Between 27 January 2017 and 08 November 2017, 133 experts from about 100 different institutions and organizations participated in the field of 133 people, 4 separate commissions (1) Identity in Our Cities-Planning and Design, (2) Urban Transformation, (3) Urbanization, Migration and Adaptation and (4) The Role of Local Governments in the New Vision of Urbanization) completed their work in 9 months and put forward a new vision document in the field of urbanism. As it is known, the results of the "Urbanization Council" held in 2009, as a roadmap for the works and services to be carried out by institutions and local governments operating in the fields of planning, environmentally sensitive settlement and construction, are very important. In this context, the Urban Development Strategy Document (KENTGES), which was prepared with the participation of 500 experts from 151 institutions and organizations and accepted in 2010, is the urbanization and development vision targeting the year 2023. The Urbanization Council, completed in 2017, is a very important text that will take the 2010 Urbanization Council one step further and contribute to urbanization by making the "Sustainable Urbanism Vision" the focus of its discussions with the recommendation decisions it has taken (KENTGES, 2010).

One of the most important principles of the New Urban Agenda is Environmental Sustainability, and sustainable use of land and resources, clean energy, protection of ecosystems and biodiversity, climate change adaptation

and establishment of urban resilience are important in the urban development process.

Today's urbanism approach in Türkiye can be defined with the following evaluations and problems can be revealed:

- Today, the urban-rural balance (80%-20%) differs dramatically. The origin of this change is the process in the industrialization process, in which people are forced to migrate from the countryside to the city, in the context of the attractiveness of the city.
- Cities have become stronger with their increasing population size and their political, economic and cultural dimensions, and they compete.
- This process has led to the rapid disappearance of urban identity, and the reshaping of ordinary cities has come to the fore.
- In a broad sense, urban planning and design are creating a new urban environment and cities are being rebuilt in the name of social benefit with these new, complex and urban projects.
- The current system, which deals with physical planning in terms of urban settlements within the hierarchy of plans such as zoning plan, master zoning plan, environmental layout plan, does not adequately comprehend ecological scale and concepts.

It will be necessary to start a new thought process in planning. How can this process be achieved? (Urbanization Council, 2017):

1) Coordination of Different Disciplines in the Urban Planning System

Preparation of plans using 3-dimensional representation and different analysis techniques in terms of preparation and presentation techniques,

2) Participation and Transparency in the Urban Planning System

It should be ensured that the public participates in the planning system, and as a result, sustainable and public benefit urbanization should be achieved.

3) The Multi-Legal Environment of the Zoning Institution Today

There are more than 30 laws and as many regulations in force on zoning and housing issues. This situation leads to legal confusion and conflicting laws and regulations that make it difficult to implement.

4) Tools for Implementing Plans

Considering the thresholds such as catchment areas, forest areas, agricultural and pasture areas, protected and protected areas, coastal areas

and other natural areas that need to be protected under the provision and protection of the state in metropolitan cities, there is increasing construction pressure towards these areas that need to be restricted and protected. For these reasons, it is observed that the existing application tools and planning system used in planning are insufficient. In this case, a new planning system and new implementation tools are needed.

5) Urban Identity Approach

In order to protect and ensure the sustainability of urban identity, it is necessary to develop planning and design strategies and policies that are respectful and impartial to the layers of sociological, cultural, economic, ecological, ideological and architectural elements formed within the historical process under the roof of that city.

6) Identity Approach in Urban Planning System, Urban Planning and Design at Human Scale

The most basic element that constitutes the urban identity is people. All human structures, activities and elements in the city belong to the people living in the city or to public institutions and organizations that represent people. Planning approaches that exclude people in the city cause the human element that makes up the identity of the city not to be reflected in the plans as required.

7) Urban Design and Identity

Urban design is the art of creating space. This is a process that aims to be fictionalized in all its details. This process is a whole that includes neighborhoods with a defined identity, architectural works, public spaces, green spaces, triangles, foci, human-scale construction and urban furniture.

8) Natural and Ecological Values

Cities are not only areas where anthropogenic activities are concentrated, but also ecosystems that contain natural structures and systems, and the interaction of cultural and natural structures. Sustaining the ecosystem functions of cities in a balanced and healthy way can only be possible with planning practices that deal with cities with an ecosystem perception (Yaman and Doygun, 2014).

The biggest problem of our cities is that they have developed and changed in parallel with the increasing human use, and they have become agglomerate areas as a result of human concentration in time and space. For the ecological,

social and economic sustainability of the cities of our country, the green network system will stand out as "critical infrastructures" in today's volatile and fragile urban environment. Green network and green infrastructure studies are on the agenda in order to analyze and integrate the ecologically based systems in our cities. Despite the extremely growing and identical structure of cities, the elements that make the city more unique, livable and identifiable are the green network systems that can be defined as the ecological values of the city. In particular, nature-based solutions that can be detailed from energy-efficient structures that can be seen in urban design applications to water-permeable surface coating materials are important in the climate change adaptation process. Thus, it will contribute to increasing the quality of life.

3. Cities, Climate and Ecology

Natural environmental conditions are the main factors in the establishment of cities. Data originating from the location, topographic condition, climatic conditions, water element, vegetation and natural environment of a city distinguishes that city from others, defines it, makes it unique and gives the city an identity (Deniz, 2004; Kır, 2009). In addition to being areas where anthropogenic activities are concentrated, cities are ecosystems that contain natural structures and systems, and the interaction of cultural and natural structures. The identity of a city cannot be thought of independently of the city's open and green spaces, except for the city's building stocks and settlement areas. Rivers and other water assets (lake, pond, sea, etc.) as natural resource values in cities are the most important characteristics that determine the identities of cities. At the same time, with the increasing population and global economic mobility in recent years, the elements that balance the appearance of cities formed by human agglomerations in time and space and make the city more livable are the green network elements as the ecological values of the city. The natural waterways and river corridors located in western cities not only stabilize the temperature of the city and create evaporation surfaces, but also provide an opportunity for many living things to live as an ecological corridor. These corridors are also privileged places where urbanites are renewed and give them the opportunity to do recreational activities. Especially in recent years, urban planners are now interested in the new face of cities, the part that is close to nature and ecologically renovated. The recognition of cities is no longer limited to their architectural structures, perfectly functioning traffic system. New concepts (Green road, Green Belt, Green Roofs-Roof Gardens, Urban Forests, Thematic Gardens, Water Conservation in Cities, Energy-Efficient Structures/Smart Buildings, etc.) it gains more meaning by taking its place as an integral part of urban life as complementary elements of the city.

This new human-shaped process, which started with the domination of nature as a result of human interaction with nature from the past to the present, has brought environmental problems to the agenda as a result of industry, urbanization and intensive population movements. Rapid population growth, which is one of these problems, brings unplanned urbanization with it. Therefore, if the urbanization trend continues like this, the increasing pressures of urbanization on the climate system will come across as a big problem. There are three main reasons for this condition:

- Urban areas, where millions of people are densely populated, are the areas that suffer the most from the effects and dangers of climate change. The dimensions of these impacts and hazards depend on the city's location, demographic structure, socio-economic structure, physical infrastructure, quality of the built environment, preparedness for disasters and institutional structuring (Yüksel, 2014).
- Urban areas are responsible for 75% of natural resource consumption and 80% of global greenhouse gas emissions.
- Depending on the population growth in cities, it is estimated that the amount of built up area will increase 3 times in developing countries and 2.5 times in developed countries until 2030.

Impacts on the city can be handled with two different approaches (Carmichael, 1999; Climate Change, 2001; UN, 2016):

1. Effects according to the change in the climate system

These effects;

- from changes in long-year averages
- will occur due to changes in extreme events.

One of the natural hazard types in cities

- hydrological hazards (flood-sudden flood, extreme wind/coastal flood, mass movement-rock fall, landslide, dent etc.),
- meteorological hazards (such as hurricanes)
- indicates that the probability of climatic hazards (such as extreme temperatures, drought, fire) will increase.

2. Effects according to the components of the city

- Impacts on the built environment (floods, temperature)
- Impacts on infrastructure (water, sewerage)
- Effects on human health,
- Effects on biological diversity,

- Effects on air quality,
- Effects on social and economic structure

Sustaining the ecosystem functions of cities in a balanced and healthy way can only be possible with planning practices that deal with the ecosystem perception of cities (Yaman and Doygun, 2014; USGS, 2018). There is a relationship between the urban texture organizations and infrastructure systems in urban areas. This relationship has become even more important, especially with the reduction of green areas in urban areas and the preference of impermeable surface coatings. As a result of these preferences, surface flow formation has occurred in transportation and construction and urban landscape areas. In parallel with this, the existing infrastructure systems, which continue with their limitations and problems, have become unable to manage water at high volume and speed due to sudden rains (City of Tucson, 2023). As a result of all this table, serious problems have been encountered such as decrease in groundwater levels, increase in erosion and pollution concentration in the river corridor and embankment (Novotny and Olem, 1994), flood disasters (Samsun flood disaster 2012, Ayamama stream flood 2009, Mersin great flood disaster 2001), collection and distribution of water in infrastructure systems, a lot of energy consumption for potable and wastewater maintenance, physical, chemical and biological degradation in watersheds and the inaccessibility of drinkable fresh water to everyone (Sert, 2013).

Sustainability is a concept with three dimensions (ecological, social and economic), and with its ecological dimension, sustainability means “the use of the natural resources of the world we live in by today’s generations, but this use being at a level that will not prevent future generations from benefiting from these resources” (Şahin, 2011). Resilience is defined as “The ability of a system, community or society exposed to hazards to resist, absorb, adapt and recover from the effects of a hazard in a timely and effective manner, including protecting and repairing its basic structures and functions” in the Hyogo Action Plan final report of the UN Office for Disaster Risk Reduction (UNISDR) (UNISDR, 2005). Resilient cities, on the other hand, have been developed to find solutions to the problems that occur with the oil production reaching the limit and the onset of climate change, and the concept of urban resilience has thus been included in the planning (Karahan, 2018).

3.1. Strategies for Combating Climate Change and Urban Infrastructures

Strategy 1: Sustainability and Resilience

The concepts of globalization and sustainability are two important issues discussed in the world today. The concept of sustainability has an expanding

field of influence in many ecological, social, political and economic fields. Deterioration as a result of rapid population growth and excessive consumption of natural resources has made it necessary to protect the environment (Beyhan and Ünügür, 2005). Therefore, it has created a reaction against excessive and unconscious consumption of natural resources in societies. Sustainability is defined by Collin (2004) as activities undertaken to protect natural resources and leave a good environment for future generations while meeting today's needs. Urban resilience can be defined as the capacity to meet the first damage caused by the problems experienced in the city, to reduce the effects of these problems, to continue the desired functions in the face of a problem and to adapt to the change experienced (Baykal and Topal, 2022). For this reason, the issue of urban resilience gains great importance in terms of sustainable development and the planning and design of resilient cities is the subject of urban planning (Altun, 2011). The basis of sustainability and resilience strategies is the protection of resources and the effective management of this in the short-and long-term. In this sense, approaches such as the recently developed smart city, the sharing economy, and the circular economy as a solution to protect and use existing resources in the most effective way (Kurdoğlu and Parlak, 2022) emphasize the responsible and effective use of resources and try to reproduce this at the intersection of the city, economy and society (Figure 1).

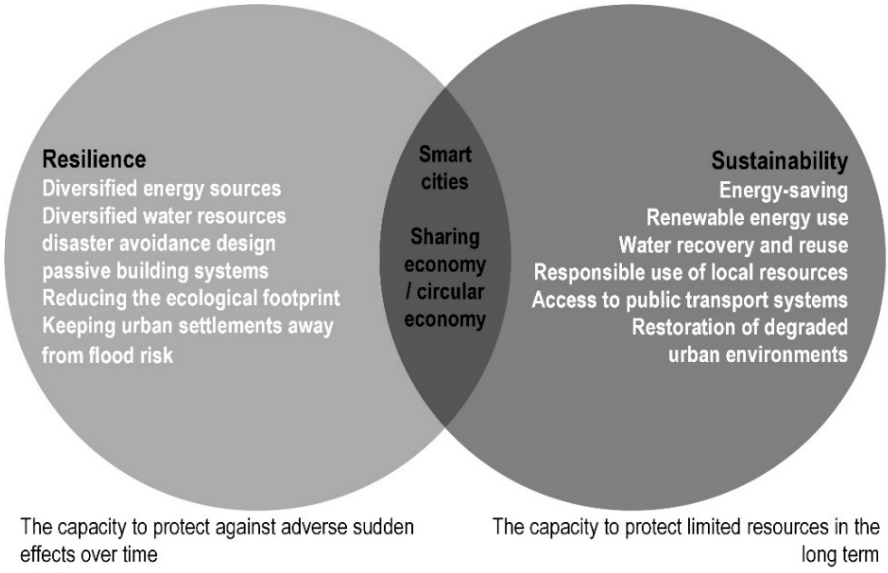

Figure 1. Relationships Between Sustainability and Resilience Strategies (Demirel ve Velibeyoğlu, 2017)

Strategy 2: Reduction and Adaptation

The reduction process is demonstrated by examining the different parameters between carbon dioxide emissions and energy consumption. These variables can be determined as (1) carbon intensity (the amount of CO_2 per unit energy production), (2) energy intensity (the amount of energy consumed per gross national product), (3) national income per capita, and (4) population. While carbon intensity and energy intensity are an indicator of the "technological development" levels of countries, gross national product refers to the level of prosperity of the country. In this case, technology, welfare and population factors determine carbon emissions. Studies reveal the importance of "energy density in the economy" and "carbon density of energy" factors. As a result, it is clear that the politically and technically feasible method of reducing CO_2 emissions is the transition to a "low carbon economy" and this can be achieved with renewable energy sources and energy efficiency (Tural, 2017). In this context,

- Storage and ingestion of carbon
- Reducing energy demand (cooling+source)
- Reducing vehicle demand by providing recreational opportunities in and around the city (indirect)
- The (indirect) measures to enable food production in the city and its immediate surroundings are also the strategies suggested by the Climate Action Plan for the ecological renewal of cities.

In terms of the adaptation process, climate change indicators (increasing temperatures, changing precipitation cycles, melting of ice and snow, sea level rise, etc.) are influential. Extreme weather and climate-related events that cause dangers such as floods and droughts have started to be experienced more frequently and intensely in many regions and will repeat with shorter cycles. Even if global efforts to reduce emissions are effective, climate change is inevitable and complementary actions are needed to adapt to its effects.

Adaptation is necessary to anticipate the effects of climate change and to minimize these effects and to take appropriate measures. Integration in other policy areas such as ecosystems and water management, disaster risk reduction, coastal zone management, agriculture and rural development, health services, urban planning and regional development is of vital importance and its necessity is increasing day by day. Actions include technological measures, ecosystem-based measures and measures that address behavioral changes (EEA, 2023).

Urban planners, landscape architects and ecologists are trying to recreate the lost natural values in the city. The concept of "all green network elements including the built environment and open spaces that find a place in the city" is a natural result of these obligations and quests. With the adaptation process, it is necessary to manage high temperatures, manage water resources, reduce the impact of river floods, reduce soil erosion, reduce coastal floods, and create a space for living species to adapt to new climatic conditions.

One of the most important tools in realizing reduction and adaptation strategies to be implemented against the effects of climate change will be green infrastructure plans. To support these, sustainable mobility and smart growth are among the things to be done in terms of transportation and land use decisions (Figure 2) (Demirel and Velibeyoğlu, 2017).

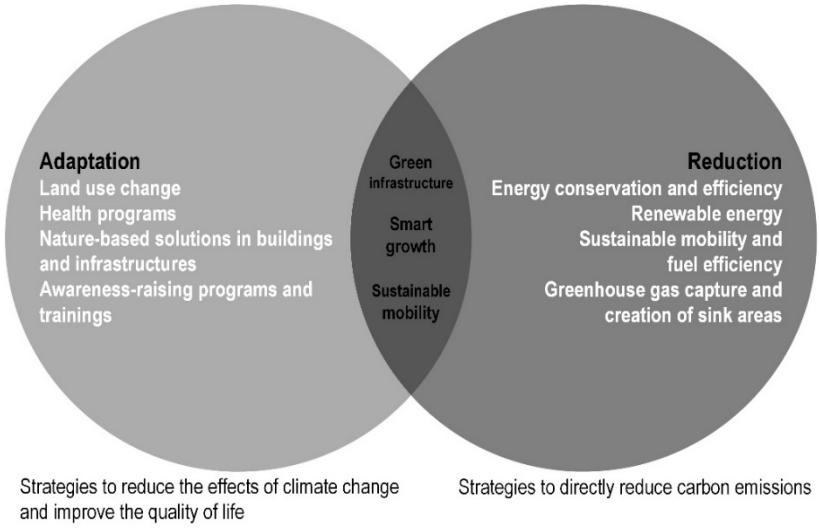

Figure 2. The Relationships Between Adaptation and Reduction Strategies (Demirel ve Velibeyoğlu, 2017)

4. Urban Design

While the name of the "Urban Design" action aimed at shaping the urban physical environment is "Urban Architecture" in our language, the first definition of the field of Public Spaces Design (Civic Design) in the west was made in 1909 as "Civic Design" (the dictionary meaning of the word civic is given as "urban, city-owned, municipal, civic and civilized"), and today it is "urban design". Urban Design is a detailed arrangement method that includes

multidimensional, urban detail scrutiny and analysis in physical, socio-cultural and socio-economic contexts in urban space.

When urban design as a form of regulation and application for the built environment is considered in terms of content, it includes the study of visual and environmental values related to the quality of urban life and the creation of urban appearance goals, as well as analytical studies, their synthesis and predictive values for this environment. With this aspect, urban design also expresses an artistic initiative, and the art of urban design is defined as the art of creating or shaping the appearance of the city. Urban design is about the physical order of the environment on one side and the fictionalization of the psychological needs of the environmental users on the other hand.

"Urban Design" was initially considered as a "Tool that Aesthetically Organizes the City", and today it has become an indispensable tool in terms of "Transforming and Implementing Urban Planning into Action". In the face of the changes, transformations and developments experienced in urban spaces, it has now emerged with new content, new dimensions and new roles. Urban Design is a cross-sectional study area of design and planning disciplines and other Natural Sciences and Social Sciences and is multidisciplinary. For example, it requires the existence of many branches of science (archaeology, history, psychology, painting, music, identity studies, etc.) that can feed designers, including urban sociologist, climate scientist, ecologist or related disciplines of fine arts.

Urban Design is a direct actionable process that develops rules and explains the relationship between the built environment and open and green spaces and how to organize and build transportation. Urban Design has been a tool used to understand and explore urban space, which deals with all aspects of the built environment, and to determine the potential of the area. At the same time, urban design is an operational process used to strengthen the identity of a place and create a sense of community. Today, the concept of urban design may differ in each country according to the urbanism and systematics of that country.

4.1. Development Process of Urban Design Concept

This concept, in its current sense, was discussed for the first time in 1956 at the Urban Design Conference held at Harvard University in the USA, where the physical dimension of planning was emphasized. It is recorded that the term Urban Design was used for the first time in a conference held at Harvard University under the chairmanship of Jose Louis Sert. Later, in 1957, the profession reached the public with the publications of the American Institute

of Architecture. The emergence of the field of urban design as a new field of expertise started when Reyner Banham identified the gap between architecture and planning disciplines in his notes in the 1960s and stated that a new expertise was needed to fill it (Manavoğlu and Ortaçeşme, 2004). Urban Design is defined as a transition between both disciplines in terms of both content and scale.

It can be said that in the UK after 1960, it came to the fore with the search for "Action Plan" in parallel with the increase in "Slum Clearance" projects in urban centers. The 'The Future of Town Planning' system, which was proposed by the Planning Advisory Group (PAG) report of 1965, brought a new planning stratification and understanding. Based on this report, the 1968 Town Planning Act determined the legal framework for the new planning system. Urban Design programs were started at the Architectural Faculties of Sheffield, Edinburgh, Manchester from 1971, and at Oxford Polytechnic in 1972.

When urbanization problems began to emerge in Türkiye, especially in the 60s and 70s, in the world of planners, architects and theorists, solution packages such as providing well-designed, flexible, core residences and creating residential environments with abundant green areas gained currency. Urban Design Graduate Education Programs were established in Türkiye in the early 1980s, first at the Department of City and Regional Planning at Mimar Sinan University, and at the Department of City and Regional Planning at METU in the mid-1990s.

In 1991, the Department of Urban Design and Landscape Architecture started as an undergraduate program within the Faculty of Fine Arts and Design at Bilkent University. Afterwards, there are Graduate Urban Design Programs, including nearly 30 Master's Programs and 1 Doctorate Program after the 1990s.

4.2. Legal Status of Urban Design in Türkiye

Within the scope of the "Spatial Plans Construction Regulation" issued in 2014, in the "Directive on the Preparation and Evaluation of Urban Design Projects" by the Ministry of Environment and Urbanization in 2018 (Spatial Plans Construction Regulation / Official Gazette Date: 14.06.2014 Official Gazette Number: 29030), the concept of urban design is expressed as follows:

Within the scope of the "Spatial Plans Construction Regulation" issued in 2014, in the "Directive on the Preparation and Evaluation of Urban Design Projects" by the Ministry of Environment and Urbanization in 2018 (Spatial Plans Construction Regulation / Official Gazette Date: 14.06.2014 Official Gazette Number: 29030), the concept of urban design is expressed as follows:

- Including mass and structuring order or open space arrangements according to the design purpose, taking into account the natural, historical, cultural, socio-economic characteristics and land structure,
- Establishing vehicle transportation, parking and service relations and pedestrian circulation relations,
- Showing the relationship of building, street, texture, open and green spaces and urban furniture details,
- Dealing with infrastructure elements interdisciplinary with a holistic approach,
- Expressing image, meaning and identity features,
- Expressed as an appropriate scale procedure that includes design principles and tools.

Spatial Strategy Plan (1/250.000, 1/500.000 or higher scale maps), Territorial Plan (1/200.000, 1/100.000, 1/50.000, 1/25.000), Master plan (1/5.000 scale, 1/5000 and 1/25.000 in metropolitan municipalities), Implementation plan (1/1.000 scale) are included in Spatial Plans Construction Regulation (2014). In addition, there are Transportation Master Plan, Long Term Development Plan, Integrated Coastal Zone Plan, Conservation Zoning Plans and Urban Design Projects. However, urban design studies is not shown and associated with the spatial planning grading. In addition, there is no reference to urban design projects in Master and Implementation Plans.

Urban Design Project within the scope of the "Directive on Preparation and Evaluation of Urban Design Projects" (2018) by the Ministry of Environment and Urbanization, repealed in 2018, (T. R. Ministry of Environment, Urbanism and Climate Change, 2023a), within the scope of the "Directive on the Preparation and Evaluation of Urban Design Projects" (2018) by the repealed T.R. Ministry of Environment and Urbanization, the Urban Design Project refers to the appropriate scale project: considering the natural, historical, cultural, social and economic characteristics and land structure, it includes mass and structuring order or open space arrangements according to the design purpose, establishing vehicle transportation, parking and service relations and pedestrian circulation relations, showing the relationship of building, street, texture, open and green spaces and urban furniture details, dealing with infrastructure elements interdisciplinary with a holistic approach, expressing image, meaning and identity features, containing design principles and tools.

What are the projects to be submitted to the Ministry to be evaluated within the scope of the Directive? The areas specified in paragraph (i) of the

first paragraph of Article 97 of the Presidential Decree (Decree Number: 1), financial and commercial centers determined by the Ministry in paragraph (ğ), special project areas and Urban Design Projects prepared in the application areas specified in the Law and Implementation Regulation No. 6306 on the Transformation of Areas at Risk of Disasters are prepared by the relevant administration or interested parties in accordance with the provisions of the legislation and submitted to the Ministry.

What are the Principles of Urban Design Project Preparation? Article 5-(1) The Urban Design Project is prepared by taking into account the nature and originality of the study area and taking into account the principles in the urban design guide and design information sheet, if any, provided that it is developed in line with the request of the Ministry. (2) Urban Design Project: It is an informational project submitted together with the urban design project report, prepared within the framework of the definitions in the relevant legislation and the format and content in the annex of this Directive, considering the nature and originality of the area. If not requested by the administration in another scale, it can be prepared at 1/1000 or 1/500 scale and alternatively if deemed necessary by the Ministry. Urban Design Projects include the elevations and dimensions allowed by the desired scale.

Urban Design Projects consist of the works and processes given under 9 titles below:

1) Aerial Photograph of the Location of the Project Area in the City

2) Aerial Photograph of the Project Area Boundary The legal status of the area, the date of announcement and the purpose of the announcement will be stated.

3) Current 1/1000 Scale Implementation plan information about the approval of the zoning plan (approval date, number, approval authority) will be provided.

4) Plan Notes for the 1/1000 Scale Implementation Plan in force Plan notes for the approved zoning plan will be included.

5) Tables Created Regarding the Construction Conditions

a. TAKS, precedent values and total building construction areas will be tabulated by taking into account the types of buildings used in the urban design project and their functions and comparing them with the zoning plan decisions.

b. A table showing the parking lot and shelter account will be given.

6) The Urban Design Project will be presented on the current map and in black and white on a 1/1000 or 1/500 scale, unless requested by the

administration on another scale. Information explaining the project, such as building elevations, heights, setback distance, inter-building distances, parking numbers, will also be processed on the project. In addition, it will be taken from four main directions and holistic sections on the same scale as the urban design project will also be located around the scheme. The sections to be presented should describe all the features of the area, comply with architectural drawing standards, and the functions used in the sections should be expressed by creating a legend according to their types.

7) Unless requested by the administration at another scale, the urban design project will be prepared in 1/1000 or 1/500 scale, on the zoning plan and colored. In order to examine the integration with the environment, the master plan decisions of the immediate environment will also be included on the project.

8) Visuals: There will be silhouettes and three-dimensional expressions to describe the relationship of the project area with the city and its immediate environment. Apart from general visuals, visuals that best describe the design should be included.

9) Schemas: In order to increase the comprehensibility of the project, the schemas requested by the Ministry can be included among the schemas detailed in the table below, at an appropriate scale, which describe the main features and decisions of the project, which are not binding in terms of implementation in terms of scale and content (Table 1).

What are the Urban Design Project Evaluation Criteria?

Urban Design Project submitted to the Ministry,

1. Construction conditions determined in the plan (Total Construction area, TAKS and KAKS, Building heights)

2. Mass arrangements (orientation, garden distances, distance between masses, etc.),

3. Ratio of Open and Closed Areas,

4. Designs for transportation-circulation (inside/outside the building block, vehicles, pedestrians, bicycles, short and long-term parking lots, service) and open/closed areas,

5. Urban furniture,

6. Facade typologies,

7. Standards for the sidewalk / pedestrian walkway for the disabled,

8. In terms of materials and details, it is evaluated within the scope of Law No. 3194, Law No. 6306, Spatial Plans Construction Regulation with Decree No. 644, Planned Areas Zoning Regulation, Parking Lot Regulation and approved Master Plan and plan notes, if any.

How are Urban Design Projects Evaluated?

The Urban Design Projects prepared and submitted to the Ministry for the areas defined in accordance with the Presidential Decree (Decree Number: 1) and Law No. 6306 are evaluated by the Urban Design Evaluation Commission assigned by the Authority of the Ministry within the scope of the Directive.

The Goal and Principles of the Urban Design Project

Article 4- (1) The Urban Design Project should aim to propose a holistic structure with conservation, renovation and development goals taking into account the characteristics of the area and to create a sustainable, livable and qualified living space that is related to its environment, takes into account the natural and ecological environmental values, enriched with social and cultural equipment in accordance with the approaches set out in the design context. (2) The basic principles of the Urban Design Project are as follows:

- Local character and identity should be emphasized,
- Historical and cultural continuity should be preserved,
- The quality of the space should be increased,
- A people-oriented transportation approach should be adopted and accessibility should be ensured,
- The place should be easy to read and perceive,
- Mixed uses should be taken into account,
- It should include sustainable and ecological approaches.

4.3. Urban Design Guides

In the Spatial Plans Construction Regulation, the "Urban Design Guide" is defined as follows:

- Article 30/7: "In accordance with the urban design project, an urban design guide is prepared to include guiding and advisory decisions aimed at gaining space, image, meaning and identity, raising aesthetic and artistic values, arranging structures in a way that creates harmony and integrity, and for implementation within the spatial planning systematics"

• The Urban Design Guides are of reference quality and their feature of being a guide-guide-guiding is emphasized. The coordination of these guides with the country's spatial planning practices is also mentioned.

It is for all segments and individuals who live, produce, experience and decide on the structuring process in a city. There are basically three groups for urban design guides. 1. Decision Makers and Professionals (Relevant Ministries and Local Administrations), 2. Consultants, Designers, Experts and Practitioners (Section Active in Design/Urban Planner, Architect, Landscape Architect, Entrepreneur, Lawyer, Financial Sector), 3. Citizens of the City (These are the segments whose active participation we desire in the design process).

The "General Directorate of Spatial Planning" under the Ministry of Environment, Urbanization and Climate Change has been assigned to the preparation and evaluation of the Urban Design Guide and Projects. In the "Directive on Preparation and Evaluation of Urban Design Projects" (31.07.2018) to be approved by the Ministry of Environment, Urbanization and Climate Change, Urban Design Project: Unless requested by the administration at another scale, it will be prepared on a 1/1000 or 1/500 scale, on the master plan and colored. In addition, Urban Design Projects, architectural (structure) and landscape design projects (structural and plant application projects) should be done at 1/200 or 1/100 scale, and detail projects should be done between 1/50-1/1 scales.

T. R. Ministry of Environment, Urbanization and Climate Change (T.R. Ministry of Environment, Urbanism and Climate Change, 2023b) in line with the strategy of creating "livable environment and spaces with identity", it conducts studies on the design of original and identity cities using human-oriented, modern architectural techniques sensitive to climate and environment within the scope of the "Preparation of Urban Design Guidelines Project" and in order to increase the effectiveness of urban design in planning and implementation.

Table 1: Schemas Requested by the Ministry, Explaining the Main Features and Decisions of the Project in order to Increase the Intelligibility of the Project, not Binding in terms of Implementation in terms of Scale and Content, in Appropriate Scale and Detailed

Scheme Name	Content	Description
Cadastral Map and Ownership Status		Lot and block numbers, cadastral status and property ownership (public, foundation, private property, etc.) will be shown regarding the project area.
Transportation scheme	Public transport line and stops	All information regarding the existing and/or planned public transport line in the project area will be shown schematically.
	Cycle path Footpath Roadway	Existing and/or planned roads in the project area will be shown schematically with different legends, and road sections will be given.
	Car Park	All information about the car parks in the project area (number, size, number of disabled car parks, open, closed, underground, car park entrances and exits, etc.) will be shown schematically.
	Measures to be taken for the disabled and disadvantaged groups	The measures taken for the disabled and disadvantaged groups in the project area (marked road, ramp, disabled lift, etc.) will be shown schematically on the plan and will be supported by schematic drawings when necessary.
Building function scheme	Building use, function decisions	The usage/function types (residential, commercial, education, etc.) of all the buildings in the project area will be shown schematically with different legends, plan or solid modeling, by specifying if there are differences in the floors in the same building.

Building density scheme	Open and closed areas (occupancy-vacancy ratio)	The hard ground/soil ground areas in the project area will be expressed schematically on the plan with different legends and percentage ratios will be calculated.
	Number of floors	All buildings in the project area will be lifted up with solid modeling technique and will be grouped with different legends according to the number of floors.
	Building heights	All buildings in the project area will be lifted up with solid modeling technique and building heights (entrance and eaves elevation depending on sea level, building height) will be displayed.
	Building coverage ratio / floor area ratio / imputed value	The construction rights given in the master plan of all the building blocks in the project area and the values used in the project will be shown on the plan.
	Typology	Typologies of all buildings in the project area will be shown.
Natural structure and landscape scheme	Environmental factors	Dominant wind direction, insolation and shade test analysis studies will be carried out regarding the project area.
	Landscape	Details on landscaping principles and planting will be given.
	Land grading	The artificial grading regarding the existing and future arrangement in the project area will be expressed schematically together with the building masses.
Infrastructure scheme	Water, energy, natural gas	Information on the infrastructure lines (clean water, gray water, energy lines, etc.) in the project area will be expressed with appropriate legends.

Details	Facade typologies	Material and detail information regarding the designed building facades will be given in appropriate scales.
	Urban furniture	Information (color, size, material, etc.) regarding the use of urban furniture (lighting elements, trash cans, benches, flooring, plant safes, etc.) to be used in the project area and the proposed products will be given and supported by visuals.

The "urban design guides" in accordance with the historical and original architectural texture of each city are published on the Internet in order to guide the relevant study participants and to be delivered and informed to all institutions and organizations developing space-based plans, projects and applications in our country, especially local governments. Especially in local governments, the implementation of decision-making mechanisms related to urban design, project preparation procedures and application techniques within the framework of urban design guidelines is important for the development of the planning system of our country.

While the "Project for the Preparation of Urban Design Guides" brought to the agenda by the Ministry will provide very important technical gains for local governments, it will also bring guiding support in the structuring of urban design units of local governments in administrative terms.

In this context, the "Preparation of Urban Design Guides Project", which aims to teach the "design guide preparation method" to the relevant administrations, by providing the necessary infrastructure for the development of proposals for the preparation and implementation of urban design guides in our country, taking into account world examples, was carried out in two stages:

Stage One 2016:

In the first stage of the Project for the Preparation of Urban Design Guides, the country models examined within the scope of the Project and the model-definition to be put forward for Türkiye and the information obtained at the end of the process of discussing the content of the Urban Design Guide in accordance with this model-description were published. The documents of the study are given below:

Urban Design Guides Volume-1, Urban Design Guides Volume-2, Urban Design Guides Volume-3, Urban Design Guide Preparation Handbook for Local Administrations, Prof. Dr. Mehmet Çubuk - Urban Design Presentation, Search Conference Ankara, Search Conference Istanbul, Search Conference Evaluation Report, Municipality Guide Questionnaire, Frequently Asked Questions on Urban Design

Stage Two 2021:

In the second stage of the Project for the Preparation of Urban Design Guides, a sample for implementation was created in a medium-sized pilot settlement (Meram - Konya) in order to disseminate the Urban Design Guides Preparation Process Model proposal, and in the light of this example to be realized, the procedures and principles on how to prepare the design guides were determined. The documents of the study are given below:

Meram Urban Design Guide Volume I Urban Atlas, Meram Urban Design Guide Volume II Strategy Document, Meram Urban Design Guide Volume III Design Guide, Urban Design Guide for Local Authorities

4.4. Searching for Different Approaches to the Urban Phenomenon

Economic Location Approach: This approach mainly investigates land use, land values and the accessibility relationships that affect them. Cost becomes important.

Formal-Intuitive Design Approach: The designer sees himself as a superior being in shaping the society by interfering with the physical environment, and he gets the impression.

Perceptual Approach: In this approach, by dealing with the spatial-physical components of the city, it is emphasized that how the city is perceived is more meaningful. This approach excludes historical development.

Social and Historical Approach: In this approach, it is accepted that the city did not emerge as a coincidence, but that the city is a social and historical product.

Urban Morphology Approach: The urban morphology approach includes functional and economic approaches. It can also include perceptual, historical and heuristic approaches. Urban morphology tries to make an objective analysis of the city (Altaban, 2013).

4.5. Urban Space

The built and unstructured areas that make up the settlement texture of the cities constitute the urban space. In general, the urban space is the whole of

the places where the actions of the four main functions of human life (shelter, work, entertainment/rest and transportation) take place (Manavoğlu and Ortaçeşme, 2004).

Urban spaces are considered as a) Private and b) Public Spaces on the basis of ownership. When urban spaces are approached in terms of responsibility, maintenance and control, a) Private Spaces can be defined as urban spaces whose users own property and are reserved for commerce. b) Public Spaces are in the form of urban spaces open to the use of society.

The public space is defined as an accessible free space in the city that has free use and expresses a public quality. On the other hand, public spaces are spaces that support public or private public life or enable social interaction. Places in the city that are open to all members of the public (street, pedestrian crossing, park, square, etc.) are public spaces. They are open or closed spaces designed with the use of each individual in mind.

Urban Public Spaces: In generally unstructured and structured spaces, the needs that emerge as a result of the qualitative and quantitative intensification of our social life must be met. In this context, there are important functions provided by public spaces. It is possible to collect them in four groups:

- Providing psychological and sensory needs (diversity that banishes boredom-pleasure-dream-exploration-traveling-with the crowd-or isolation-calmness or mobility-speed or slowness, definition of places-symbols of common life)
- Ensuring Social Relations (Spontaneous, individual or joint ventures, programmed welcome-information exchange-trust-waiting-leisure-culture-demonstration-different communications-educational learning games)
- Ensuring Economic Changes (Ensuring economic change in conditions specific to each of the sectors that do not have the same relations in services-trade-business-common spaces)
- Providing Beneficial Displacements/transportation-access-mobility-displacement/ (Providing transportation facilities such as pedestrian-vehicle-prams that adapt to all vehicles in comfortable conditions-mobility of the physically disabled, bicycle-motorcycle-public transportation-bus etc.) (Çubuk, 1989).

In recent years, it is seen that urban centers, shopping malls and green areas and areas that have emerged with the transformation of industry have an increasing importance in the city. With the global ecological crisis and the increasing importance given to nature, the importance of nature and the

representations of nature in the city has increased. In this context, the importance of green space as a public space in the city has started to be discussed more.

4.6. Water Sensitive Urban Design

Spatial Planning is Also a Water Use Decision

• Urban and water planning are related as two sides of a coin in the construction of a sustainable water system.

What is Water Responsive Urban Design? (Tamer, 2016)

• In this approach, water management is sensitive to natural hydrological and ecological cycles. In short, it is an approach that integrates the management, protection and conservation of the urban water cycle with urban planning.

In particular, within the Principles of Water Sensitive Urban Design,

• Developing methods to reuse runoff, including collecting stormwater runoff from roofs and other stormwater runoff, and to reduce peak runoff in runoff from urban development.

• Designing multi-purpose green spaces to enhance visual, social, cultural and ecological values in urban areas through landscape and integrated water are extremely important approaches for the urban green network.

With Integrated Urban Water Planning (Tamer, 2016), it is aimed to provide a more effective approach in the management of urban water demand and planning of supply. This coordinated planning process is the linking of sustainable development and water to the management of land and other related resources (including energy use).

Urban Water Efficiency Plan

The Urban Water Efficiency Plan serves as a framework for efforts to protect water resources and includes scope, objectives, potential results, specific targets set for reducing demand, and recommendations for the implementation of programs (Durmuş, 2013).

Urban Infrastructure Systems

As a result of the excessive increase in impermeable hard surfaces in urban areas and the decrease in open-green areas inversely proportional to this increase, rain water cannot penetrate the soil sufficiently after precipitation. With this situation, the excess rainwater that emerges flows along the hard surfaces and collects in the low-elevation areas.

Use of Rain Water in Cities

Today, storm water management is handled with a holistic perspective. Stormwater Management Systems are known as Sustainable Systems and consist of the following methods: A) Green Roofs/Roof Gardens, B) Waterproof Surface Coatings, C) Vegetated Roof Covers, D) Infiltration Chambers, E) Vegetated Water Arcs, F) Bioretention structures, G) Structured wetlands, H) Rain tanks and cisterns, and F) Rain Gardens.

Ecological Sustainability of Buildings within the Scope of ECO-CITY Concept

Ecological awareness has led us to find solutions to reduce the carbon emissions of buildings and their negative effects on the environment in the construction sector. The construction industry has also entered the "green transformation" in the world to combat climate change. In this context, the construction of environmentally friendly ecological buildings has come to the fore. While the interest in environmentally friendly building construction is increasing, the concept of green building, which develops with sustainable principles, has emerged (Akça, 2011). Green building evaluation systems, namely certification systems, which approve the sustainability of buildings within the framework of a number of standards, have been developed by green building councils around the world in order to ensure and encourage the implementation of green buildings. The main green building certification systems developed by different countries are as follows (Sev and Canbay, 2009):

BREEAM, which emerged in England in 1990, is the first example of an evaluation system based on criteria, which was developed by the Building Research Establishment Environmental Assessment Method (BREEAM) and the Building Research Establishment (BRE) in England in 1990.

SBTOOL, SBTool (formerly GBTool), which emerged in Canada in 1996, is an international assessment system established in 1998 with 14 participating countries. In 2008, the number of participating countries increased to 21. It is a general evaluation framework that SBTool targets, not directly applied to structures alone, and has determined 7 performance criteria in the evaluation.

The LEED Certification System, which emerged in the United States in 1998, was developed by the USGBC and was implemented in 1998 for the sustainable building industry to identify and evaluate green buildings.

GREENSTAR, which was created in Australia by adapting from BREEAM in 2003, was developed by the Green Building Council of Australia (GBCA).

It is very similar to BREEAM and aims to evaluate the life cycle effects of structures.

The German Sustainable Building Council was founded in 2007 and became a member of the World Green Building Council in 2008. The primary goal of the German Sustainable Building Council was the establishment and subsequent development of its own certification system. In this context, the DGNB Certification System was established in 2009 for office and administration buildings. This system was developed and became an international system in 2010, including existing and new buildings, educational institutions and commercial buildings (Anbarcı et al., 2012).

It is CASBEE that emerged in Japan in 2004 (ÇEDBİK, 2023). CASBEE, which was developed in 2001 with the cooperation of the Japan Sustainable Building Consortium (JSBC) and the Green Building Council (JaGBC), was prepared taking into account the sustainability principles of Asian countries as well as Japan.

The issues that BREEAM, LEED, CASBEE green building assessment certification systems deal with in common are: Sustainable Lands, Water Conservation, Indoor Air Quality, Selection of Appropriate Materials and Structural Elements, Efficiency in Water Conservation, Energy and Atmosphere (Tonguç, 2012).

Evaluation of buildings according to green building evaluation systems in Türkiye is a topic that has come to the fore in recent years. A local assessment system in Türkiye was first established in 2021 under the name of YeS-TR, however, building owners and investors who were interested in the subject in our country previously preferred to certify their buildings using one of the LEED or BREEAM Green Building Assessment systems (Erten, 2009).

"Green Certificate Implementation Communique for Buildings and Settlements" was issued by the T.R. Ministry of Environment, Urbanization and Climate Change on 09.06.2021 (T. R. Ministry of Environment, Urbanism and Climate Change, 2021). According to this communique, with the establishment of the National Green Certificate (YeS-TR) System for Buildings and Settlements (YES-TR, 2023), the dissemination of energy-efficient, environmentally friendly, low-water, geographical features of the building applications at the national and local levels, promoting renewable energy technologies, reducing CO_2 emissions, developing awareness and capacity on energy efficiency and renewable energy issues, and addressing certification criteria for the promotion of product detail design construction of sustainable buildings, country-specific,

the creation of sustainable Green Buildings and Green Settlements with brand value will be ensured.

A green building certificate is a certificate that identifies and certifies the sustainable characteristics of a building or structure. These certificates are issued by organizations that evaluate and approve the features of buildings such as energy and water saving, waste management, air quality, and use of environmentally friendly materials. Green building certificates can be given in varying degrees according to the sustainable characteristics of a building or structure.

4.7. Dimensions of Urban Design (Brian Goodey, 1979; quoted from Altaban, 2013)

• *Spatial Dimension (Scale):*

The special interest of urban design is the spaces among the buildings that are not owned by anyone in the city, but actually belong to everyone. However, urban design does not only deal with the structure, appearance, silhouette, vistas, guiding signs of these outdoor spaces, and this design is not a unique branch of art. It is also necessary to correctly evaluate the areas in which Architecture and Planning specializes.

• *Time Dimension:*

Urban Design is closely related to the change dimension of cities over a long period of time. As such, it is closer to planning. Urban design has to see the environment in a historical perspective. It has to read and understand the evolution of the physical structure existing in the city, human activities, built forms, in the light of economic, social and political processes. It must see future changes and transformations in a phased series, along with opportunities and limitations, and is faced with assessing that change will be experienced, used and visited over the lifetime of a generation.

• *Human and Environment Relationship:*

The urban designer should also observe the users of the outdoor spaces and their relations with the interior spaces. It is also necessary for the users of the space to evaluate the economic resource opportunities, mobility, aesthetic interests, and the sensitivities of the families arising from their lifestyles very well.

• *Multi-Actor (Multilateralism):*

When dealing directly with public spaces, the urban designer will be encountered by a large number of property owners and users. Multifunctional

(mixed-use) development areas will have diverse domain and functional customers. This time, the urban designer will encounter many managers (bureaucrats) and management organizations in the reorganization or control of the built or natural environment. For this reason, the urban designer will be a very patient and skillful negotiator, balancing interests and keeping relations alive. Given that resources are generally scarce, this role will become much more functional. The urban designer will be successful thanks to his ability to persuade and reconcile the parties he encounters.

• *Multidisciplinary*:

The urban designer acts as an intermediary/middle man between two major disciplines such as Planning and Architecture. It is an AGENT that brings these two disciplines closer. The architect sees himself as a technologist and artist, and the Planner sees himself as a social scientist and business manager. Other branches of specialization are also considered within the inviolable limits of their own fields. The urban designer will also face the very difficult task of knowing the boundaries of these professions and at what points common relations can be established and directing them to joint work.

• *Guidance*:

The main role of the urban designer is to direct the development, change and transformation in the urban area where he works. He has to see these processes in a series of stages that extend to the intended ends. Therefore, the social, economic, political and visual results that will emerge on the way to the goals should be considered as a "problem area" for each stage. For this reason, in the selection of targets, sub-targets and operational tools, users have to establish relationships with various parties and professions and give them a continuous message. In this case, the designer has to present research, analysis and creative/artistic presentations that everyone can understand with great skill and guide.

4.8. Problems Encountered in Türkiye in the Scope of Urban Design Process

• The issues and agendas that require an urban design project are not clear,

• It is not clear how it will be related to the upper scale city master plan and the implementation plan. It is not clear how and in what way decisions should be made regarding urban design in master plans.

• Most of the Urban Design applications are market-driven projects that make the city uneasy, rely more on power and impose the logic and order of

this power, cannot integrate with its surroundings, and are generally aimed at marketing the city,

- In Urban Design projects, public interest has not been demonstrated to the required extent,
- Variety of naming projects,
- Project preparation procedures and principles have not been completed yet,
- It has not been clarified yet which subjects will be done by which occupational group and which scale will have a say in urban design,
- The documents to be covered by the urban design projects are not defined,
- There is no common language in terms of content and quality of the project, the scale and presentation formats are unclear,
- Lack of criteria for the examination and evaluation of their projects,
- The control, approval processes and procedures of the projects are different,
- Orientation and/or sanction effectiveness of urban design projects,
- Inadequate standards for spatial capacities to be used in urban design,
- Not introducing a definition in terms of ownership for the urban design areas to be projected,
- There is no information about which unit and how the approved urban design projects will be made or implemented during the implementation process,
- The authorized unit for the urban design process has not been defined in local governments,
- Insufficient number of interdisciplinary professions in local government and Institutions/Organizations and not working as experts, etc. (Keleş et al., 2017).

4.9. General Components of Urban Design

- Urban design is an important part of the urban planning process, urban development and spatial quality. Urban design is a design process that ends with the product, and it also directs the implementation and management process. Urban design has a scientific and artistic approach content and is an intersection of both. Urban design is considered as an interdisciplinary or supradisciplinary "common" platform subject rather than a single professional work subject.
- This, at the same time, requires a joint decision to be made as a result of the cooperation of all actors and participating stakeholders to create livable and suitable spaces for all. For this reason, the creation of Urban Design Guides for each city is a partnership document and an innovative tool.

• Urban Design is a field of expertise that deals with environmental responsibilities, social equality and economic vitality as a whole while organizing urban space. At the same time, it is closely interested in the quality of space and unique identity in the cities we live in. It is an area that offers and integrates the dynamic structure of the city and the creative features of design together to increase the quality of life. Urban Design requires an integrated approach with all stakeholders with interdisciplinary collaboration.

• Urban design is an important tool that directs the construction (building), landscape, transportation and infrastructure applications as action plans that have come to the stage of implementation and increase the quality of urban life with three-dimensional design projects, which are compatible with the policies and urban characteristics in the whole of urban settlements, in short, resulting in the continuity and relationship of urban planning (Gül et al., 2011).

• Urban design includes not only the building arrangement (building), but also the holistic organization of the buildings together with their surroundings (landscape space) and transportation systems. The most important part of the urban design is the public and private open and green spaces outside the building.

• It has not been clarified yet which subjects will be done by which occupational group and which scale will have a say in urban design. In this case, the concept and framework of urban design should be clearly revealed. Urban design projects should be considered as integrated with physical planning (master plan, spatial plan, city plan, etc.) processes.

• Subject headings that can be taken into account in the urban design process can be envisaged as follows: Urban Identity and Image, Building Architecture, Building Block and Densities, Urban Open and Green Area Systems, Infrastructure and Superstructure Systems, Building Materials, Hard Landscape and Materials, Urban Furniture and Accessories, Implementation Development Plans, Transportation and Accessibility, Urban Conservation, Building and Landscape System, Urbanization, Urbanization and Environmental Security, Urban Health and Environmental Security Policies, Urban Food System and Urban Agriculture, Urban Information System, Urban Economy, Urban Energy System, Public and Private and Legal Spaces, Spatial Demands and Tendencies of Urban People, Urban Design Strategies etc.

4.10. The Role of Professional Disciplines and Collaboration in the Urban Design Process

In our world where specialization is increasing, it is imperative for successful planning/design studies that disciplines with different perspectives

come together and produce solutions to problems with an interdisciplinary approach (Korkut and Topal, 2015). The basic disciplines that carry out spatial planning and design studies in today's Higher Education, "Building Architecture", "Landscape Architecture", "City and Regional Planning" disciplines are actually the basic professional components under the upper roof of "Architectural Sciences". Building architects are capable of designing building and building scale, Landscape Architects are capable of designing urban open and green spaces, and City and Regional Planner are capable of mastering and implementing plans. In addition to the joint work of these basic disciplines in urban design, cooperation can be made with other supporting disciplines (interior architects, economists, civil engineers, mechanical engineers, sociologists, geomatic engineers, archaeologists, art historians, infrastructure engineers, etc.) (Figure 3). However, today, it is not clear which disciplines have professional duties and responsibilities in urban design, and their scope, quality, legal and administrative framework. In particular, the working areas and boundaries of the professions are not defined. This lack of definition also causes misperceptions and conflicts in the work of occupational groups (Gül and Bostan, 2018).

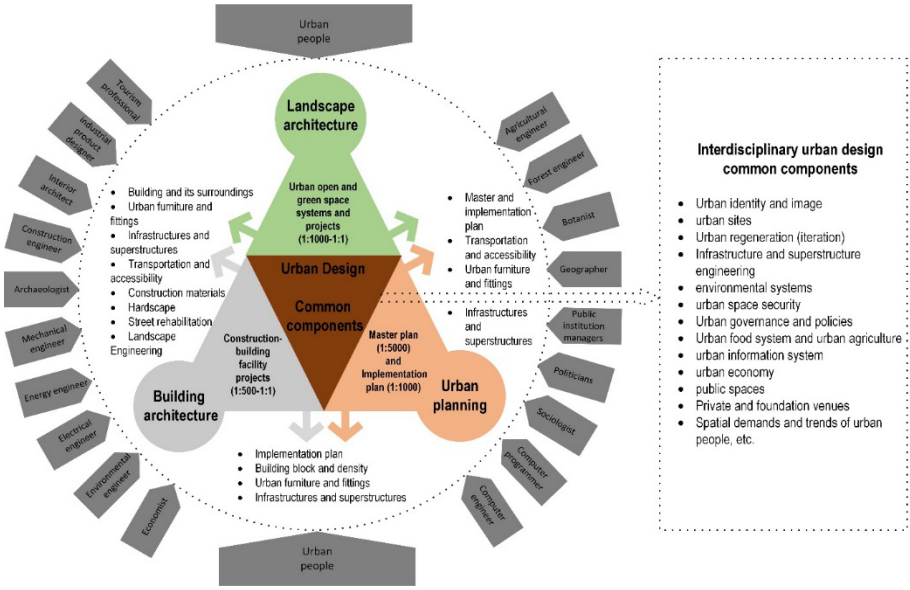

Figure 3. Urban Design Interdisciplinary Fields of Study
(Gül and Bostan, 2018)

Urban design guides are interface/bridge documents that establish the link between spatial planning and design, and ensure that policy and plan decisions continue up to the spatial design scale. These guides are important tools in the

creation of public space in cities and the strengthening of urban identity. On the other hand, they are tools that can be effective on the environment and daily life style of the people of the city, that is, on private places (Anonymous, 2016).

For this reason, a multidisciplinary working environment is required in the preparation process of the guides. The involvement of many professional specialty groups for basic, support or supplementary purposes is important. The weights of specializations may be different at different stages of the preparation of urban design guides. Interdisciplinary cooperation in the stages to be made for "Urban Design Guides" can be suggested as follows (Gül and Bostan, 2018):

Stage 1: Preparation and Vision Stage: At this stage, issues such as defining the project subject, determining the urban design goals and boundaries, defining the problems and strategies related to the area, establishing the project team, determining the strategy and resources, creating the project management plan, defining the workshop, communicating and participating with the stakeholders are taken into consideration. At this stage, the main disciplines should be Landscape Architect, Urban Planner and Building Architect. The disciplines that can provide support can be Transportation Specialist, Interior Architect, Economist, Sociologist, Geographer, Historian, Ecologist, Archaeologist, Art Historian, etc.

Stage 2: Context and Analysis: At this stage, studies such as the area's relationship with the city at the upper scale and its relationship with planning, defining the urban identity and local character, obtaining data on the social, spatial and natural environment for the target, creating digital base maps, making resource analysis, defining the structures and landscape spaces and transportation areas for protection and use are carried out. At this stage, professionals such as Landscape Architect, Urban Planner, Building Architect, Civil Engineer, Sociologist, Geographer, Historian, Ecologist, Economist and, according to the prominent features of the city, such as Archaeologist, Art Historian, can be active with a multidisciplinary study.

Stage 3: Urban Design Decisions and Principles: Urban design strategies, the relationship between master plan and implementation plans and urban design, design studies in the details of city, district, neighborhood, street, construction (building) and object will be at this stage. Options are created in subjects such as urban texture, transportation, use, density, reinforcement relationship, energy, nature and ecology, image and meaning and urban identity, building block formation, parcel relationship, open and green space systems, public pattern, street improvement (rehabilitation), infrastructure and superstructure relations, building and landscape protection approaches. At this stage, in addition to the

active role of Landscape Architect, Urban Planner, Building Architect, Interior Architect, Civil Engineer, it is also possible to receive support from other disciplines.

Stage 4: Spatial Detailing: At this stage, details such as building blocks, interfaces, landscape spaces, green texture and landscape pattern, size and scales of construction (building) mass, building environment, urban furniture, art objects and elements, building materials, infrastructure and superstructure relations, accessibility are developed. At this stage, Building Architect, Landscape Architect, Interior Architect, Industrial Product Designer and Urban Planner and other support disciplines may take place.

Stage 5: Control and Monitoring: At this stage, processes such as checking and monitoring whether the relationship between urban design conceptual schemes and principles and directions in urban design guides and urban projects are correctly established, defining funds and resources for urban design implementation projects, establishing performance evaluation criteria, determining the operational duties and responsibilities of stakeholders, promotion and development of sustainable participation strategies should be foreseen. This stage is actually the realization of internal and external audit. At this stage, primarily planning and design disciplines, Local Administrators, Decision Makers, Politicians, Official Institutions and Organization Representatives, Urban People and Other Disciplines should take place.

5. Conclusion and Suggestions

Urban design is an interdisciplinary approach that includes organizing, arranging and implementing holistic, sustainable protection and development of livable, healthy, quality, accessible and usable spaces (city-town-neighborhood-street-construction (building) and object scale). The concept of urban design is a multifaceted discipline with spatial, social, economic, cultural, ecological, aesthetic, political and technological dimensions.

Today, the demands and needs for the use of space are changing and diversifying. The concept of architecture, which is directly related to the concept of space, is experiencing a change and development from singular architecture to plural architecture. Urban design has to guide more responsible, flexible and more creative thinking in intervention to the environment.

Today, there is a need to move away from the logic of construction (constructionist) and to deal with the protection-utilization balance in the face of new developments and changes. There is a need for them to be integrated with

each other with planning and design scales and to adopt a new understanding in which content, activities, products and processes are defined to increase the quality of life within the scope of city-town-neighborhood-street-building and object scales. For this, legal regulations are needed. In this context, a holistic solution should be produced that can integrate sustainable and ecological concepts and principles to all components of the city. The main task of all professions in urban design, without the concept of overturning between professions, is to meet the social and cultural needs of the citizens, to create a healthy and reliable environment and to increase the quality of life. For this purpose, usage and restriction decisions and the principles of organization, design, implementation and management should be put forward holistically, taking into account natural, economic, demographic, social, cultural, historical and physical characteristics (Gül and Polat, 2009).

What needs to be done for contemporary and livable cities in the future can be summarized as follows: adopting a professional ethical approach by preserving our existing values with ecological approaches in the goals of the sustainability principle and realizing discourse and actions in line with urban design principles and objectives (Keleş et al., 2017).

In order to achieve the purpose of urban design, which is an interdisciplinary study, in terms of discourse and action, first of all, it is necessary to create environments in which the culture of working together between the basic disciplines of spatial planning and design can be developed and dialogue and cooperation opportunities can be put into practice in the Higher Education environment. For example, taking the basic planning and design courses of the disciplines within the Faculty of Architecture together and jointly conducting joint design projects, especially in the 3rd or 4th grade, will be of great benefit. In this way, it will be possible to apply integrative learning processes that will enable students from different disciplines to come together in design projects, share their perspectives, skills and tools, deal with complex design problems with different dimensions, and produce design solutions by developing a common mind, especially in the context of the joint design studio.

For urban design in professional practice, especially urban design competitions should be disseminated and team work should be increased. In public institutions and organizations working on urban design, technical staff from basic disciplines, including building architects, landscape architects and city planners, must be employed to work together.

Reflecting the harmonious coexistence and cooperation between human and nature in urban spaces will be possible with Ecological Self, Holism, Universality, Ethics, Sharing and Love, especially in educational, environmental, professional, economic and political dimensions. In this context, increasing the level of individual and social awareness and awareness will make important contributions in the dimension of discourse and action.

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CHAPTER V

LANDSCAPE RESTORATION OF POST COAL-FIRED POWER PLANT AREAS: AN EVALUATION ON ÇAN DISTRICT IN TURKEY

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1. Introduction

Countries must be able to produce a certain amount of electricity to ensure and maintain economic development and social welfare of citizens in today's technological world. Energy sources are divided into two which are renewable and non-renewable energy. Renewable which are called sustainable energies have emerged as an alternative to fossil energies i.e., coal which have limited quantities and periods of use and potential for depletion. When the total coal production in 2015 is considered, the calculations showing that the global coal reserves have a lifespan of about 134 years empirically prove the limitedness and depletion of coal (Republic of Türkiye Ministry of Energy and Natural Resources, 2023). Various countries confirms that the generation of electricity with coal worldwide will be reduced by certain commissions and agreements. One of the important examples of is Paris Agreement that is approved by more than 190 countries in 2015 to combat climate change due to the global temperature increase. The global average temperature rise should be kept below 2 degrees according to agreement. So, that target requires a gradual reduction in the use of fossil fuels like coal and a shift towards renewable energy.

Likewise, it was accepted by the International Energy Agency that 82% of the existing coal reserves in the world should be left underground to combat climate change (TEMA, 2019).

Thermal power plants which are considered as one of the major investment projects have significant ecological impact on its surroundings. Because they have to be evaluated with other facilities such as coal mines, waste collection areas and its cooling systems etc. The closure of at least 59% of the existing thermal power plants worldwide by 2030 is highlighted in the United Nations Intergovernmental Climate Change Panel (IPCC) (URL-1). In IPCC, 25 countries, including England and Canada made a global alliance aim to minimize the current coal consumption. The closure of coal-fired thermal power plant is expected in the next century. Nonetheless, Turkey's energy production with domestic coal is at the core of the energy policies implemented in recent years that is on the purpose of reducing dependence on external resources such as natural gas. Turkey is the fourth country with the world's most coal-fired power plant projects. These include the Licensed, Undergraduate / Associate evaluation process, EIA process and Unlicensed plants (URL-3). These projects are supported by legal regulations. For example, one of these regulations is the Electricity Market Law No. 6446. In the Law No. 6446; there are legal provisions regarding the establishment, regulation, and control of the energy market for electricity generation. However, compliance with the environment is stated in the same law while these provisions are applied. However, there is often a mismatch between implementation and legal provisions.

In summary, environmental pollution is increasing since too many thermal power plants are designed and legal provisions covering compliance with the natural environment are not implemented during the construction and operation of the thermal power plants. Furthermore, our country should have a similar approach with IPCC global alliance in terms reducing the use of coal. Because both the environmental ethics strategies included in the State Development Plan decisions and the international agreements signed requires a change in strategy of energy production in Turkey. Some of the international agreement examples are Basel Convention on the control of transboundary movements of hazardous wastes and their disposal, Convention for The Protection of The Ozone Layer and Paris Agreement (Kaya, 2011).

The elimination of environmental degradation after the closure of the power plant has been identified as one of the important issues to be addressed by the landscape architecture discipline. In this direction, it is aimed to analyse

the strategies and practices developed in other countries and to compile them for Turkey through the example of Çan District. The discipline of landscape architecture has an effective role in eliminating the negative effects caused by existing coal fired thermal power plants. To illustrate, applying a green belt around the thermal power plant is important in terms of capturing carbon in the air and absorbing small particles such as fly ash in the air (Jamil et al., 2009). Moreover, landscape architects have important duties to recycle the degraded land after the closure of thermal power plants.

Aim: Reducing coal usage has become an international target due to enhancing renewable energy alternatives. It is aimed to conduct research on the solutions what landscape architecture discipline can produce in order to eliminate the environmental and social effects of the power plants to be closed. In this respect, landscape restoration techniques and applications examples compile from literature.

Method: The method of the research is case study. This method is a type of qualitative research in which a single situation or event is examined in depth, information is presented in a systematic way and application outputs are compiled (Subaşı & Okumuş, 2017). In this study, it covers the examination of four successful examples of landscape restoration techniques in the world. We gave importance to the selection of cases applicable to Çan District which is sample area.

Evaluation: Understanding intervention techniques for Post Coal-Fired Power Plant based on re-development projects which are urban functions, hybrid landscape and remaining natural areas. The selected samples were preferred considering the ecological and economic balance. However, it should be taken into consideration that the most sustainable landscape technique is to adopt participatory planning approach and to decide with the participation of experts and local people.

2. A Brief Evaluation of Coal-Fired Power Plants in Turkey

The working principle of thermal power plants that produce electricity with coal is to produce electricity because of obtaining steam from water with the heat released for the combustion reaction of fossil fuels in general (Ünsal, 2010). Anthracite, hard coal, graphite, coke and especially lignite coal types are required as raw materials. While 76% is used for electricity generation, the rest is used in other sectors such as heating and industry. The search for alternative resources (oil, natural gas, nuclear energy, and renewable energy, etc.) continues simultaneously in the world for sustainable urbanization. However, coal use

remains because there are more coal deposits than other fossil fuels, therefore it is relatively inexpensive, and the ever-increasing demand for electricity in parallel with industrialization and population growth (Bartan, 2017). According to the data shared by Taner (2014), worldwide electricity generation is met by thermal power plants that burn coal at rates ranging from 35% to 40%.

Apart from its economic advantage, it mostly negatively affects the ecological and social structure of the region. In summary, the most important outcomes of the Thermal Power Plant affect the natural flora and have negative effects on agricultural products, the problem of transport of ash and wastes, the need for storage space, changes in vegetation and forest cover, increased atmospheric material input into the atmosphere, deterioration in soil and groundwater quality and surrounding streams. Meanwhile, pollution are impacts for air pollution in residential areas around the region. Due to these adversities, it is emphasized that the citizens living in agriculture in the geographical area may become increasingly impoverished, the possibility of people and animals getting various diseases or losing their lives due to air and water pollution (Ilgar, 2008). However, some researchers have found that nearly 42% of the coal-fired power plants around the world take a financial bath due to high fuel costs and the same study determined that the costs of renewable energies such as wind and solar energy will decrease by 2030. (Acar et al., 2015). As seen, its economic impacts are discussed as much as its effects environmental impacts (Avcı, 2012; URL-1).

In terms of Turkey, the most common type of coal in our country is lignite and hard coal. Reserve and production amounts are at the middle and lower levels in the world average, respectively. The lignite reserve is 3.2% of the total reserve in the world and it has been found to have low thermal values and high ash and moisture content. Although it is not a very efficient source of raw materials, as it was mentioned before, it is frequently used in energy production since it is found more in nature. Approximately 46% of our country's lignite reserve is in the Afşin-Elbistan basin. The most important hard coal reserves of our country are in Zonguldak (URL-2).

The locations of thermal power plants in other countries vary. For example, in parallel with earlier industrialization and industrial growth in developed countries, the need for energy has already started compared to Turkey. There were also thermal power plants within the industrial areas created in the city. Then, because of the policies of deindustrialization process in city center, the power plants, and their surroundings, like other industrial facilities, turned into abandoned areas. In developed countries, there are thermal power plant structures

that are considered as industrial heritage in the metropolitan city center today. There are examples of removing the soil pollution caused by and restoring the building to the city. The central Istanbul stands out as the only example that can be evaluated in a similar way in Turkey. Silahtarağa Power Plant is the first power plant of the Ottoman Empire. It was put into use in 1914. The electricity produced was first given to the Dolmabahçe Palace, where the Ottoman sultan (Sultan Reşad) lived at the time with the Istanbul trams. Approximately 70 years (1914-1983) has been registered as a central cultural asset that meets Istanbul's energy needs. It was opened as a museum in İstanbul Bilgi University campus in 2007 (Şener et. Al., 2017). Most of the remaining coal-fired power plants are located adjacent to rural settlements or on rural areas. Tunçbilek (1956), Soma A (1957), Seyitömer (1973), Soma (1981), Yatağan (1982) and Afşin (1984) power plants are the first power plants in the history of the Turkish Republic and have been operating for more than 40 years (DTE Energy in 2017, Logan et al., 2017).

Today, government policies are aimed at reducing foreign dependency by using domestic coal reserves while increasing electricity production and employment. There are 40 coal and lignite fired power plants in Turkey. Nine thermal power plants are under construction and twenty projects are in the licensing and planning process. Furthermore, nearly 80 coal power plants, especially in Zonguldak, Adana, İzmir, Çanakkale cities and other important agricultural regions such as Konya Basin, Trakya Ergene, Eskişehir Alpu, Afyon Dinar are planned to be converted into coal mines (TEMA, 2019). Assuming all projects are completed, it is calculated that it will create a capacity that equivalent to UK electrical energy (Carrington, 2015). When looking at the existing and proposed coal-fired thermal power plants distributed throughout Turkey some power plants is concentrated in cities and provinces is planned based on other more establishment (Figure 1). Considering the installed power of the planned thermal power plants, the planned total installed power of the coal-fired thermal power plants proposed to Çanakkale, Kahramanmaraş and Hatay provinces will be higher than that of other provinces. Despite the high urban and industrial pollution in the Marmara region, it is noteworthy that a new coal-fired thermal power plant is proposed to be installed in these regions. Therefore, the study focuses on Marmara Region. When the thermal power plants in the Marmara Region are examined, Çan Power Plants are most threaten both public health and natural habitat. The most important reasons are using highest the ratio of the amount of lignite coal used, causing the highest amount of slag-fly ash, and having highest score of air pollution.

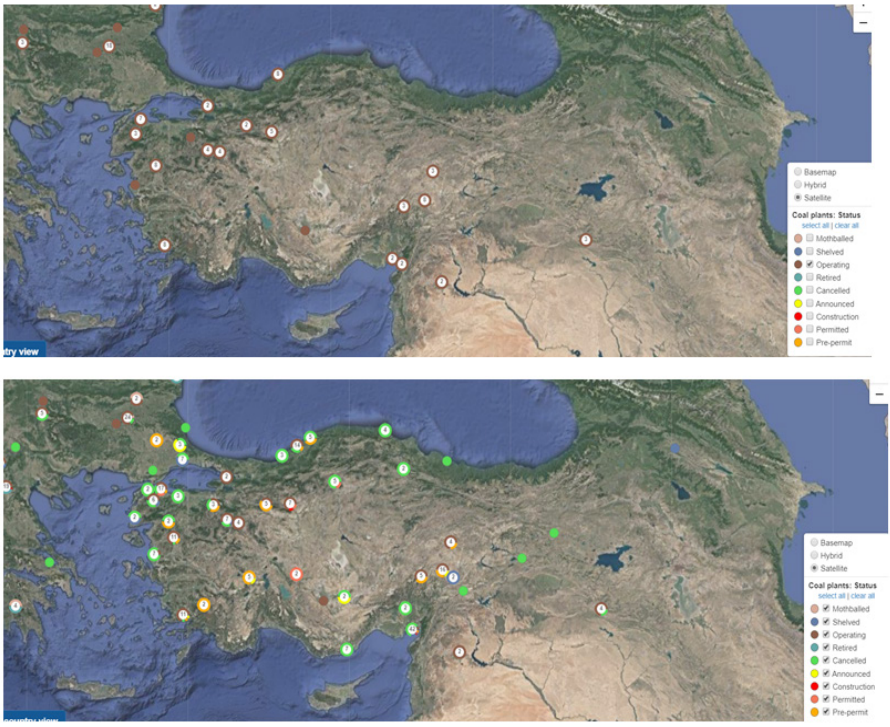

Figure 1: Coal-fired power plants in Turkey (The upper image shows the operating plants, while the lower image shows both operating and planned ones.) Source: URL-3.

3. Case Study: Power Plants in Çan District and Alternative Re-Development Examples

According to Çanakkale Tourism Inventory Strategy Study (2019) data; Çan is 71 km from the city center. The surface area of the district is 887 km². According to TÜİK 2018 data, Çan is a district with 48.331 inhabitants consisting of 2 municipalities and 67 villages together with the central municipality. Natural attraction elements area is 62% forest, 32% agricultural land, 3% pasture and 3% residential area. There are kaolin, quartz, clay, and feldspar deposits, which are important raw materials of the ceramic industry. The majority of these are used by Çan Ceramic Factories. It is open for wind directions. Northern winds are very effective. Annual rainfall is about 600-850 mm. Precipitation is mostly seen in autumn, winter, and spring seasons. The highest average temperature is + 38.7 ° C, the lowest average value is 11.5 ° C. It is in plain. Important plains close to the district are Karakoca Plain, Bahadırlı Plain, Helvacı Plain.

Çan thermal power plant creates pressure both in terms of natural environment and socially on Çan District. Although the potential is high in terms of cattle farming, especially cattle breeding and especially the number of hives, it stands out as an industrial district (Renewable Energy Research Report, 2019). In addition, the district has many geothermal resources. For example, Çan-Etli Hot Springs and Çan district were declared as thermal tourism centers in 2006. The hot springs of Çan are important attraction elements. Hot springs can be international, however T.K.İ. The presence of open bell lignite coal mines of Business and the biggest reason is Turkey's largest ceramic industrial district is characteristic of the presence of production facilities. However, it is 6.5 km from the district center. Large-scale energy investments are another factor, such as the 18 March Çan Thermal Power Plant established on 1600 hectare of land and the Çan-2 Power Plant installed on 1000 hectare of land at 8 km (Figure 2).

Figure 2: Çan 2 Local Coal Fired Thermal Power Plant.
Source: URL-4.

According to TR22 South Marmara Region Regional Plan data (2014-2023), production works are continuing at Çan lignite field, covering an area of approximately 2.4 thousand hectares. In this area, there is a total of 77 million tons of lignite reserves with a lower thermal value of 3 thousand kcal / kg and all of which can be purchased through open pit operation. The coal requirement of the fluidized-bed Çan Thermal Power Plant, which was put into operation in 2004 and the Çan-2 Thermal Power Plant, which started operating in 2017, are met here. While the coal deposits in the region were formerly operated in a closed style, today all the quarries except Çan-Yeniçeri quarry are operated openly. Ilgar (2008) states that there is a coal stock that is suitable for processing for 46 years in the region (Figure 3).

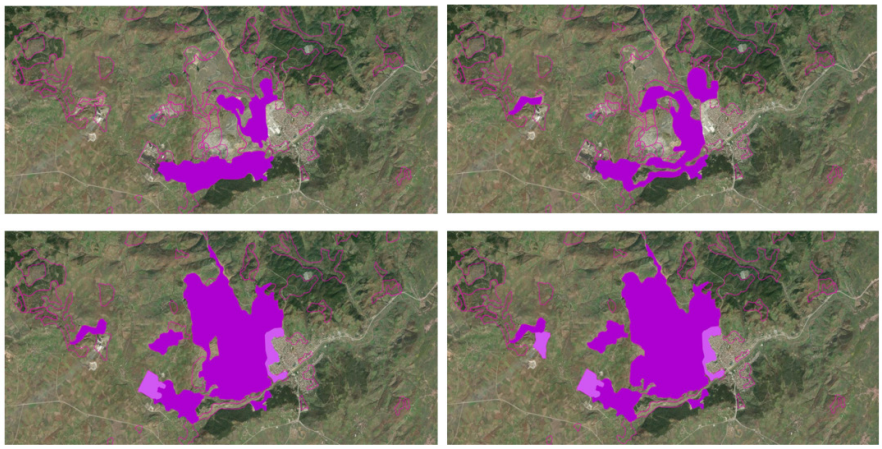

Figure 3: Understanding the change in the size of the open lignite mine in Çan District over the years respectively 1990, 2000, 2012 and 2018. Source: Corine Land Use Cover Data, 2020

Çan district and its surroundings have many natural protected areas and large-leaved, coniferous forests that preserve the undisturbed relative integrity of the Biga Mountains KBA (important natural area) and its surroundings. Natural areas are mostly agricultural areas and pasture areas without cover on the base map of the forest and shrub and/or herbaceous vegetation association (Figure 4). Agricultural lands are first class agricultural lands, and it is an area where agricultural lands are large. This provides a steady green connectivity.

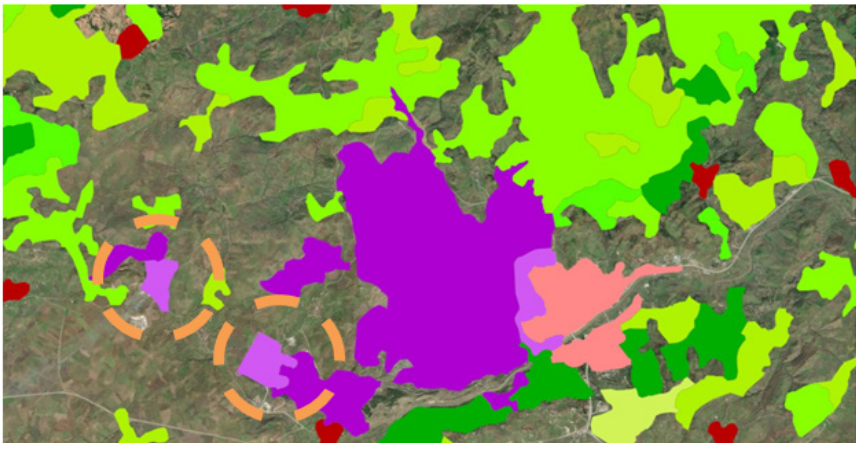

Figure 4: Understanding green network capasity of Çan District. Source: Corine Land Use Cover Data, 2020

It has been observed from various reports that thermal power plants and lignite mining disrupt the economic and ecological balance. At the same time, as it can be understood from the geographical structure of the district, it has a geomorphological structure that can create air pollution because it is a plain-shaped pit. The presence of a ceramic factory and TKİ Çan Lignite Plant in the district create sufficient air pollution in this area. These industrial facilities cause air pollution especially in the county of Çan. For example, according to the Environmental Status Report (2007), it was observed that the hourly limit value of 440 µg / m3 for SO2 was exceeded 76 times at Çan Station and never at Lapseki and Çanakkale stations. In addition, Kocabaş Stream is negatively affected by the thermal power plant. Because it provides water and cooling needs from Kocabaş Stream. On the other hand, lignite mining causes social and environmental problems and costs, such as open mines abandoned without rehabilitation or forced migration of the population living in the mining area.

3.1. Alternative Re-Development Examples

Carbon oxides, nitrogen oxides, sulfur oxides released because of the burning of coal have harmful effects on all living things. At the same time, they increase the greenhouse effect and cause global warming. Small particle density is high in flue gases released from thermal power plants to the atmosphere. Therefore, the possibility of these particles being rich in radioactive isotopes carries a great risk. It threatens the nearby ponds with erosion and destruction of soils, changes in groundwater quality, noise emissions, loss of energy and labour, SOx and NOx emissions that cause acid precipitation and their inevitable destruction in the ecosystem. The transportation of ash and wastes and the need for storage space appear as problems. In addition, the results such as excess heat dissipated by the cooling water in fluidized bed power plants and the discharge of these waters to the surrounding water resources are also risk factors for the impact area. Preparing a site for reuse after scarred landscapes is complicated and multi-year process. According to United States Environmental Protection Agency (2016), this process includes decommissioning the existing power plant, cleaning up contamination (e.g., in materials, soil and ground water), and creating and implementing a redevelopment plan (Figure 5).

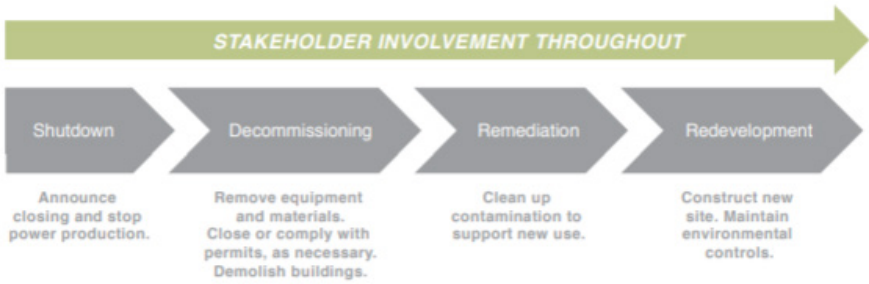

Figure 5: Process of Re-development of Coal-Fired Power Plants.
Source: United States Environmental Protection Agency (EPA), 2016.

Three examples have been chosen because they have different spatial uses. These uses are urban function that includes a university campus, hybrid landscapes that center renewable energy, and areas left natural by the Phytoremediation method for nature's revival. However, each example has different intervention techniques. In addition, it is necessary to consider the thermal power plants and Çan district together with the existing open lignite mine. Assuming that the thermal power plant is closed in terms of the area it covers and its proximity, rehabilitation studies should be carried out for this area, which is suitable for the rural character and that, can maintain the green connectivity around. Although this study focuses on thermal power plants, it is necessary to consider the power plants and Çan district together with an open pit. Especially open pit mining is the scars of nature. Although its economic contribution is considered by providing energy production or job opportunities, it causes important environmental problems.

Because of assuming that the thermal power plant is closed in terms of both the area it covers and its proximity, rehabilitation studies should be carried out for this area as well. After mining the land in open pit mining, there is a lot of soil accumulation, and direct changes occur in the geological structure, relief, and water regime. Its natural vegetation is destroyed and leads to visual pollution. In fact, mining means not only destroying the area where the mine is located, but also cutting forests and groves to melt the ores. Restoration, reclamation, reforestation, and revegetation concepts come to the fore to eliminate the deformation that occurs after mining (Aktaş, 2008).

Aktaş (2008) mentions four different restoration methods for mine restoration works. The first one is field works. The stabilization of the area, preventing landslides, application of natural slopes, levelling, contouring,

ditch and ridge construction and soil compaction work should be completed. Then the soil should be made suitable for planting with soil placement. In mine rehabilitation works, ground stabilization is provided by using inanimate structural elements. Another method is chemical studies applied in areas where vegetation is impossible. Finally, bioengineering studies are mostly the use of soft-engineering techniques to re-plant the field.

In this process, which is defined as the restoration of the area when possible, re-planting is the use of ground cover plants that grew in that area in the past. It is also considered as an ecological restoration. In both procedures, the target is to regain wildlife, regulate the appearance of the area, prevent erosion, and create wind curtains. There are different usage examples related to mine rehabilitation. Different rehabilitation suggestions can be developed for Çan district such as naturalization of the area in accordance with its rural character (Özcan, 2008) or recycling as an agropark (Yıldız, 2013). In the article, Çan county lignite open pit mines will not be studied in detail. It was mentioned to create a base for future studies and to be placed as a new area to be examined. Buchsbaum (2015) says that, beyond attempting to restore degraded landscapes to their "approximate original contours" in the light of environmental aspect, there may be other approaches for benefiting whole environmental, economic and social aspects. To find a comprehensive perspective, intervention techniques for Post Coal-Fired Power Plant based on re-development projects which are urban functions, hybrid landscape and remaining natural areas has been chosen.

3.1.1. Urban Functions: University Campus, Herne

Herne City is located in North Rhine-Westphalia in the Ruhr area, Germany. Before coal mining sector until 19th century, city was a small village. After mining and production of coke, almost all villages like Herne of the Ruhr area slowly grew into towns and cities due to growing migration and population. In 1860 the first of several of many coal mines started operating. In the following thirty years the population increased twentyfold. In 1847 population was under 1.000 people, in 1890 it was over 20.000 people. Since the city has lost population due to economic transitions in the coal and steel production of the area. Today, 156,374 people live in Herne city and density of population is 3,000/km2 (URL-4).

City is part of the project area of IBA Emscher Park was revitalized in order to create a new location for education in 1990's. Converting a Vacant Site into a District Centre and Energy Source District Centre and Advanced Training

Academy Mont-Cenis Sodingen in Herne. Therefore, the city has new theme/ image as education center the Region.

According to Bell et. Al. (2000) study about rehabilitation of industrial areas in the example of Herne Power Plant;

"The life of the mine extended over 100 years, closing in 1978. After closing of power plant, 26-ha site was abandoned. Not only were there contamination and massive subsurface structures associated with the site but also there were the effects of acid mine drainage and subsidence. The contamination consisted of coal-mining-related contaminants and polycyclic aromatic hydrocarbons. The authorities would not allow excavation and removal of the contaminated soil because risk of uncontrollable release of contaminants, an expensive off-site treatment procedure, the storage of non-degradable wastes in landfills that would occupy further space and so contribute to land consumption. The solution chosen for the site was to line the contaminated area with a geomembrane over a clay liner. A gravel and sand filter were to be placed on top of the geomembrane to intercept infiltrating precipitation. Lastly, topsoil was to be laid over the gravel and sand, in which an herb garden was to be established. The system, except for the topsoil, was to be reinforced with geogrids to allow the construction of buildings at some future date."

The building is a 180-meter lon, g, 75-meter wide and 15-meter-high structure made of wood, steel, and glasns. It houses an academy for further education, a hotel, a library, a town hall and open spaces. This intelligent building uses waste heat, stores warmth, and generates energy. Building a part of Energy Park which creates 3,200 photovoltaic energy its roof. This heating not only for the building but also for the adjacent urban area that includes 250 housing units (Banerjee, 2017). Thus, it is a kind of method for producing energy via block heating station that uses the mine gas which is still leaking from the closed underground mine. A new town quarter and a park were also built besides the building: the academy is surrounded by trees and streetlights in the form of an ellipsis. Some remains of the original colliery buildings have been preserved and vegetation has been allowed to grow spontaneously on the compounds. In other places, trenches prevent the rain from leaking into the polluted soil (Figure 6). In Çanakkale there is an important university. Furthermore, Ceramic is and an important raw material for both Çanakkale and Turkey. A university campus that includes ceramic school, museum and workshops has the capacity to make Çan district one of the important focal points of education and cultural tourism.

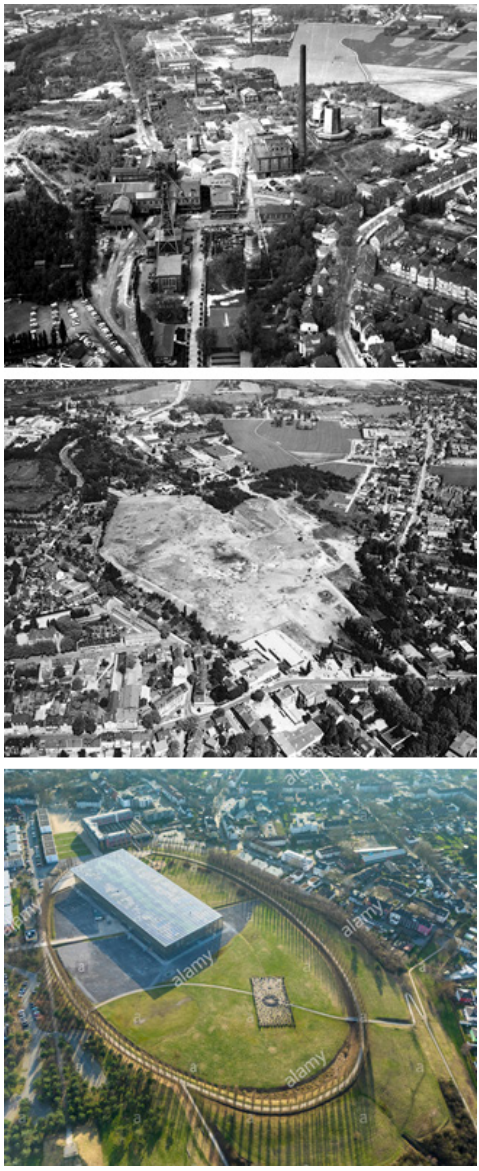

Figure 6: Power plant before its demolition (1974),
after demolition (1984) and remediation project (2020)
Source: Bell et. Al. (2000).

3.1.2. Hybrid Landscapes: Combining Renewable Energy

Renewable energies counting sustainability on earth have emerged as an alternative to fossil originated energies, including coal, which have limited

quantities and periods of use and potentially depletion. Also, another important difference with renewable energy is that they emit much more gases and particles in the environment. Compared to renewable energies, the greenhouse gas emission released by obtaining electricity from coal is quite high. According to Şahin (2015); greenhouse gas emission caused by coal power plant; 75 times more than the emission caused by the wind farm.

According to the Renewable Energy Research Final Report (2019), Çan District has different potentials in terms of renewable energy alternatives. First, compared to other districts in Çanakkale, the energy value of the animal wastes of Çan district is quite high (Figure 7). This situation leads to high biomass energy potential of the district. According to the same report, it is recommended to plan and establish biogas plants in the vicinity of Biga and Çan districts of Çanakkale, where the presence of cattle is intense. In addition, when it is analysed by Çanakkale districts, it ranks third with its annual average global radiation value including Çan District, the annual sunshine duration over six districts of Turkey's average. Global radiation values of all districts in Çanakkale are higher than the maximum value determined in Germany. It is advantageous both environmentally and economically to position renewable energy facilities in areas with artificial land cover (Figure 8). For this reason, it is appropriate to build such a facility in terms of both energy alternative and land use instead of the thermal power plants to be closed.

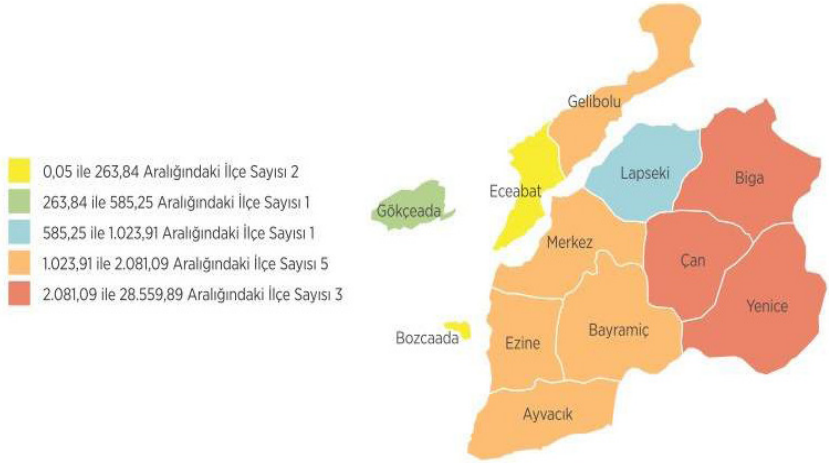

Figure 7: Energy value of animal waste by districts in Çanakkale (TEP/year)
Source: Çanakkale Tourism Inventory Strategy Study, 2019.

Figure 8: Biogas production facility model.
Source: URL-6.

One of the alternative scenarios produced after the closure of the thermal power plant and the current mine is the hybrid landscape concept (URL-5). The example chosen for this approach is the Terra nova BiosphereBelt project in Rhein-Erft Energy Park located in Germany which combines the ecological, sustainable, social and economic aspects of power generation, landscape utilization and nature development in a whole new way and demonstrates prospects for the time after coal for this landscape setting (Figure 9). According to URL-7, the Project includes,

"Main purpose of Project is that the result of a transformation process of a former excavation material into a nature, leisure, and recreation belt. The 14 km long route for the former soil conveyor system is cut into the landscape in a straight line with a width of 100 m and 10 m high emission protection walls along both sides of the route. The artificial topography of the excavation material belt system has been outwardly retained, whilst special vegetation communities and landscape setting types are developing inside the spatially protected area. This newly created BiosphereBelt shows the geological story of the origins of lignite in the region in sequences of different landscape types – between power station and open-cast mining. For this purpose, pre-glacial landscape types such as bald cypress woods, pine woods and dry sand dune grasslands have been formed along the route, creating diverse spatial sequences. Individual areas have been

filled with 4 million m^3 of tertiary excavation material and dunes have been formed with GPS-controlled crawlers based on a 3D model. Through selected trees and the development of special seeding systems it has been possible to ensure the early occupation of this area with initial planting. Orange avalanche barriers, a visible sign of the intervention, shaped over the areas of vegetation as a guard against damage caused by browsing game. Orange info boxes positioned at landscape points of significance provide information on the transformation processes that are on-going to this day. With their individual language of form, the boxes pick up on the location and theme of the information they provide. However, their colour and material ensure that they are recognizable as a unit."

Figure 9: Terra Nova BiosphereBelt project.
Source: URL-7.

Another example is that the Leipziger Solar Power Plant in Germany. According to Buchsbaum (2015) one of the first brownfield to greenfield

redevelopments, was installed upon 49 acres of a former lignite mine site in Espenhain, Germany. Initially, the 5-MW photovoltaic power plant was made up of 33,500 solar modules feeding directly into the German electricity grid. A solar energy plant was an option, but only after on-site contamination was remediated the Espenhain site, located near Leipzig, was a former settling area for lignite or "brown coal" ash and dust. At the Espenhain site, the lignite waste had to first be buried under a foot of soil before custom-built supports for the solar panels could be installed.

As is seen, in the first example, this study also includes the soft intervention techniques that will be seen in the next example. However, since it includes different artificial topography interventions, it includes hard engineering techniques. The fact that it is included in the energy park in context increases the possibility of the future thermal power plant to be converted with renewable energy sources. In the second example, lignite waste was first buried under the ground to remove the pollution. Then the solar field was placed on this burial. Consequently, biogas plants should be planned and established in the vicinity of Biga and Çan districts of Çanakkale, where cattle are intense, to the Renewable Energy Research Final Report (2019). So, he can develop similar examples for the study.

3.1.3. Remaining Natural Areas: Phytoremediation Garden, Australia

The former Power Plant stations are kinds of brownfield sites have contaminated soil structure. Traditional methods of remediating contaminated lands comprise soil scraping and capping. However, these methods are not sustainable due to resolve pollution problems. Phytoremediation can be an alternative option. University of Newcastle (Landscape Architects), University of Technology, Sydney (Phytoremediation Lab) and University of New South Wales (Artists/ Filmmakers) they carried out interdisciplinary research about phytoremediation technique Power Plants located at the former White Bay Power Station (WBPS) in Sydney in 2019 (Figure 10). According to report of this research (URL-8),

"Phytoremediation is also a low cost, plant vegetative) and solar energy driven, soil remediation technique. Through the establishment of a plant phytoremediation garden/pasture toxins are removed from the contaminated soils, through the selected plants absorbing and metabolizing various pollutants into their tissues. Main components are plant materials such as annuals, both native and non-native species. The absorbed the pollutants from soil."

This example gives different perspective that waiting for a relatively long term; we can see that the pollution of an area can be reduced with completely soft techniques. This model can be applied for Çan District as well and may offer a alternative opportunity ready for new usage areas in the future.

Figure 10: Power Plants Phytoremediation Garden Project.
Source: URL-8.

4. Conclusion

It is known that mining areas are mostly first-degree agricultural lands, protected areas and forest areas that require special protection. Between nature conservation and energy investments, there is a problem in the priority issue. The current approach: Considering that investments in thermal power plants have increased along with strategies and policies, it is understood that it is a priority for energy investment. Public interest needs to be examined in its broad perspective. Social and environmental benefits should be evaluated not only from that economic point of view.

Within the framework of certain principles, the ecological and economic balance must be implemented in some way. When the ecological balance is completely cancelled; reactions of the people, especially the local people, are increasing. Opinions and approval of the public are required in the decision to build a thermal power plant. Similarly, when a thermal power plant is closed, the local people should be asked for the intervention in that area. In other words, action should be taken in line with the common opinions of local people and experts. Only in this way, a fully sustainable intervention technique and re-development can be achieved. For example, Shenango Thermal Power Plant, Pennsylvania is one of the examples that implements participatory design. According to Delta Institute Shenango Reimagined Site Visioning Report (2020),

"In the spirit of collaboration, concerned parties from these communities worked together as the Shenango Reimagined Advisory Council (Council) and through a site re-visioning process conducted in 2019 and 2020 the Council explored and articulated its chief concerns regarding how the redevelopment may impact the community. The Shenango Reimagined Advisory Council began work in July 2019 to develop a set of principles to reflected wants and needs of the local and regional community related to the redevelopment of the former Shenango Power Plant Site."

These sites present tremendous opportunities for new civic and private uses such as urban functions– as well as museums, parks, and other community amenities like natural areas. Remediating landscape of former power plant stations causes special challenges meanwhile it creates opportunities to build stronger communities and foster economic growth. Taking advantage of these opportunities can assists communities create a healthier environment, foster new business activity and job development. As a result, all three categories of examples are successful in establishing an ecological and socio-economic balance in their context. However, for the most sustainable landscape intervention technique, it is necessary to take into consideration the opinions of the people and experts living in Çan District with a participatory understanding and rehabilitation in this direction. Decision on how to intervene in this area should be decided by the implementation of participatory design approach.

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CHAPTER VI

EVALUATION OF URBAN UNIVERSITY CAMPUSES WITHIN THE SCOPE OF SUSTAINABILITY; SOME URBAN CAMPUS EXAMPLES

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1. Introduction

Universities, which have intense usage areas and are important places in the city, are important potential areas that highlight the society they live in in terms of their social, cultural, economic, and political characteristics and offer alternative green spaces to cities (Yıldız, 2020). Universities are institutions that train high-level people in need of society, while at the same time, they are institutions that make scientific studies that will be beneficial for individuals and societies and contribute to the development of the society in which they are established (Tukker, 2008; Jackson, 2011). The region where the university campuses are established, their site selection, and social, economic, and cultural characteristics are important for the environment and campus development, and they are important for spatial construction. Therefore, establishing a university in a region that is desired to be developed is one of the tools used to achieve the planned goals (Oğuztürk and Pulatkan, 2022). University campuses offer a different life to the city where they are established, to city users and students, such as increasing productivity in

society, improving the quality of life, personal and socio-cultural development, reducing unemployment, providing economic developments, etc. Meeting social and cultural needs and using it as an urban image increases the relationship of universities with the city. In universities that have great effects on their environment, the effect is seen more in university campuses located in the city center rather than in university campuses that isolate themselves from the city (Güneroğlu and Pektaş, 2022). It is advantageous in many respects that university campuses are traditionally established in the city center or nearby. Recreation and sports fields, library, educational and intellectual environment etc. are provided to the city users. While providing the opportunity to benefit from activities, advantages can be listed for students such as socializing with the city and city users. Universities in the city are developing in building blocks. These building blocks in the city are also a part of the city as they are open for urban use (Sönmezler, 1995) such as transportation, rest, accommodation, and work, etc. They contain many basic needs, which are urban functions, in small scales. Building blocks, which are perceived as a part of the city, also contain the problems experienced in the city centers and must cope with these problems (Ertekin and Çorbacı, 2010).

The Interaction between university campuses and the city provides diversity in terms of communication and transportation opportunities, as well as their functional richness. As a result of the shrinkage experienced in the spaces due to the structural developments that have emerged over time, the interaction between them gains importance by showing more differences with its social, cultural, and economic aspects. Universities, which tend to grow physically, are one of the educational institutions that have many different fields uses side by side or intertwined for the purpose of their functional structures. Due to the similarities between the city and the university, the organic bond comes to the fore and the necessity of planning the relations between the campus and the city arises (Dober, 2000). The campus, which has a rich relationship with the city, is also rich in terms of feeding the city in terms of the social and cultural values and needs it offers to the city as a production and academic environment. In the settlements that have a weak relationship with the city, the interaction between the city and the campus is also weak, and as a result, some problems occur (Çorbacı, 2020). These problems can be solved with ecosystem and ecological approaches, which are one of the basic elements in determining and strengthening the physical relationship between the city and the university campus (Oğuztürk and Pulatkan, 2022).

According to the ecosystem approach, university campuses are ecosystems that are heterogeneous, dynamic and include human-nature relations (Alshuwaikhat and Abubakar, 2008; Kurtaslan, 2020). In this respect, university campuses are an important component of urban ecosystems. It is necessary to evaluate each component with the perception of a biointegrated ecosystem and to make it a part of the ecological cycle (Aksu, 2022). In addition to the social and economic benefits it offers to the city, the campus, which is located in wider areas compared to other institutional structures, provides important contributions to the ecology of the city with its open and green areas. Each university campus has its own ecological system based on its ecosystem relationship and climate. Climate, sun-shade patterns, differences in soil, vegetation and topography selection are the determining factors that affect the quality, appearance and size of the natural environment of the campus. Campus landscape plans containing natural and cultural data offer links between land uses and buildings, open spaces, park and public transport, recreation areas and infrastructure. Ecological landscape design in cities, especially in campuses, is handled under different parameters on the scale of "building, campus and city". The relationship between building and open space at building scale, building energy use, accessibility and green space system at urban scale, appropriate plant selection and hydrological system at campus scale, transportation systems, biodiversity, metabolic systems, recreation and assembly areas, bicycle and pedestrian paths, vehicle roads and parking lots are included in this process. It evaluates the relationship between landscape ecology, spatial patterns and ecological processes in the campus areas by examining the cause-effect relationship between environmental variables and reveals their relationships with each other (Turner et al., 2001; Kurtaslan, 2020). In this context, landscape ecology aims to establish a sustainable system that is compatible with the environment with minimum natural resource consumption and minimum waste. In landscape ecology, design is a solution to the world's problems on the upper scale and for sustainable cities and settlements on the lower scale (Yeang, 2006; Aklanoğlu, 2009; Kurtaslan, 2020).

In addition to ecological design and planning elements, sustainable practices are needed for university campuses to cope with environmental, social, and economic problems. A sustainable university campus encourages it to meet the economic, social and health impacts that arise in the use of its resources by minimizing adverse environmental impacts at the regional or global level. In the concept of sustainable campus, which does not ignore the needs of the future, meets the needs of today, and aims to act with a

protection-use balance approach by considering environmental rights, green infrastructure, carbon storage, correct management of waste, use of nature-friendly materials, efficient water use, environmentally friendly, efficient use and management of energy such issues come to the fore (Artar et al., 2019; Derbentoğlu, 2021; Altun, 2022). At the same time, it requires consideration of the formal and morphological characteristics of the spaces in sustainable campuses (Oikonomou, 2015). In this context, university campuses have an important place in minimizing the impact on the environment, increasing sustainable practices and raising awareness of the society by evaluating them with the concept of sustainability integrated with new technologies, which sets an example for other institutions related to sustainability. The concept of sustainability is related to the accessibility, concentration, etc. of the urban form with technological approaches and new techniques. It aims to disseminate sustainability on a local scale by determining the needs of the city such as settlement area, waste and water management (Yıldız, 2014; Artar et al., 2019; Kaya et al., 2019). In order to ensure the spatial sustainability of the university campuses, to realize the planning stages in an ecological way, and to offer a life in harmony with nature, a design approach that increases the relationship among economy-ecology-energy is needed. The importance of design suitable for sustainable living has been realized over time. In this process, the need for a holistic understanding that progresses from planning to designing ecological approaches put forward to offer solutions to environmental problems arose (Aklanoğlu, 2009). In holistic approaches, it is emphasized that the landscape features of natural areas should be evaluated as a whole, not seperately (Şahin, 2010). In order to be able to evaluate the campuses in a holistic way and to take sustainable management decisions about the campuses, first of all, information about the landscape function, structure and change should be obtained and the relations between them should be questioned. Each of the components gives important information about the ecological, spatial and sociological structure of the landscape. For this reason, in order to make sustainable landscape planning, including ecological, sociological and spatial components of the landscape should be evaluated as a whole (Aksu, 2014). The aim is to evaluate the city-campus relationship with a sustainable, ecological and holistic landscape planning approach.

Ecological contributions of urban university campuses to the city were examined through university campuses selected as sample study areas. In the light of these data, the selected settlements were evaluated within the scope of

sustainable, ecological and holistic landscape design approaches. It is aimed to create guidelines and develop recommendations for sustainable, ecological and holistic planning and management decisions.

2. Material and Method

The main material of the study is the University Campuses located in Turkey and abroad. Related literature, data obtained from public institutions, zoning plans, observations, notes and university websites were used as supplementary materials. Written and drawn materials related to the study area have been obtained from public and private institutions through official means.

Quantitative and qualitative research methods were used in the research and in this direction, the research method (determination of study areas, literature reviews, data collection, determination of the method, evaluation and suggestion) was formed in 6 stages. Domestic and foreign university campus examples were evaluated within the scope of ecological and holistic planning criteria. While selecting the university campuses examined, the QS World University Rankings (2022) for overseas examples and the rankings within the scope of the Professionalism awards from the American Association of Landscape Architects (ASLA) between 2015 and 2021 were taken into account. In addition, the University of Michigan, which is a good example in terms of city-campus relationships and urban university campuses, is also included in this area. The Green Metric 2020 Ranking (University Sustainability Rating) was used for the selection of campuses in Turkey (domestic). Urban in our country campus examples (ITU/Istanbul, ODTU/Ankara, Erciyes University-Kayseri, Yıldız Technical University-Istanbul, Ege University/İzmir) are in the Green Metric 2020 ranking. It has been selected from among the top 10 Universities (Outside the city and private universities were excluded). The examination of the selected campuses was made by making use of the reports and publications published on the web pages of the universities. When the results of the examination are evaluated, it has been determined that there are settlements with different characteristics in terms of topography, climate, size, etc. Therefore, it was determined that it would not be correct to make comparisons with each other. However, in line with the sustainability and ecological parameters, it has been tried to develop suggestions for other campuses by taking the sustainable and ecological studies of the campuses as an example.

3. Results

In this study, as an example of urban settlements, the sample area is urban university campuses (domestic and abroad) selected within the scope of the study; It has been analyzed within the scope of ecological parameters, and the data obtained are structure, urban, natural and artificial components by guiding on ecological campus design by analyzing campus and urban scales important criteria will be established (Table 1, 2).

Table 1. Examples of Urban Campuses Selected from Abroad

MIT, USA	**Structure:** Since it has an integrated system with the city, the city and the campus are intertwined. There are no campus boundaries in its open areas. Therefore, there is no entrance to the campus. There are courtyards and gardens as open spaces in the campus. Energy-saving buildings are available.
	Urban: It has green areas integrated with the city. Public transport is efficient as it is located in the city center. As they aim to reduce the use of private vehicles, the number of parking lots is limited inside the ground. Efforts are being made to encourage more public transport.
	Campus: Precipitation water is collected by rain gardens and used for irrigation water. There are also uses of gray water. It is designed with plant species suitable for climatic conditions. They donate by producing plants with water-saving containers. Irrigation is carried out with central irrigation systems with weather humidity sensors. Organic residues are used in landscape areas as compost and fertilizer. Transportation is usually provided by bicycle, and more is encouraged to increase its use. There are environmentally friendly vehicle fleets. There is active pedestrian access to every point. Vehicle and spring paths are in the same code and the difference is provided by different flooring. It is possible to reach many points in the campus by car. At the points where vehicles reach, there are car parks designed in the form of pockets in front of the buildings. They use the grass areas as meeting places.
	Natural and Artificial Components: Cambridge university is built on flat land and lies along the Charles River. It has a humid and continental climate, and it is not very fertile because its soil is acidic and stony. It has developed as a network model as a settlement model (URL-3, 2022).

Oxford, England	**Structure:** It consists of buildings in the form of colleges, so the entrance to the campus is provided with the college entrances. Colleges have courtyards as open spaces. There are grass areas and infested areas on the remaining parts of hard floors.
	Urban: Since it consists of many college structures, each college is spread over the city as a patch. Since it is located in the city center, there is no problem with transportation. Colleges can be reached by public transport and private vehicles.
	Campus: There are trees and grass areas in the landscape areas. Plant species that do not need much water are preferred from an ecological point of view. Vehicles are not mostly allowed by most. Therefore, the areas on the streets are used as parking lots. Due to the narrowness of the colleges, there are no bicycle paths, and there are roads suitable for bicycle use on the main streets that connect them. On the pedestrian side, the city streets are used to provide transportation between colleges, and there are pedestrian paths around the grass areas inside the colleges. Some colleges have sports fields and recreational areas. Gray water is converted and used as irrigation water. In addition, attention is paid to the use of water-saving systems in the buildings. It is used as fertilizer by making compost from landscape waste. In order to reduce the university's impact on biodiversity, a biodiversity policy was developed to protect urban and rural wildlife. Some auxiliary departments (such as Botanical garden group, Whtham farm, Harcourt arboretum and Oxford Botanical garden) have been established for biodiversity conservation.
	Natural and Artificial Components: It was established on a flat land at an altitude of about 500 m relative to sea level. The campus is located between the Charwell and Castle rivers. Although it is located in the northern latitude in terms of climate, the average temperature is 7º C in winter and 15º C in summer. It has a molecular structure as a settlement model (URL-4, 2022).
Cambridge, England	**Structure:** Landscape areas consist of green areas around the building and courtyards between the buildings. The campus consists of colleges and each college has private entrances to the campus as it is surrounded by border elements. New buildings are constructed according to the energy efficient building certification system.

	Urban: Its campus is surrounded by green areas. In terms of transportation, their purpose within the campus is to be economical, sustainable, and easy. Developing car-free transportation models, reducing carbon emissions, reducing travel costs and needs are among the objectives. In order to do this, they aim to reduce the use of private vehicles.
	Campus: Although the usage area on the campus has increased recently, water consumption remains constant. Their aim in this regard is to keep the water consumption constant against the increasing use per m^2 academically. There are trees and grass areas that do not require much water in terms of plants in the campus. In order to protect biodiversity, studies are carried out within the campus. They aim to raise awareness of recycling and energy. The campus is not suitable for bicycle and vehicle access in terms of transportation. It is because there are very few parking lots. There are also courtyards within the campus as pedestrian access.
	Natural and Artificial Components: The glass river flows through the campus, which is built on a flat land. There is no fertile soil structure. The climate is in an arid region. As a location model, it is molecular localization. It is located in the city by spreading organically (URL-5, 2022).
Harvard, USA	**Structure:** The campus, which is located in the Harvard yard park, has large green areas. Green areas, courtyards and hard floor areas make up the campus open areas. Although it is located in the city, the campus is surrounded by railings.
	Urban: Since the campus has been established within the park, it has large green areas. Since it is located in the city, it is close to bus and metro stops and aims to increase public transportation.
	Campus: While choosing the plant species in the campus area, attention is paid to the use of species that are resistant to the climate and do not require much water. With the "Community Gardens" program, these plants are included in the landscaping areas in order to produce the products necessary for use in the cafeteria of the campus. They aim to reduce water use through projects such as rainwater and water reuse. More space is given to green roofs and drought-resistant species. They also save water by using air data sensors for irrigation. Reducing their

	carbon footprint by directing them to walking, cycling and running for transportation is another goal. There are walking and cycling trails within the campus area. Since the area is large, transportation is provided to many parts of the campus by vehicle. There are open parking areas made of asphalt pavement throughout the campus. Arboretum, herbarium and forest were established to increase biodiversity. In order to reduce the amount of waste, it works to encourage studies such as compost, reuse and recycling from landscape waste. The hard floors in front of the buildings and the remaining grass areas are used as gathering areas.
	Natural and Artificial Components: Harvard university is built on flat land and continues along the Charles River. The climate is continental, with hot summers and cold winters. The campus model is the network model. It is located in the city center in the form of building blocks (URL-6, 2022).
ETH, Sweden	**Structure:** It is integrated with the city. There is no space limit, so it does not have a unique entrance. There are public gardens, green spaces and open spaces (terrace garden, roof garden, seed city community garden and greenhouse) within the campus
	Urban: It is located in the city center and integrated with the city. The use of buses and bicycles as transportation is quite common. It recommends public transport for sustainability.
	Campus: The university consists of two campus buildings. Since the main building is integrated with the center, there is no transportation problem. They support public transportation and the use of electric bicycles as transportation. There are bicycle parks in the campus. There are quite large grass areas. They have biodiversity and animal-friendly activities, they are trying to provide biodiversity in the urban context, they are promoting the consumption of tap water instead of bottled mineral water in terms of sustainability.
	Natural and Artificial Components: It was built on a flat land. It has a humid and continental climate (URL-7, 2022).
UCL, The United Kingdom	**Structure:** It is easy to reach as it is in the city center. It has its own large hard floors and grass areas.
	Urban: Since it is located in the city center, it is within walking distance to many points.

	Campus: It has large hard floors and grass areas. There are national and international sustainability studies on many different subjects.
	Natural and Artificial Components: It is located on a flat land. A temperate and humid oceanic climate is observed (URL-8, 2022).
Chicago, ABD	**Structure:** The university is not separated from the city by the border, so it does not have its own entrance gates. It has large grass areas.
	Urban: It is possible to reach the campus by car and bicycle: there are parking areas. Courtyard structures available
	Campus: The north and south parts of campus are separated by Midway Plaisance, a linear park.
	Natural and Artificial Components: Positioned on a flat area it is located in the humid continental climate zone (URL-9, 2022).
Duke University, The USA	**Structure:** The university is not separated from the city by the border, so it does not have its own entrance gates. There are large green and grass areas.
	Urban: It is possible to reach the campus by car, bus, shuttle and bicycle, there are parking areas.
	Campus: The campus has its own large grass and green areas. There are alternative transportations within the campus such as car, bus, shuttles and bicycles. It has studies on energy and water resources. There are studies to encourage the use of bicycles.
	Natural and Artificial Components: It is positioned on a flat area (URL-10, 2022).
Chulalongkorn University, Thailand	**Structure:** The university area is not limited, so it does not have its own entrance gates. There are large green and grass areas.
	Urban: There is transportation within the campus by car and bus.
	Campus: Large green areas and rain trees are common on the university campus. Half of the land is used as the university campus: the rest is developed commercially by the University's Property Management Office or is used by other institutions. There is a water retention pool with a capacity of 3.8 million liters and a rain garden. There are studies on sustainability. It encourages cycling to reduce carbon dioxide emissions, reduce traffic on campus, and promote a healthier and more sustainable lifestyle for students. Zero waste projects are available.
	Natural and Artificial Components: It is located on a flat area (URL-11, 2022).

Ohio State University, USA	**Structure:** There is no boundary for the campus area.
	Urban: The campus has its own green areas and various gardens.
	Campus: Chadwick Arboretum, Sustainability on many topics such as Facility operations and development, recycling, recycling information, recycling waste reduction and collection, zero waste incident demand, public transport, alternative transit, low emission, fuel efficient vehicle parking related studies are available. It also has studies on green roof and water habitats. There are also pedestrians and bicycle paths.
	Natural and Artificial Components: It is positioned on a flat surface. There is water in the campus. Summers are hot and sweltering, and winters are cold and dry (URL-12, 2022).
Michigan University, USA	**Structure:** There is no special entrance to the campus area and entrances are free. While there are courtyards in the interior of the buildings, the points close to the buildings in the campus are designed as hard ground, and the areas between and around the pedestrian paths are designed as green areas.
	Urban: The campus has its own green areas. It has no connection with the green areas in the city. It can be thought of as a landscape patch.
	Campus: In order to increase the ecological value of the campus, more native species are included. Perennial plants, shrub species, and meadow areas are included in the green areas. There is storm water management in the campus. Drainage systems of rain water and sewage waters are together, and this system delivers rain water to rivers and streams. In terms of recycling and energy, compost is made from food waste in the campus and used as fertilizer in green areas. In addition, landscape wastes are used in the production of organic tea. It is tried to contribute to the protection of biodiversity in the river by preventing and reducing the chemicals going to the river with precipitation management and increasing the water quality of the Huron river. The use of bicycles as a transportation system is widespread, and to increase more use, incentives are provided by increasing the number of parking spaces. There are pedestrian and footpath roads in the campus. The pedestrian paths in the campus are suitable for bicycle use. There is no separate distinction made for the bicycle path. There are asphalt car parks that cannot have a high capacity in the campus and they are usually located at the end of the places where you can go by car. Grass areas and hard floors in front of the buildings are used as gathering areas.

	Natural and Artificial Components: It is located on a flat land at an altitude of approximately 800 m above sea level. There is no water presence on the campus, but 40 km west of the Detroit Huron river is located. Continental climate is felt in all seasons. As a layout model, it is in the network layout model (URL-13, 2022).

Table 2. Examples of urban campuses selected from Turkey (Türkiye)

Istanbul Technical University (İTÜ), İstanbul	**Structure:** The university has 7 entrance gates of its own, as its surroundings are limited. There are large planted areas in it.
	Urban: The campus has its own large green areas. Public transportation ring system and bicycle use are common in the campus. In addition, it is possible to easily reach urban travel alternatives such as tram and metrobus.
	Campus: The university consists of 5 campuses. Since all of them are in central points, transportation is very convenient. They also provide transportation between them easily through the public transportation system. Ferry, metrobus, tram, cable car systems are widely used. There are bicycle and, walking paths closed to traffic and transportation alternatives designed for the disabled in the campus. Many studies have been carried out within the scope of sustainable green campus studies within the campus. These are increasing the rate of green areas, increasing bicycle paths, providing suitable transportation for the disabled, collecting rain water and feeding the pond in the area, establishing a biogas facility by collecting waste, and establishing a nature-friendly material sales office.
	Natural and Artificial Components: It is positioned on a flat surface. It includes ponds. In terms of climate, summers are generally hot and dry, and winters are rainy and warm (URL-14, 2022).
Middle East Technical University (ODTÜ), Ankara	**Structure:** The surrounding of the university is limited. It has 4 entrances of its own. It has large green areas.
	Urban: There are large grass areas and vegetative texture, METU forest in the campus. It is possible to reach the campus by public buses, EGO, ring system, taxi, and private car.

	Campus: The most important feature of the campus is that it is a comprehensive and first planned application. Another important feature is that it is a place where all infrastructure services (electricity, water, communication, heating) are implemented under the ground. Approximately 10 million coniferous species and 23 million leafy tree species suitable for drought conditions such as yellow pine, black pine, oak, taurus cedar, almond and poplar have been planted on the campus. In 1995, the METU Forest of 3043 hectares was declared a Natural and Archaeological Site by the Ministry of Culture and Tourism. This natural environment that has been created hosts many different animals such as partridges, snakes, foxes, wolves, rabbits and turtles, more than 140 bird species, and many fish species that can live in fresh water. Today, the water requirement of the university is provided from the deep-water sources around Eymir Lake (URL-15, 2022).
	Natural and Artificial Components: The campus, which was built on a flat area, includes a forest area and Eymir lake (URL-16, 2022).
Erciyes University, Kayseri	**Structure:** The university has its own entrance gates as its surroundings are limited. There are large green areas in the campus.
	Urban: The campus can be easily reached by bus and tram. There is also a free ring service within the campus.
	Campus: The university has four campuses. A zero- waste management system has been established in the campus. Studies have been carried out on accessibility in the space related to the disabled. Within the scope of universal sustainability, by protecting existing infrastructures and systems, especially energy efficiency, zero waste, transportation, etc. They carry out new studies in the fields every year. The university thinks that it has created an exemplary campus with its green areas, energy efficient buildings, bicycle and ring services in the campus (URL-17, 2022).
	Natural and Artificial Components: The continental climate is cold and snowy in winters and hot and dry in summers.

Ege University, İzmir	**Structure:** The university has its own entrance gates. The campus has its own green areas and grass areas.
	Urban: It is possible to reach the central campus of the University by various means of transportation such as metro, bus and minibus.
	Campus: Transportation within the campus is provided by free ring system and bicycle. There are bicycle paths and free bicycles to provide free transportation for students within the campus. In addition, private vehicle transportation is provided and parking is available at various points.
	Natural and Artificial Components: The summers are hot and dry, and the winters are warm and rainy. Barrier-free transportation studies are available (URL-18, 2022).
Yıldız Technical University, İstanbul	**Structure:** Since the university is restricted, it has its own entrances. It has its own large green areas. Two large campuses are in the foreground.
	Urban: It provides transportation by Metro and IETT. There are walking paths and bike trails on campus.
	Campus: Waste management, energy efficiency, smart campus, and digital transformation studies are carried out in the campus. There are also designs for an unhindered healthy future. Applications such as walking and cycling tracks, natural habitats that are integrated with landscape aesthetics, environmentally friendly construction materials used for the recovery of waste and rain-water, and green energy supported lighting come to the fore. A zero waste policy is also common.
	Natural and Artificial Components: In general, summers are hot and dry, and winters are rainy and warm (URL-19, 2022).

3.1. Evaluation of Selected Campuses According to Landscape Design Components

• Most of the campuses are located on flat areas.

• Network type settlement model, which can be easily applied on flat lands, is generally preferred.

• Bicycles and pedestrian transportation are generally preferred for reasons such as the suitability of the land, reducing carbon emissions and improving air quality, and many campuses continue to offer incentives in this regard. In addition, electric ring systems are also widely used.

• Michigan, Chicago etc. There are no restrictions around many of the settlements, they are integrated with the city, and the entrance and exit of all citizens are free. In domestic universities, it has been observed that the university is usually separated from the city by a border member and has its own entrance gates.

• Most of the assessed campuses do not have natural water resources, and there are often established areas to manage rainwater artificially.

• It is important to plan by considering the climatic conditions in terms of the active use of open spaces and the correct planning of the location of the building directions.

3.2. Selected Campuses at the Scale of Structure, City, Campus Evaluation through ecological parameters

Building scale:

• There are courtyard gardens as the grid layout model is generally used in the campuses.

• Courtyards are used for different purposes such as resting, gathering, and providing pedestrian circulation.

• Most of the campuses do not have a separate entrance as there is no border element between them and the city.

• The campuses generally give importance to the LEED certification system in their new buildings by prioritizing energy-efficient studies.

Campus Scale:

• In general, they focused on the use of local plant species suitable for the climate.

• They pay attention to the use of local plant species to reduce plant maintenance costs and water consumption.

• Stormwater management is usually at the forefront for each campus. In this way, they aim to reduce the use of main water and use it instead of irrigation water. In order to achieve this goal, creating a Bioswale and installing a drainage system by taking advantage of the slope are some of the preferred methods.

• By expanding the use of automatic and drip irrigation systems, they aim to reduce unnecessary water consumption by using air humidity sensors. At the same time, they pay attention to the use of water-saving equipment.

• Since recycling is important in general, use of wastes in landscape areas as compost, separation of solid wastes, training on recycling and reducing the use of disposable materials are some of the objectives.

• In order to prevent energy consumption, they increase the number of materials in which solar energy can be used.

• There are generally incentives for campus users to use public transportation.

• Since they want to increase the use of pedestrians and bicycles in the transportation networks used in the campus, efforts to encourage them continue in this direction. Therefore there are designs with a lot of pedestrian and bicycle circulation.

• By reducing the amount of parking available on campus, most campuses are trying to reduce vehicle use.

• Integrated pest management is often used to combat pests on campuses. This method is very important as it reduces the use of chemicals in plant areas and prevents water pollution.

• Although studies are carried out to protect biodiversity, their number is not high.

• It is seen that wide grass surfaces are mostly preferred for resting places. Also, hard floors around the buildings are used for this purpose.

• Vehicle and pedestrian roads are generally planned at the same level, with floor or linear separation. On the grass areas, pathways have been created.

• Cycling is very common in terms of transportation preference and it is generally designed with pedestrian paths. Bicycle parking areas are tried to be encouraged by increasing them.

• Disabled transportation in the campuses has been taken into account in general.

• Considering the flooring preferences, it has been determined that the floorings used in the campuses are generally not permeable.

• There are incentives for alternative transportation to reduce the use of vehicles throughout the campuses. For this reason, vehicle access to all areas is restricted by designing mass parking lots or a small number of pocket parks within the campus.

Urban Scale:

• They are suitable for cyclists and pedestrians as they are generally positioned on flat areas,

• Since the campus areas are generally located in the city center, there is intense use, but transportation is easy,

• Since they are located in city centers, they have access to public transportation points,

• Generally, it has been observed that the landscape areas are in the form of patches and there is no full connection between them. Due to the intense use in the city, there are no corridors to provide connection. It was observed that only the University of Chicago took on the role of corridor.

4. Discussion

In cities where the ecological balance has been damaged due to the destruction of natural areas in recent years, many environmental problems are experienced due to artificial living conditions. In big cities, life is getting harder day by day due to designing and planning approaches that are not made on an ecological basis. The solution to the problems experienced in cities can be presented by applying the sustainability approach from macro scale to micro scale.

University campuses, which offer alternative green spaces for cities, are important places in terms of improving the ecology and quality of life of the city (Yıldız, 2020; Güneroğlu and Pulatkan, 2021; Sarı, 2021, Ekren and Çorbacı, 2022). Beckett et al. (1998), Akça and Gülgün Aslan (2019), in addition to the physical and mental effects of plants used in urban areas, to provide a healthy living environment, to provide a living environment for fauna and flora, to prevent noise, sound, light, dust and wind., preventing temperature difference, reducing air pollution, etc. It has been seen that it contributes ecologically and economically to the urban ecosystem in many areas (Yazıcı and Ünsal, 2019; Çorbacı et al., 2020; Kahveci and Güneroğlu, 2022).

Landscape metrics, which are evaluated through a landscape planning approach based on landscape ecology, are of great importance in making sustainable decisions in terms of land use and in preserving the natural and cultural values of the landscape. Evaluation of ecological processes at the planning stage (landscape planning, landscape restoration, land management, transportation planning, water resources, wildlife, determination of biological diversity, evaluation of ecological risk analysis, determination of landscape development strategies, etc.) contributes to many issues. Most of the natural resources are endangered due to the uncontrollably increasing population. The landscape ecology approach, which is based on landscape planning, restoration, management and protection studies, provides the opportunity to repair the risks and negative effects that may arise from unsustainable land uses. Therefore, it is necessary to evaluate the land use decisions, which will be made during the landscape planning stage, through an ecological approach by determining the

environmental conditions of the landscape areas, the living communities, and the relations of their spaces with each other (Çınar, 2007).

When the economic contributions of the university campuses to the cities are investigated, it has been determined that there are academic studies evaluating the city and region where the university was founded in the 1990s in Turkey, from a socio-economic point of view. Atik (1999) Erciyes University, Erkekoğlu (2000) Sivas Cumhuriyet University, Karataş (2002) Muğla University, Torun et al. (2009) Kars Kafkas University, Görkemli (2009) Konya Selçuk University, Çınar and Emsen (2010) Erzurum Atatürk University and Güneş and Gökçe (2022) discuss the direct or indirect economic impacts of Düzce University on the economy of their regions. Phelps (1998), on the other hand, states that the most important contribution of universities to the cities in which they are located is in the direction of income level. Supporting the studies carried out abroad, the results of the research in general are that universities contribute economically to the cities they are located in. Our research supports these finding.

The contributions of the expenditure items of university students to the city economy are reported by Erkekoğlu (2000) Sivas Cumhuriyet University, Tugay and Başgül (2004) Burdur Mehmet Akif Ersoy University, Dalğar et al. (2009), Özer et al. (2010) Erzurum Atatürk University, Selçuk and Başar (2012) Kars Kafkas University, Demireli and Taşkın (2013),Tösten, (2013) Diyarbakır Dicle University, Arslan (2014) Çankırı Karatekin University, Çayın and Özer (2015) Muş Alparslan University, Demir (2022) Kırıkkale University, Cengiz and Saruç (2023) examined Kırklareli University. It has been determined that there are differences according to the university, year, and city in the studies. However, the common conclusion reached in all of them is that students are a great resource in terms of urban economy. It was observed that the most amount of expenditure items of the students consisted of accommodation and food. In the study conducted by Yavuzçehre (2016) at Pamukkale University, it was revealed that the effects of the campus on the city of Denizli were high in terms of social, cultural, economic, spatial, and demographic.

5. Conclusion and Suggestions

In this study, it has been observed that in most of the examples abroad in the urban university campuses, the University campuses are not separated from the city by a border, large gardens and courtyards are included, alternative transportation vehicles are common, and recycling activities are given

importance. In domestic examples, university campuses are usually separated from the city by border and entrance gates. It has been observed that alternative transportation vehicles and recycling activities are also given importance in the country. It is important to evaluate the positive and negative effects of these issues, which are important for sustainability.

- The open green areas of the city and university campuses should be planned as "green belt, green wedge, green mesh, and green heart" through a holistic planning and design approach to create a spatial continuity, offering alternative accessibility and various recreation opportunities, protecting wildlife, air corridors, which is important for the formation of the urban macro form.
- Protecting and increasing the number of green areas in the city and university campuses will contribute to many issues (noise prevention, oxygen production, reduction of dust and exhaust gases, etc.). These areas should be evaluated in accordance with the design purpose. Instead of exotic plant species with high maintenance and cost, plants that are suitable for the climate of the region, do not require much maintenance and have continuity should be used. Thus, unnecessary use of fertilizers and chemical pesticides will be prevented.
- Newly designed or existing open green areas should be highly suitable for ecological environmental conditions such as temperature, humidity, wind, odor and dust. It is important to reduce these factors to appropriate values for people's health and quality of life.
- Landscape aesthetics with an ecological value should be brought to the fore in the city and university campuses.
- Sustainability of natural ecosystems should be ensured by protecting biodiversity in the city and university campuses.

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CHAPTER VII

URBANIZATION PRACTICES AND THE REFLECTIONS ON THE URBAN STREAM ENVIRONMENT

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1. Introduction

Streams have played various and essential roles in urban settlements throughout history. The surroundings of the streams, which were the center of commercial activities in the early settlement periods, became where most of today's urban centers developed (Paul and Mayer, 2001). Streams, one of the main elements that make up the identity of cities, not only provide economic benefits to the city but also become an essential representative of nature in city centers.

Urban streams, with the green corridors they create and their rich flora and fauna biodiversity, form critical physical networks and cultural and recreational areas in the city (Tsakaldimi and Tsitsoni, 2015). Urban streams and streams within the dense urban pattern offer an easily accessible piece of nature to the inhabitants in that region. For this reason, urban streams are an important environmental

heritage and should be considered not only as natural drainage channels but also as significant ecosystem service providers for cities (Dilman et al., 2020).

The rapid increase in the world population causes an increase in the rate of construction in cities. These rapid urbanization processes are changing and fragmenting natural habitats at the same rate by removing natural vegetation and bringing new infrastructure (e.g., buildings, sidewalks, and roads) to the fore. Urbanization pressure; It makes urban streams, stream banks, and their surroundings the world's most degraded aquatic and semi-aquatic ecosystems, significantly different from natural ecosystems (Francis and Hoggarts, 2008). Factors such as changes in the land use of the areas near the stream corridors, changes in soil cover, changes in groundwater, and changes in stormwater flow cause the destruction of the stream corridor habitat (FISRWG, 1998).

This study aims to scrutinize the spatial interplay between urbanization practices and the streams The study area selected within the scope of this research is the Nilüfer Stream, which is the main stream corridor of the city of Bursa. The pressure of urbanization on the Nilüfer Stream, which reveals more than one character by passing through different contexts within the city, has been examined. By the NDVI analysis carried out within the scope of the study, the urban development processes of the city of Bursa were examined, while the scheme of the Nilüfer Stream and its immediate surroundings and green areas were analyzed. In this context, as a result of this study, which examines the changing profile of the Nilüfer Stream with the pressure of urbanization and the problems it brings, suggestions have been developed to increase the ecological value of the creek in the city.

2. Literature Review

The positive effect of streams on the settlement and development of human culture in the world is an indisputable and universally accepted fact. Since the beginning of known history, settlements have been located on the water's edge, and the greatest states and cultures have developed on these watersides. The land's usability depends on the availability of clean and ample water for various purposes. According to Adler (2007), factors such as water availability, irrigation, industrial development, and defense are influenced by proximity. Stream edges are among the first lands to be developed because they are beneficial for situations and needs. Streams and waterfronts in the urban area encourage economic and recreational activities and provide access to the public (Şimşek, 2011).

Stream ecosystems are heterogeneous landscape areas that interact strongly with terrestrial ecosystems, including groundwater, lakes, large streams, and

coastal ecosystems (Dahm et al., 1998; Fisher et al., 1998). Urban streams are a vital part of the urban environment with their potential to create streambank greenways (Gilbert, 2012). It has been stated that urban stream habitats may be the richest of all wildlife areas in the city if they do not undergo severe physical changes and are not exposed to too many urban pollutants. Streams are important habitats not only for aquatic organisms but also for other living species. For example, streams and the ecosystem services provided by streams are vital for birds and people living in urban areas (Melles et al., 2003).

However, it is also seen that there is a dual situation regarding urban rivers. In this context, It is predicted that the adverse effects of misuse and interventions on rivers, which provide vital services for cities and are an essential part of ecological sustainability in the city, will exceed the positive effects of water on urban ecology, human culture, and communities (Şimşek, 2011). For this reason, it is important to understand urban streams' functions well and maintain their existence in the city without losing their natural structures.

Urban streams are one of the most critical elements in providing recreational services for the city. Urban streams offer potentially preferred areas for urban dwellers to relax, find peace worldwide, and create landscape elements that can positively affect human health and social well-being (Korpela et al., 2001; Grahn and Stigsdotter, 2003). The sound of streams is considered pleasant and peaceful by people. In addition, as urban residents are increasingly disconnected from nature, urban stream ecosystems provide opportunities for people to interact with the natural world (Yli-Pelkonen and Kohl, 2005). Urban stream banks are critical focal points for human and nature interactions and catalyze ecological and socio-economic revitalization in urban systems (Groffman et al., 2003).

2.1. Problems due to Urbanization in Urban Streams

Urbanization is a widespread and rapidly growing form of land use change. According to studies, more than 60% of the world's population is expected to live in urban areas by 2030, and most of this growth occurs in developing countries. (U.N. Population Division, 1997; Paul and Mayer, 2001). While the total area covered by urban areas around the world constitutes only 2% of the world's land surface, their ecological footprints are enormous (Folke et al., 1997; Paul and Mayer, 2001). The increasing rate of urbanization and the problems it brings with it are becoming a danger for stream ecosystems. Even the most minor deformation in the stream corridors can affect the entire corridor and its ecosystem. The results of urban pressures can be observed at many scales (FISRWG, 1998). The increase in impervious surfaces in urbanized areas,

stream corridors included in concrete canals or sewer systems with various infrastructure works, the undergrounding of streams in line with the increasing need for transportation networks, and the destruction caused by pollutants are the main situations that threaten the sustainability of streams in cities.

One of the most dominant problems urbanization brings is the decrease in the permeability of the land. This decrease leads to deterioration of infiltration and an increase in surface runoff (Paul and Mayer, 2001). As the impermeable surface cover in the field increases to 10-20%, the runoff doubles; 35–50% impermeable surface cover increases runoff threefold, and 75–100% impermeable surface cover increases runoff more than five times over forested watersheds (Arnold and Gibbons, 1996). Impermeability has become one of the most important triggers of the urban effects of urbanization on streams (McMahon and Cuffney, 2000), and today, the degradation threshold of many streams progress in direct proportion to an impermeable surface cover of 10-20% (Booth and Jackson, 1997; Paul et al. Mayer, 2001).

With the rapid increase in urban sprawl, the pollutants that cause the pollution of the streams are increasing. Especially in unplanned urban development areas, due to poor construction of gray infrastructure, urban streams progress by merging with sewage systems. In regions where water treatment technology is not good, polluted stream corridors also pollute the soil and natural structure of the lands they pass through (Nagumo and Hatano, 2000). Thus, pollution starting from one area affects the entire stream ecosystem.

2.2. Situation of Urban Streams in Turkey

Most of the cities in Turkey are lucky to have watercourses. While these watercourses may vary from small streams to large ones, there are some major riverfront cities. However, in Turkey, urban streams are usually considered only as an infrastructure element that provides water transmission. Urban streams, whose social and ecological services are put into the background, are perceived by the residents of the city as a dumping area where bad smells spread, the source of fly and insect problems, and frequently causing flooding, with the effect of wrong interventions (Özeren and Hepcan, 2013). Rapid urbanization, which results from the increasing human population in Turkey as in other countries, threatens the ecological structure of the streams in our country and makes them invisible in the city. The high level of legal and administrative openings for streams also causes cities to lose their stream corridors (Özalp, 2019).

As a result of these interventions, due to unplanned urbanization, disasters such as floods and overflows are experienced in urban streams.

In Turkey, disasters, floods, and overflows cause the most loss of life and property after the earthquake (Uşkay and Aksu, 2002). For this reason, it is essential to reconsider streams' relationship with our cities. It is seen that the stream corridors, whose coasts are planned and their ecological and recreational potential are revealed in our country, are very limited compared to the examples in the world (Önen, 2007).

2.3. Urbanization in Bursa

Bursa was established on the northwest foothills of Uludağ and developed mainly in the east-west direction. Thanks to its fertile plain, rich water resources, and close location to Istanbul and other international trade centers, it has been an important commercial center from the past to the present. The archaeological remains show that Bursa has been a settlement area for about 7000 years (Tekeli, 1999; İlhan, 2019).

The city of Bursa, which the Ottoman Empire made the first capital city, consists of two Greek and one Jewish quarters, with the settlement inside the castle in this period. In the 1340s, a mosque, a madrasah, and a covered bazaar were built outside the castle walls, and this area formed the Hanlar Region, the main center of today's Bursa City. (Kaplanoglu, 2008). The urban pattern that developed and grew around this region was often damaged due to fires and significant earthquakes in the following years. To redesign the layout of the city., a comprehensive city map was drawn by Suphi Bey in 1862 (Figure 1) (İlhan, 2019).

Figure 1: Bursa City Map Prepared By Suphi Bey in 1862 (İlhan, 2019)

In 1958, there was a great fire disaster in the city, and after this fire, Luigi Piccinato prepared a new city plan. In this plan, urban development was aimed at the east-west axis in line with preserving the historical urban pattern and the agricultural value of the Bursa Plain and considering the estimated population growth (Tekeli, 1999). However, with the increase in investments in industry and, therefore, the number of industrial enterprises in the city, the population has increased much more than expected, and unplanned urbanization activities have emerged (İlhan, 2019). For this reason, the 1984 Master Plan, 1990, and 1995 Revision Master Plans were prepared, and according to these plans, it was suggested that the industrial areas should be gathered in a particular region and Nilüfer district should be a mass housing area to meet the housing needs (İlhan, 2019).

Bursa Metropolitan Area was defined for the first time with the Bursa Environmental Plan with a scale of 1/100,000, which was updated in 2009. Although there are strategies to highlight urban development, conservation, and historical-cultural identity in the plan, Since these plans could not be completed all over the city, irregular urbanization continued (İlhan, 2019). With the construction of luxury residences and business centers, some of the Bursa Plain and stream corridors have been under urban pressure (Figure 2) (Eryılmaz et al., 2008).

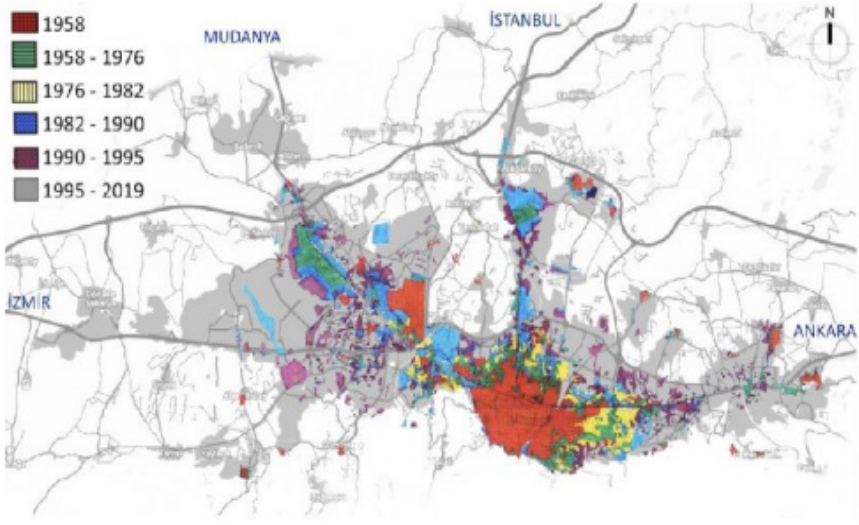

Figure 2: The development of the city of Bursa (İlhan, 2019)

3. Materials and Methods

3.1. Material: Study Area

Nilüfer Stream is the mainstream corridor of Bursa City and one of the essential characteristics of the city. The water collection size of the Nilüfer Stream Sub-Basin, which is located within the Susurluk Basin, is 680 km2. The length of the Nilüfer Stream, which originates in the vicinity of the Keles district, located in the south of Uludağ, is 176.5 km, and its average flow is 23.58 m3/s (Ministry of Forestry and Water Affairs, 2016). Nilüfer Stream flows in a very narrow valley in the northwest direction. Soğukpınar, Kaplıkaya, Değirmendere, Ayvalı Stream, Madendere, Gökdere, Kırkpınar, Cilimboz Stream, and Balıklı Stream are important tributaries connecting to the Nilüfer Stream. The Nilüfer Stream, which descends from the west of Bursa to the Bursa Plain, increases the water potential by collecting these side streams and joins with the Susurluk Stream downstream of Uluabat Lake and meets the Sea of Marmara from the Karacabey Strait (Figure 3) (Bursa Provincial Directorate of Environment and Urbanization, 2020).

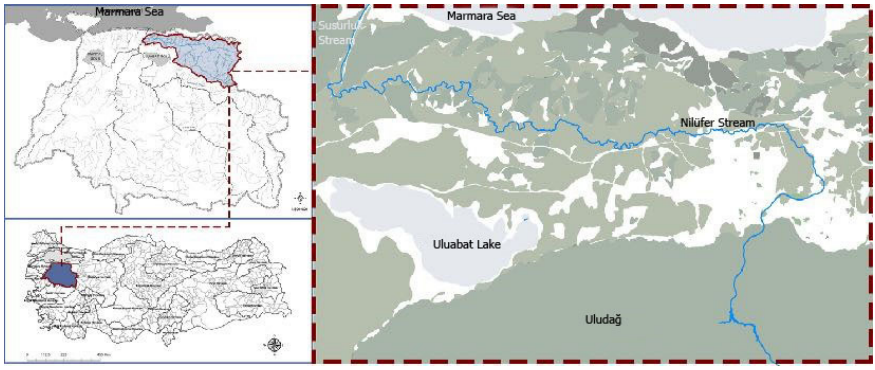

Figure 3: Study Area (Dilman, 2022)

Nilüfer Stream, together with the Doğancı Dam and the Nilüfer Dam on it, meets a large part of the drinking water needed by the city of Bursa (Bursa Provincial Directorate of Environment and Urbanization, 2020). Nilüfer Stream passes through 3 different contexts within Bursa: rural, urban, and urban periphery. The rural context, consisting of forest and farmland, is where the Nilüfer Stream originates and spills into another stream corridor. The urban and periphery contexts are where urban, industrial, and agricultural patterns come together (Dilman, 2022). Nilüfer Stream is also a stream corridor with the potential to connect the green pattern provided by Uludağ in the south and the green pattern formed by the agricultural areas in the north.

3.2. Method

With the increase in urbanization and industrial activities, the changing land cover has also decreased the green pattern in the immediate vicinity of the Nilüfer Stream. The NDVI (Normalised Difference Vegetation Index) analysis method was used to determine the extent of the change in the green tissue in and around the Nilüfer Stream over the years. Within the scope of NDVI analysis, satellite images dated 1985, 1995, 2005, 2015, and 2021 were used. In the next stage, the land cover map of the Nilüfer Stream Sub-basin was prepared using the 2018 CORINE image. With the analyzes and maps prepared, the urbanization pressure on the Nilüfer Stream was determined, and the problems brought by this urbanization pressure were examined. According to the analysis and detections, suggestions were made to solve the problems caused by the pressure of urbanization on the Nilüfer Stream (Figure 4).

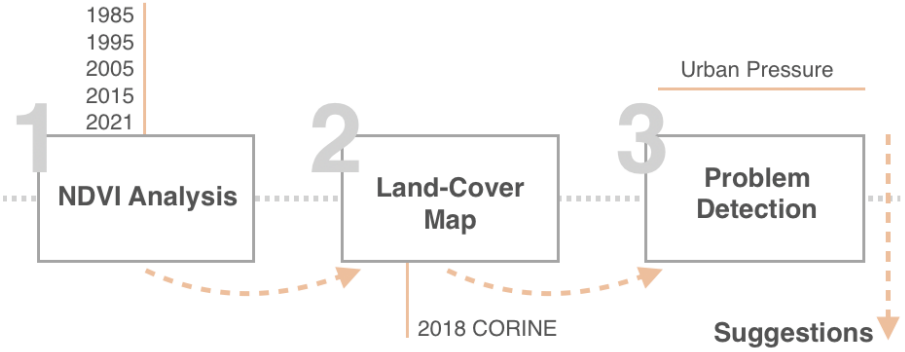

Figure 4: Methodology Chart

4. Results and Discussion

Bursa stands as a city where the majority of the investments are made with the feature of being an industrial city. Although this is a favorable situation for the city's development, the increase in industrial enterprises caused the urban population to increase much more than expected. The increasing urban population has brought unplanned urbanization activities (İlhan, 2019). With the increase in urbanization and industrial activities, the changing land cover has also changed the pattern near the Nilüfer Stream. According to the NDVI analysis conducted in this context, the green area ratios in and around the Nilüfer Stream have decreased dramatically (Figure 5). The most significant share of

this change is the increase in residential areas on the whole city scale and the use of areas that should be agricultural land for industrial activities. One of the factors most affected by this change has been the Nilüfer Stream. The changes in the lands it passes through from Uludağ until it spills into the Marmara Sea and the changes in the use of land have caused the natural form of the Nilüfer Stream to change in some regions, the flow rate to decrease, and most importantly, the water quality to decrease.

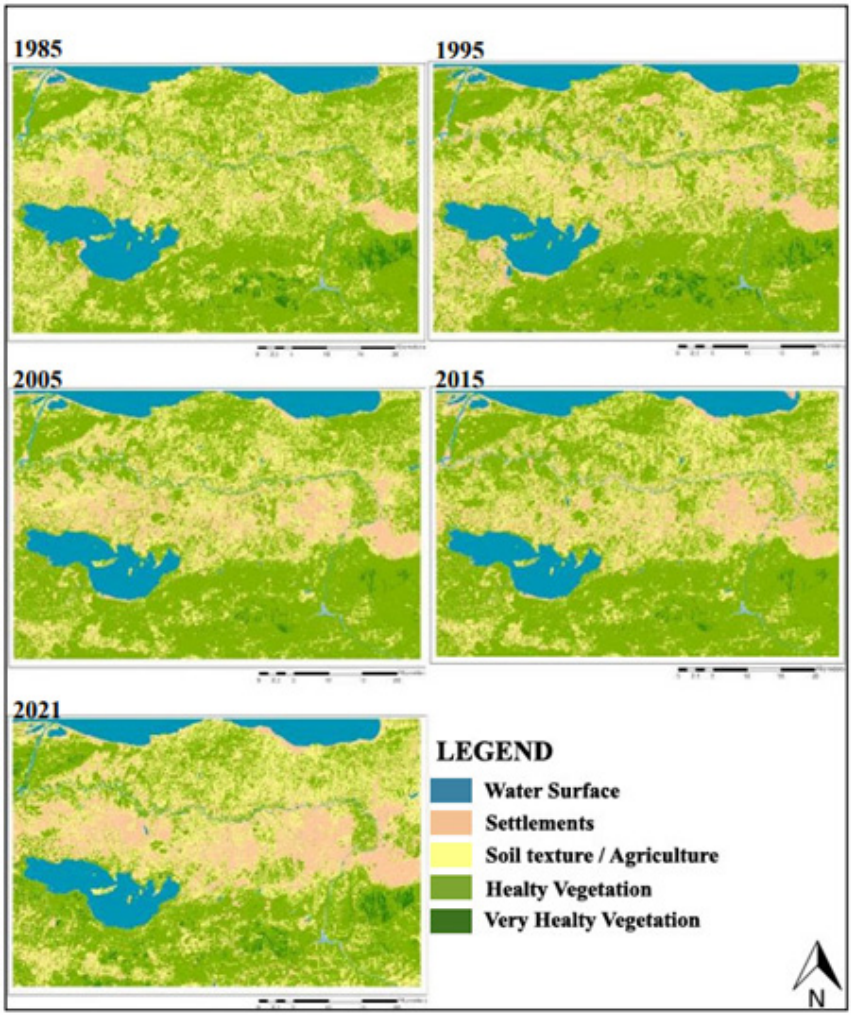

Figure 5: NDVI analysis of Bursa city and Nilüfer Stream (Dilman, 2022)

When the land cover of the Nilüfer Stream Sub-Basin is examined, it is seen that approximately 91% of it is the areas outside the urban settlement, that

is, in the rural class. While the part of the stream remaining in the urban pattern seems to cover 8% of the land cover, the remaining 1% is wetlands (Ministry of Forestry and Water Affairs, 2016). Although the regions where the Nilüfer Stream passes are expressed as natural or rural, the destruction of the urban pattern affects the entire stream corridor. In particular, the fact that the urban pattern is in the middle of the forest and agricultural lands causes the green pattern to break (Figure 6).

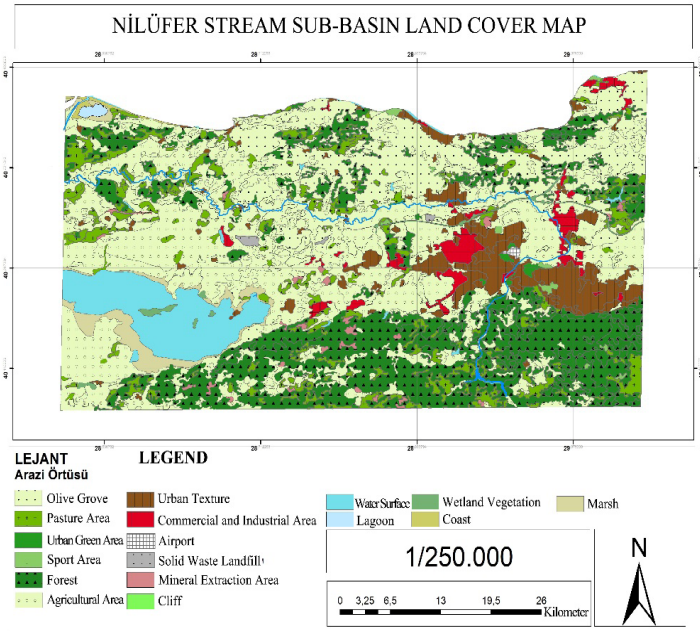

Figure 6: Nilüfer Stream Sub-basin CORINE land cover (Dilman, 2022)

The low water quality of the Nilüfer Stream, which is also used as a part of recreation in urban areas, threatens urban health. In the regions where the stream remains inactive, bad smells and flies were observed, drying in places. The visibility of the Nilüfer Stream in the city is very low. Although it provides drinking water for the city, recreational potential in urban areas, and an irrigation source for agricultural areas, it is seen that the stream's potential to meet with the city and the citizens is not well managed. The polluted stream with urbanization and industrialization has been seen as a source of pollution and odor in the city, and its versatile characteristics in Bursa have not been considered (Figure 7). Although the municipality has infrastructure works, these works are often insufficient, and the wastewater from the houses and businesses in the vicinity pollutes the Nilüfer Stream.

Figure 7: Pollution and drying condition of Nilüfer Stream in the urban area (Dilman, 2022)

On the other hand, there is no continuous green corridor around the stream in the city. Especially in the region where commercial activities are intense, the creek has completely lost its natural form as a result of stadium construction activities. In this area, the stream was taken into a U-section concrete channel within the scope of the improvement project, and the natural stream bed deteriorated. The permeability situation at the creek nearly ended because of that, and this part of the creek, which started to dry up, remained a completely useless and inactive area (Figure 8).

Figure 8: The intervened stream form and its idle surroundings (Url-14)

5. Conclusion and Suggestions

Streams have been one of the most fundamental factors in the development of cities throughout history. They have been the natural elements that fed the settlements and gave their character to the region for years. Urban streams, which represent nature in the city, play a critical role in maintaining the ecological balance in cities. For this reason, the sustainability of these stream corridors is essential in urban and rural areas. However, the population growth in the world and the migration movement to the cities that developed with the industrial revolution caused the increase of urban settlements and increased urban pressure. Urban streams are one of the natural elements most affected by urban pressure. It is crucial to see the streams, which come to the forefront with their unfavorable conditions, as important ecological corridors that need to be recovered for the city rather than a problem factor and to develop approaches. In this context, it has been determined that the Bursa Nilüfer Stream is exposed to intense urbanization pressure within the urban pattern. The stream started to dry out due to urbanization activities polluting it, interfering with its natural form, and the increase in the impermeable surfaces around it has made it an ultimately problematic factor. All these problems have reduced the recreational potential of the stream, and its visibility in the city has been adversely affected. In order to ensure ecological sustainability in the city and to end the adverse ongoing process of the creek, which initially started as a natural and clean one, it must be secure against urban pressure. In this context, green infrastructure studies are of great importance. Removing the elements that cause pollution of the stream and increasing the amount of green space around the stream will eliminate the drying problem of the permeable surfaces around it, and increase the quality of life along the streamfront. Meanwhile, enhancing its recreational potential in this way will also strengthen the relationship between people and streams. Moreover, the participation of local governments and relevant stakeholders in the process is critical for correctly implementing these recommendations. In order to regenerate Nilüfer Stream as the basic ecological corridor of the city instead of a destruction corridor, it is essential to add design strategies for the amelioration of the stream. These strategies should be officially attached to the development and environmental plans of the city, which may, phase by phase, conduct a city-scale rehabilitation. Benefitting from the case of Bursa City, this study stands as an initial step for further studies on promoting strategies for stream-front cities.

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CHAPTER VIII

INTERACTION OF URBANIZATION AND PUBLIC GREEN SPACES

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1. Introduction

Urban areas; are built environments used by humans, plants and animals and contain a mix of natural, semi-natural and modified habitats. They serve as assets that are mobile and contain many elements of different types (Mensah, 2014). Today, more than half of the world's population lives in these areas. It is estimated that this proportion will reach 70% by 2050 as global population increases and urban areas expand (Ferreira et al., 2020).

People develop and change physically and psychologically throughout their lives. However, they also want to change their environment to make it suitable for them. Thus, they have the opportunity to use and live for a long time without leaving the areas they are in (Alpak & Düzenli, 2018). It is one of the areas where people use and continue their lives in cities. The change, development and progress in areas such as industrial, commercial, cultural, social, economic, environmental and educational have continued throughout the periods; cities begin to change physically and the society living in them in terms of lifestyle and livelihood (Zhang et al., 2022). Today, unplanned urbanization and global climate change, which occur due to excessive and

rapid population growth in cities, cause cities to gradually grow with buildings, reduce their natural environment and expose them to environmental pollution, climate change and its negative consequences (Gouran & Koç, 2021). It also leads to changes in the use and management of urban land, the deterioration of groundwater quality, and the reduction of water levels due to precipitation, temperature, and evaporation events (Ramaiah & Avtar, 2019). At this point, measures need to be taken to improve the urban environment in order to prevent, stop or slow down the transformation of urban life to an unsustainable state. The protection of existing public green spaces or the creation of new ones is one of the most effective planning tools to solve the negative consequences of changes and developments in cities (Doygun et al., 2015).

Public green space is one of the essential elements of the urban environment. It is the only land use type with natural and semi-natural features in the city. Cities have an active role in protecting their ecological environment and diversity (Yang et al., 2017). It is defined as an open space with a significant amount of vegetation within the urban area. It is usually semi-natural and is seen as the last remnant of nature. It also typically has important functions such as preventing soil erosion, absorbing rainwater and pollutants, reducing the urban heat island effect, providing entertainment, reducing work-related stress and increasing property values (Kong & Nakagoshi, 2006; Labuz, 2019; Düzenli & Alpak, 2021). At the same time, it is one of the most important urban elements that show the development and quality of life of today's cities. Creating a healthy environment in cities, ensuring physical balance, limiting the negative developments of cities, providing microclimatic benefits, fulfilling the ecosystem services of the city, ensuring that people are in touch with nature, removing them from the tiring and oppressive city life, enabling people to witness seasonal changes, contributing to scientific studies and all providing equal opportunities to its users (Chiesura, 2004; Kısak, 2021).

The benefits of public green spaces come to the fore when considering their interaction with cities. These benefits are discussed under three headings: environmental, economic and aesthetic, and social and psychological.

1. Environmental Benefits: Green spaces provide many ecosystem services, from protecting biodiversity in cities to regulating the urban climate. These areas act as protection centres for the reproduction of species and the protection of plant, soil and water quality in cities. They provide a link between urban and rural areas (Salazar et al., 2015; Li et al.,2019). There are differences

in temperature, sunshine, humidity, wind and precipitation patterns in urban areas compared to rural areas. This situation varies according to the built environment of cities. The fact that heat-absorbing surfaces come from large areas, combined with high energy consumption in cities, leads to an increase in urban temperatures due to the urban heat island effect. To prevent this, adequate planting of forests, preservation and development of vegetation near residents' homes, and management of water resources by authorities can help mitigate the situation (Heidt & Neef, 2008; Haq, 2015).

Chemicals in the form of solid particles, liquid droplets or gases cause pollution in cities because they contain particles and biological materials. The most common types of pollution in cities are air pollution and noise pollution. This is because there are many motor vehicles. These vehicles produce air pollutants such as carbon dioxide and carbon monoxide, as well as noise. By greening cities, vegetation traps dust and smoke particles, directly reducing air pollution. Public green spaces in congested cities can significantly reduce noise levels, depending on their quantity, quality and distance from the source of noise pollution (Sorensen et al., 1997; Bolund & Hunhammar,1999; Haq, 2015).

2. Economic Benefits: Using plants to reduce the cost of energy used to cool buildings and increasing the planting of green spaces and trees in temperate cities are shown to be cost-effective functions of cities.

Plants improve air circulation, shade and evaporation. This helps to reduce air temperatures by giving cities a cooling effect. Research shows that the tree cover in cities can reduce the total energy used for heating and cooling (Heidt & Neef, 2008).

The fact that cities have sufficient green space is aesthetically attractive to both city dwellers and investors. In this situation, green spaces and landscaping increase property values and financial returns (Sorensen et al., 1997).

3. Psychological and Social Benefits: People get most of their recreational needs from the area in which they live. In terms of public green spaces, cities are one of the areas that offer people this opportunity (Neuvonen et al., 2007).

When people come into contact with the natural environment, their stress levels decrease compared to the urban environment. Public green spaces increase the physical and psychological well-being of people living in cities. At this point, the relationship between people and nature is important for daily enjoyment, work efficiency and general mental health (Grahn & Stigsdotter, 2003).

In light of these benefits, rapid urbanisation and population growth in recent years have led to significant changes in urban areas, resulting in the fragmentation, reduction and degradation of public green spaces. As a result, environmental, economic, aesthetic, social and psychological problems arise and the benefits of public green spaces are not available to cities.

In this study, the urbanization processes of cities, their impact on public green spaces and the economic status of the city on public green spaces that change with urbanisation were investigated.

1.1. Urbanization of Cities

Cities enter the urbanization process for economic, technological, political and socio-psychological reasons. From an economic point of view, cities have very different areas of employment compared to rural areas. At the same time, the division of labour and reconciliation facilitate people's production and increase their income. This gives people in urban areas economic advantages over those in rural areas. The use of electric energy in the industrial sector in cities, the penetration of computer technologies in our home and business life and their direction make cities a centre of attraction in terms of technology. The administrative structures of cities, the characteristics of the legal institutions and the political decisions taken at various levels add to the attractiveness of cities. There are differences in the lifestyles of rural and urban areas. The free atmosphere of the city, the cultural and social opportunities and services, and the pride of being an urban citizen make cities attractive (Ekinci & Susmaz, 2009; Düzenli & Alpak, 2022). In the light of all these, considering the situation of cities, they open their existing areas for urbanization to meet the needs and demands. In this case, urbanisation drags cities down by reducing or destroying their public green spaces. As an example of this situation, Figure 1 briefly shows the situation with an example of a built city.

Figure 1. The Example of Trabzon in the Urbanization of Cities (Seyhan, 2023)

1.2. The Effect of Urbanization on Public Green Spaces

Urbanization is defined as the outgrowth of urban centres from the area in which they are located, the renewal of the existing structure and its transformation through time. Unplanned urbanization is the fact that cities go through the process they are in in an uncontrolled, fast and irregular way without a project, programme or plan. In cities in such a process, a structure is formed where there is no harmony between the environment and people, infrastructure, problems such as roads, water and sewerage are not solved, far from aesthetic concerns, there is chaos in communication and transport, and impossibilities are experienced in education, health and cultural services. As a result, while society is materially impoverished and spiritually troubled, in the cities it is transformed into a pile of concrete and stones. As cities are built day by day, they also have a negative impact on nature. The poisoning of water, the pollution of air and the destruction of public green spaces, especially with the destruction of soil, are just some of the negative effects (Aksoy & Ergun, 2009).

When we look at the impact of urbanization on public green spaces (Aksoy & Ergun, 2009; Önder & Polat, 2012; Ilıcalı, 2016; Parlak & Bayramoğlu, 2023).

• It threatens their existence in the city. It is shown as an example in Figure 2.

Figure 2. The disappearance of public green spaces in cities (Url-1,2023)

• Buildings and related infrastructure that have been created as a result of urbanization increase the rate of concretisation and reduce green areas if not well planned. As shown in Figure 3, in this case the interaction between man and nature in cities gradually decreases, plant and animal species begin to die out with the loss of biodiversity, the warming of the urban surface cannot be prevented, and with the increase of impermeable surfaces it becomes difficult to absorb rainwater. The decrease in green space and the increase in concrete surfaces create serious network problems.

Figure 3. Results of urbanization (URL-2, 2023)

- Since the individual benefit rather than the social benefit is the predominant factor in modern urban planning, this results in green spaces that do not meet the needs.
- The increase in built up areas with urbanization has a serious impact on carbon emission rates.
- Contrary to public green space covered with vegetation and soil, the increase in impermeable surfaces with urbanization affects the retention and storage of solar radiation and the increase in temperature, creating an albedo effect.
- Energy saving, tourism and employment opportunities, property value, production function, oxygen production, filtration of polluted air and supply of fresh air, cooling and heating effect, effect on relative humidity, retention of carbon in the atmosphere and reduction of greenhouse gas effect, prevention of erosion and water management, protection of biodiversity, noise reduction, cultural and educational activities, reduction of crime rate, recreational activities, contribution to social development, protection of public health, circulation and access, esteric, buffer between different urban uses. Urban aspects such as duty, historical protection and architectural effects mean that green spaces do not fulfil many functions.
- The haphazard and irregular determination of industrial and commercial centres and settlements established as workplaces in cities destroys public green spaces.
- People are not sufficiently aware of green spaces. Since there are no planned and regular educational institutions in the cities that teach urban awareness, or the content of the education cannot be changed and replanned accordingly, the insensitivity and unconsciousness of the city dwellers on this issue is increasing day by day.

1.3. Economic Effects of Public Green Spaces on Urbanization

A city can add value to the commercial and residential properties around it with its quality public green spaces. This situation also increases the data yield from a local government perspective. It also contributes to increased retail sales, investment in tourism and the region, employment and even the creation of a skilled workforce (Arvanitidis et al., 2009). In short, open green spaces in cities are considered as green infrastructure systems of cities and some economic benefits come to the fore. These benefits are illustrated in Figure 4 below (ECOTEC, 2008; NENW, 2008). The economic benefits of public green spaces for urbanization are briefly explained below.

Figure 4. Economic benefits of green infrastructure (ECOTEC, 2008; NENW,2008)

1. Economic Grwoth and Invetment: It is believed that investment in public green spaces in cities improves the image of the region and helps to attract and retain high-value industries, new businesses, entrepreneurs and employees. This increases the economic scope of the region and reduces unemployment rates (NENW, 2008).

2. Land and Property Values, Aesthetics: The value of a building generally depends on the physical characteristics of the city in which it is located. The most important of these is location. The development and improvement of public green spaces in the location increases the value of both the land and the building. At this point, investment in green space leads to increased demand for buildings and higher returns in the property sector. People's choices of where to live depend largely on their individual preferences. However, its distance from work, education and health facilities and the accessibility of public transport can have positive or negative effects. At this point, if we look at the factors that influence the choice and price of buildings, environmental factors are at the top of the list (Trojanek et al., 2018). In addition, the development and assessment of aesthetic quality affects the land and property prices of the building. The visual comfort and aesthetic quality provided by the green space contributes to the quality of life that people will have at home and during their commute (Regeneris, 2009).

3. Regional and Local Economic Regeneration; The regeneration of regional and local economies is one of the most important activities of government. In terms of economic regeneration, increasing the employment rate in cities and promoting job growth and investment also means combating economic disadvantages in cities (Saraev, 2012). In this direction, making the necessary arrangements for the improvement and development of green areas in cities is an important step towards creating a quality and social environment that is environmentally friendly and sensitive to the landscape. This situation will contribute to the economy as it will encourage investors, entrepreneurs and employees both at local and regional level (ECOTEC, 2008).

4. Labour Productivity: More and better quality green space in cities improves health; it offers employers the opportunity to develop a more productive workforce with the benefits of reduced stress, illness and absenteeism. It keeps people in their environment by providing motivation (NENW, 2008).

5. Tourism: The development and improvement of open green spaces in cities plays an important role in creating new tourism opportunities. Here, the greening of forests and urban centres for communities to attract new visitors increases the potential of cities. This can support the urban retail and tourism sectors. The benefits of tourism to cities are market-based. Spending by visiting tourists, for example on transport, retail goods, food and drink, has an impact on the economy both directly and indirectly at the local level (ECOTEC, 2008).

6. Products From The Land: Green spaces, such as agricultural land, managed forest areas and grasslands, are generally productive land, and forest products are mainly extracted from these areas (ECOTEC, 2008). Investment in green areas can increase the amount of productive land and/or productivity. This can support urban employment.

7. Health and Well-Being: Green spaces improve air quality and help reduce stress levels, which is good for mental health. It has a positive impact on physical health. Increasing green space in cities reduces health problems, absenteeism and premature deaths, thus reducing economic costs and increasing economic output (Saraev, 2012).

8. Recreation and Leisure: Public green spaces provide people with opportunities for leisure and recreation in cities. They are valued because they are free, easy, accessible and meet people's recreational needs in their leisure time (ECOTEC, 2008).

9. Quality of Place: Green spaces provide people with a developed living space. Sometimes it provides recreational and visual opportunities, and

sometimes it provides opportunities for community empowerment. It enables community participation in management and ownership while improving the quality of life of local users. It leads to increased social cohesion and reduced crime rates. It makes a region more attractive to business and skilled workers. It provides new inward employment opportunities, reduces the price of health services and increases the price of land and housing (ECOTEC, 2008).

10. Land and Biodiversity: Investing in green spaces in cities is known to improve and protect living spaces, thereby promoting and maintaining biodiversity. It is effective in forestry, agriculture, land conservation and management to support employment both directly and indirectly. It reconnects society to green spaces that have been lost to urbanisation and provides marketing opportunities at the local level (ECOTEC, 200

11. Flood, Alleviation, Water Management: Increasing the coverage of buildings, green spaces and soft surfaces in urban areas reduces and controls run-off, improves absorption rates and increases storage capacity. It encourages investment in improving the quality of the urban environment, reducing the risk of flooding in densely populated areas and encouraging inward investment. This contributes to an increase in building prices, a reduction in insurance premiums, lower cleaning costs, employment in economic activities and an increase in growth (ECOTEC, 2008).

12. Climate Change Adaptation and Mitigation: In reducing the amount of carbon produced in cities, trees provide carbon sequestration. At the same time, trees contribute to energy savings in the city by providing natural air conditioning and shade, thus reducing the need for heating and cooling (Regeneris, 2009). The use of land-based products can also lead to carbon substitution benefits. It also allows for adaptation in microclimate control and water management.

2. Conclusion

Cities, which are constantly evolving due to various changes and developments from the past to the present, enter the process of urbanization with industrialisation. While this process is sometimes planned and programmed, more recently it has begun to develop in a disorderly manner in line with increasing needs and demands. In this case, along with the structure of the city, the lifestyles and livelihoods of the people who live in it are affected. In addition, public green spaces, which are located in the city and offer the city's natural life and human needs together, are one of the most affected areas. The need for urbanisation, which comes with the growth of the city's population, is attempted to be met by

the destruction or reduction of these areas. At this point, with the structuring of cities, the public green spaces of the city began to decrease proportionally. In such a process, urban open green spaces do not fulfil the functions they provide to the city. This has caused serious problems in the city. In this direction, it is necessary to plan and programme the structuring of cities without ignoring the important functions of open green spaces in the ecological, economic, social, educational and cultural fields. This situation should be taken into account when making plans, programmes and projects in the city. The economic benefits of open green spaces should not be ignored, especially in solving the economic problems that are one of the biggest problems of our time.

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CHAPTER IX

HOT-ARID LANDSCAPING: MAXIMIZING WATER USE EFFICIENCY THROUGH XERISCAPING

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1. Introduction

In the years to come, our planet will face one of its most significant challenges: the impending water crisis. This crisis has sparked a transformation in the field of landscaping. Xeriscaping has become essential, particularly in hot and arid climates as a water-efficient landscape design. While it is commonly practiced in regions with scarce freshwater, xeriscaping can also be implemented in other climates to promote water conservation. Unlike conventional landscaping methods that consume large amounts of water, xeriscaping embraces principles such as "low water usage," "water-smart or water-wise" practices, and "natural landscaping" (Çöp and Akat, 2021; Nirmala and Jyothi, 2022). The Primary goal of xeriscaping is to conserve water by minimizing its usage and creating sustainable landscapes. Sustainable water usage in a landscape is important. Although eliminating water usage in landscaping is unattainable, xeriscaping promotes the efficient and sustainable use of water (Yazıcı et al., 2014; Çorbacı and Erken, 2022). To achieve this, xeriscaping relies on locally adapted plant species that can thrive in the prevailing climatic conditions, as opposed to exotic and water-intensive plants. Additionally, the area dedicated to lawns is minimized to reduce water consumption (Herkes and Korkut, 2021). Xeriscaping has now emerged as a crucial approach, not only for creating visually appealing landscapes in urban areas but also for conserving water resources. It plays a vital role in addressing the challenges posed by the impending water crisis.

The effective management and utilization of water in urban areas are essential requirements due to two main reasons. Firstly, in densely populated urban environments, green spaces serve as important connections with nature. Secondly, these areas are highly visible and well-suited for development and organizational purposes (Çorbacı et al., 2011). Green spaces play a significant role in addressing climate change through nature-based solutions, offering substantial potential to mitigate the impacts of heat waves and increase the resilience of urban areas against climate change. Yet, green spaces availability and their contribution to climate change mitigation and adaptation strategies pose unexplored challenges due to limited water resources. Therefore, it is crucial to incorporate comprehensive planning and design strategies in landscape architecture, ensuring clear definitions and alignment with sustainability objectives and principles (Ismaeil and Sobaih, 2022).

Sustainable landscape design aims to achieve several key goals, including the conservation of water and energy, waste reduction, and the management of runoff. Another important objective is to incorporate local plant life that thrives under similar environmental conditions. The American Association of Landscape Architects (ASLA) has established seven fundamental principles that guide sustainable landscape design. These principles encompass various practices such as collecting rainwater and gray water, utilizing native plants, integrating drought-resistant plants that are native or adapted to the area, creating low-maintenance landscapes, using permeable surfaces, incorporating fire pits and fireplaces, establishing food and vegetable gardens (including orchards and vineyards), implementing rain gardens, employing drip irrigation, and minimizing the use of turf areas (Table 1). These principles closely align with the principles of xeriscaping design (Ismaeil and Sobaih, 2022).

Table 1: Xeriscaping Design Principles

Xeriscaping Principles	Benefits of Xeriscaping	Designing Sustainable Landscapes
Planning and preparation	Minimal maintenance is required.	Well-planned and designed
Analyzing and preparing the soil	Water conservation is achieved.	Harvesting rainwater/ graywater
Choosing appropriate plant species	Fertilizer usage is reduced.	Utilizing native or drought-resistant plants
Creating lawn areas	Environmental pollution is minimized.	Reduced turf areas
Effective irrigation	Xeriscaping is visually appealing.	Drip irrigation systems
Using mulch	Habitat for wildlife.	Permeable surface
Maintenance	It offers economic advantages.	Low maintenance landscape

Xeriscaping provides numerous benefits that contribute to both the environment and the economy. By adopting xeriscaping techniques, significant water conservation efforts can be achieved, leading to a substantial 50% reduction in water usage. This approach promotes the preservation of water resources. Additionally, xeriscaping encourages the utilization of indigenous plant species, thereby supporting the preservation of local flora and promoting biodiversity in the region. By reducing reliance on fertilizers and herbicides, xeriscaping fosters a healthier ecosystem and minimizes the risk of pollution. Furthermore, this landscaping method requires less maintenance compared to traditional approaches, resulting in time and resource savings. It's worth noting that xeriscaping encompasses a wide range of plant varieties, including trees, small trees, shrubs, and ground cover species, beyond the common association with cacti and succulents. Moreover, xeriscaping offers flexibility in terms of landscape styles and materials, allowing for diverse aesthetic options that can range from lush green gardens to desert-like landscapes.

The objective of this study is to evaluate the water consumption of xeriscaping designs, focusing specifically on Arizona State University (ASU). With its semi-arid climate, Arizona offers an optimal environment for examining the effectiveness of xeriscaping. ASU, like many other locations in the state, utilizes various landscape designs that incorporate both extensive lawns and xeriscaped areas, making it an excellent case study for this research.

2. Material and Method

2.1 Material

The research conducted centered on Tempe, an Arizona city positioned at coordinates 33°26′54″ North and 112°04′26″ West. Its primary objective was to examine the city's limited water resources and the importance of water management in the context of global climate change. According to the Köppen-Greiger climate classification, Tempe falls within a tropical and subtropical desert climate (Bwh). This climate is characterized by scanty rainfall, resulting in an arid region with an average annual precipitation of 203.2 mm (Kottek et al., 2006). Tempe experiences hot summers with high daytime temperatures, while winters are relatively mild. The highest temperatures are recorded in July and August, ranging from 41-53º, whereas the lowest temperatures occur in January and February, ranging from 6-13º (AZMET, 2022). The predominant vegetation in this hot-arid desert climate consists of local plant species adapted to drought conditions. Specifically, the study focuses on the ASU Tempe campus, which is part of ASU, a prominent public university situated within the Phoenix metropolitan area. ASU comprises four campuses spread across different parts of the city, with the Tempe campus being the primary and original one. The research area selected for the study is the ASU Art Museum landscape project, occupying an area of 44,000 m^2. This landscape project incorporates an equal mix of xeriscaping and lawns and is located to the west of the campus (Figure 1).

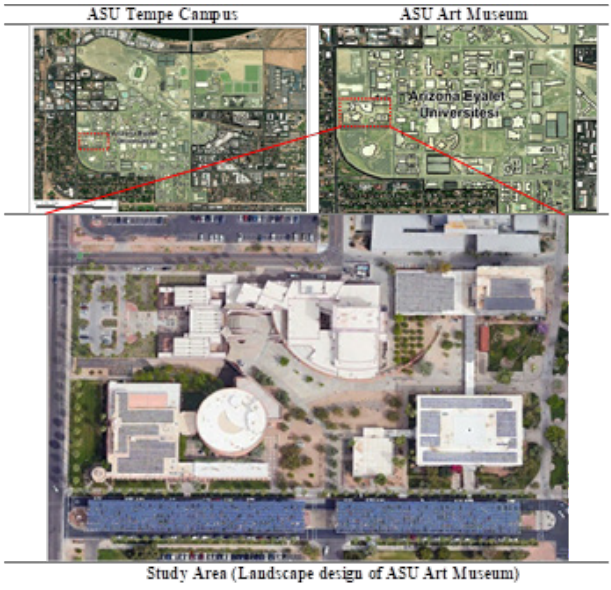


Figure 1: Study Area

2.2 Methods

The study methodology has four sequential steps, which are detailed below.

a) Determination of criteria: The initial step in the process was to establish the criteria required for determining water usage. The criteria considered were as follows:

- Size of the turf area (in square meters)
- Application of winter grass (Yes/No)
- Size of the xeriscaping area
- The density of plants (sparse: 0-40%, medium: 41-70%, dense: 71-100%)
- Water tolerance of the plants (minimal, moderate, significant).

Due to the unique landscape characteristics and the use of different plant species in each sub-area, the water consumption of each area was evaluated separately.

b) Data acquisition: Secondly, an assessment was conducted to evaluate the criteria conditions present in the designated study area and to identify particular plant species. Various sources were utilized to gather information about the study area, including formal networks, on-site observations, and field studies. Satellite imagery was employed to extract information on specific attributes such as paved surfaces, building floor area, green space dimensions, xeriscaping area measurements, and the existence of water bodies. Additionally, descriptive details about the identified plant species were obtained from pertinent websites.

c) Calculation of water consumption: To calculate water consumption, the third step involved determining the amount of water used in various areas throughout the year and analyzing its fluctuations across different months. To simplify this calculation, we made use of a web-based module called the "Water Usage Calculator," which was developed by the local government of Phoenix, Arizona. The study areas were categorized into three groups: significant, moderate, and minimal water consumption, depending on the data that was calculated.

d) Scenarios: In the final step, regions with high water usage were transformed into a xeriscape landscape design. Four different scenarios were created to explore the impact on water consumption, in addition to the existing pattern. The scenarios involved converting 25%, 50%, 75%, and 100% of the lawn area into xeriscaping, allowing us to assess the extent to which water consumption could be reduced by implementing xeriscaping techniques. This

methodology facilitated the evaluation of the potential reduction in water usage achieved through the adoption of xeriscaping.

3. Results

The first step involved assessing the land use features and capturing images of the landscape project at the ASU Art Center (Figure 2). The fieldwork findings revealed that the land use distribution in the study area is as follows: buildings account for 36.6%, hard-surface areas make up 39.0%, and planting areas encompass 24.4% (Table 2). Within the planting areas, xeriscaping covers 56.8% of the total, while lawn areas make up 43.2%. The distribution between lawns and xeriscaping fields is almost equal. The sparse plant density group represents the largest proportion in the study area, amounting to 47.7%, whereas the dense plant density group accounts for the lowest percentage at 22.2%. The medium plant density group covers 30.1% of the area. Prior to the winter season, the grass becomes dry, and its color turn yellow. As the lawn areas dry up, the summer seeds are unable to survive during the winter season. Consequently, winter seeds are sown at the beginning of the autumn season (September-October). Germinating grass seeds require additional water, resulting in increased water consumption during this period. The irrigation systems in the area consist of two types: drip irrigation is used for xeric landscape design and trees, while sprinkler irrigation is employed for large lawns.

Figure 2: Plant Species in ASU Art Center Landscape Design
(Photos by Muge UNAL CILEK)

Table 2: Data Collected Based on Criteria

Criteria		**Area size (m^2)**	**Percentage (%)**
Total area size (m^2)		44,401	100.0%
Building area (m^2)		16,270	36.6%
Hard-cover area (m^2)		17,711	39.0%
Plantation area (m^2)		10.828	24.4%
Lawn area size (m^2)		4,678	43.2%
Xeriscaping area size (m^2)		6,150	56.8%
Plant density (m^2)	Sparse (%10-40)	5,160	47.7%
	Medium (%41-70)	3,264	30.1%
	Dense (%71-100)	2,404	22.2%
Water tolerance	Minimal	x	
	Moderate	x	
	Significant	x	
Winter seed		Yes	
Irrigation	Lawn area	Sprinkler	
	Xeriscaping	Drip	

Secondly, a field study was conducted to identify the plant species present in the area. A total of 42 plant species were observed, categorized as 17 small trees, 24 shrubs and groundcovers, and one seasonal plant. The tree species commonly chosen for their excellent shading performance include *Citrus x sinensis, Ficus microcarpa*, and *Olea europaea*. Although *Phoenix canariensis* and *Washingtonia filifera* may not provide as much shade, there are other commonly utilized plant species in the area. Palm varieties are predominantly used along the roadsides due to their directing effect. The frequently employed shrubs consist of *Bougainvillea hybrid*, *Caesalpinia gilliesii, Lantana hybrid, Leucophyllum candidum, Muhlenbergia capillaris*, and *Ruellia brittoniana*. These species are particularly visually appealing due to their vibrant flowers. Furthermore, the east side of the Payne Hall building boasts a collection of 17 distinct varieties of cacti and succulents specifically chosen for rock gardens. Additionally, it was found various species of succulents on the terrace in front of the building. Common cacti and succulent types include *Agave* sp., *Aloe* sp., *Yucca*, and *Euphorbia* sp. In the lawn areas, *Cynodon dactylon*, also known as Bermuda grass, is used in the summer, while *Lolium perenne*, commonly referred to as Ryegrass or English grass, is planted during the winter. Before each winter season, the English grass variety is replanted because the high

temperatures in summer cause the grass to dry up and disappear. However, there is no need to reapply grass during the summer months. Bermuda grass, which thrives in the summer, becomes dormant in winter and regrows in spring when the climate conditions are favorable.

Although the majority of plants in Arizona are indigenous, some species from neighboring countries have effectively acclimated to the local climate. These plants typically possess a strong resistance to drought or have adapted to thrive in arid conditions. As a result, the water needs of most plants in the region are minimal, except for the lawns (Table 3).

Table 3: Plant List for Planting Design in ASU

Plant species	Common name	Family name	Water consumption	Drought resist
Trees and small-trees				
Butia capitata	Jelly palm	*Arecaceae*	Moderate	Medium
Chitalpa tashkentensis	Pink dawn	*Bignoniaceae*	Minimal	High
Citrus x sinensis	Sweet orange	*Rutacaea*	Moderate	Medium
Ficus microcarpa	Malayan Banyan, Jawi Jawi	*Moraceae*	Moderate	Medium
Ficus lyrata	Fiddle-leaf fig	*Moraceae*	Moderate	Medium
Fraxinus uhdei	Shamel ash	*Oleaceae*	Moderate	High
Melaleuca alternifolia	Tea Tree	*Myrtaceae*	Minimal	High
Melicoccus bijugatus	Genip	*Sapindaceae*	Moderate	Medium
Olea europaea	Olive	*Oleaceae*	Minimal	High
Phoenix canariensis	Canary Island date palm	*Aracaceae*	Moderate	Medium
Phoenix reclinata	Senegal date palm	*Aracaceae*	Moderate	Medium
Pistacia chinensis	Chinese pistachio	*Anacardiaceae*	Moderate	Medium
Platycladus orientalis	Oriental thuja	*Cupressaceae*	Moderate	High
Prosopis hybrid	Thornless South American Hybrid Mesquite	*Fabaceae*	Minimal	High
Quercus virginiana	Southern live oak	*Fagaceae*	Minimal	High

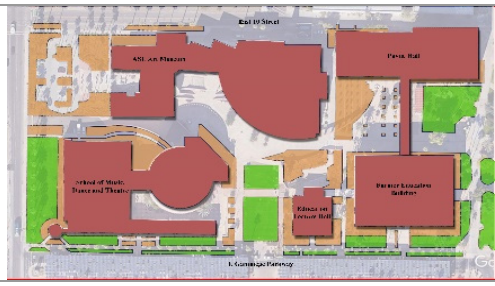
Plant species	Common name	Family name	Water consumption	Drought resist
Ulmus parvifolia	Chinese elm, lacebark elm	*Ulmaceae*	Significant	Low
Washingtonia filifera	Desert fan palm, California palm	*Arecaceae*	Minimal	High
Shrubs and groundcovers				
Bougainvillea hybrid	Paper flower	*Nyctaginaceae*	Significant	Low
Caesalpinia gilliesii	Bird of paradise	*Fabaceae*	Moderate	Medium
Calliandra californica	Red Fairyduster	*Fabaceae*	Minimal	High
Canna lily	Garden Canna	*Cannaceae*	Significant	Low
Carissa macrocarpa	Natal plum	*Apocynaceae*	Moderate	Medium
Chamaerops humilis	Mediterranean or European fan palm	*Arecaceae*	Minimal	High
Cuphea ramosissima	Pink shimmer Cuphea	*Lythraceae*	Moderate	Medium
Cynodon dactylon	Bermuda grass	*Poaceae*	Minimal	High
Festuca mairei	Atlas Fescue, Moroccan Fescue	*Poaceae*	Moderate	Medium
Hedera helix	English ivy	*Araliaceae*	Significant	Low
Lantana hybrid	Lantana, shrub verbena	*Verbenaceae*	Moderate	Medium
Leucophyllum candidum	Violet Silverleaf, Big Bend Silverleaf, Cenizo	*Scrophulariaceae*	Moderate	Medium
Muhlenbergia capillaris	Pink muhly grass, pink hair grass	*Poaceae*	Minimal	High
Myrtus communis	Myrtle	*Myrtaceae*	Minimal	High
Nerium oleander	Sweet Oleander	*Apocynaceae*	Minimal	High
Pennisetum alopecuroides	Fountain grass	*Poaceae*	Moderate	Medium
Rosa banksiae	Lady Banks' rose	*Rosaceae*	Minimal	High
Rosmarinus officinalis	Rosemary	*Lamiaceae*	Moderate	Medium
Ruellia brittoniana	Mexican Petunia, Desert Petunia	*Acanthaceae*	Moderate	Medium

Plant species	Common name	Family name	Water consumption	Drought resist
Russelia equisetiformis	Coral plant, coral fountain	*Plantaginaceae*	Significant	Low
Sphagneticola trilobata	Creeping-oxeye, wedelia	*Asteraceae*	Significant	Low
Strelitzia reginae	Crane flower, bird of paradise	*Strelitziaceae*	Significant	Low
Tecoma capensis	Cape honeysuckle	*Bignoniaceae*	Moderate	Medium
Tradescantia pallida	Purple Heart	*Commelinaceae*	Minimal	High
Cacti and Succulents				
Agave americana	Century plant, maguey, American aloe	*Asparagaceae*	Minimal	High
Agave chiapensis	Century plant, maguey, American aloe	*Asparagaceae*	Minimal	High
Agave attenuata	Century plant, maguey, American aloe	*Asparagaceae*	Minimal	High
Aloe vera	medicinal aloe	*Asphodelaceae*	Minimal	High
Dasylirion wheeleri	Desert spoon, blue spoon	*Asparagaceae*	Minimal	High
Echinocereus engelmannii	Strawberry hedgehog cactus, Engelmann's hedgehog cactus	*Cactaceae*	Minimal	High
Euphorbia antisyphilitica	candelilla and wax plant	*Euphorbiaceae*	Minimal	High
Echinocactus grusonii	Golden Barrell Cactus	*Cactaceae*	Minimal	High
Hesperaloe parviflora	Coral yucca, Hummingbird yucca	*Asparagaceae*	Minimal	High
Juncus effuses 'spiralis'	The corkscrew rush	*Juncaceae*	Minimal	High
Opuntia engelmannii var. *linguiform*	Texas prickly-pear, desert prickly-pear, nopal	*Cisactaceae*	Minimal	High
Opuntia polyacantha var. *erinacea*	Grizzly bear prickly pear	*Cactaceae*	Minimal	High
Pachycereus schottii	Senita cactus	*Cactaceae*	Minimal	High

Plant species	Common name	Family name	Water consumption	Drought resist
Pachycereus weberi	Candelabro, Cardon,	*Cactaceae*	Minimal	High
Portulacaria afra	Elephant bush, pork bush, purslane tree	*Didiereaceae*	Minimal	High
Stenocereus thurberi	The organ pipe cactus	*Cactaceae*	Minimal	High
Yucca	Spanish bayonet, yucca, needle palm	*Asparagaceae*	Minimal	High
Seasonal Plant Species				
Lobularia maritima	Sweet alyssum	*Brassicaceae*	Significant	Low
Grass				
Cynodon dactylon	Bermuda grass	*Poaceae*	Significant	Low
Lolium perenn	English ryegrass, winter ryegrass, ray grass	*Poaceae*	Significant	Low

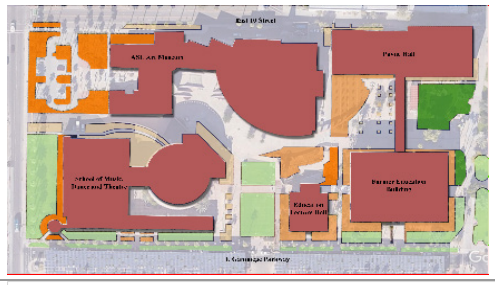
Thirdly, the study conducted an assessment of water consumption in areas with landscaping, utilizing specific criteria. The study area was divided into two categories: xeriscaping and lawns, as they have different water consumption patterns. The density of plants within each category was further classified into six classes: Sparse vegetation-Lawn area (SL), Medium vegetation-Lawn area (ML), Dense vegetation-Lawn area (DL), Sparse vegetation-Xeriscaping (SX), Medium vegetation-Xeriscaping (MX), and Dense vegetation-Xeriscaping (DX). Subsequently, a web-based computational model was utilized to approximate the monthly and yearly total water usage (Table 4). The computations indicated that lawns and seasonal plants have a significant water demand due to periodic watering requirements. Each category was assigned a water consumption coefficient within the program. According to a web-based computational model, turf areas, regardless of plant density, consume 1.43 m^3 of water, while sparse xeriscaping consumes 0.04 m^3, medium xeriscaping consumes 0.12 m^3, and dense xeriscaping consumes 0.21 m^3. Notably, the study area does not contain any grass areas with high plant density. In the study area, the total water used per year is 7,520.4 m^3. Xeriscaping, which makes up 841.9 m^3, consumes less water than lawns, which account for 6,678.5 m^3.

Land Cover



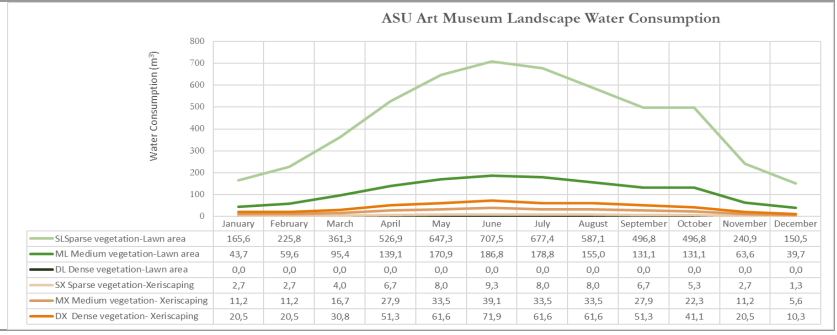
	Buildings
	Lawn area
	Xeriscaping
	Hard-covered surface

Landscape Categories



	Area size (m^2)	Water use (m^3)
SL	3,293	5,283.6
ML	977	1,394.9
DL	0	0.0
SX	1,459	65.4
MX	2,287	273.5
DX	2,404	503.1
Annually water consumption		7,520.4

Water Consumption Graphic



	January	February	March	April	May	June	July	August	September	October	November	December
SLSparse vegetation-Lawn area	165,6	225,8	361,3	526,9	647,3	707,5	677,4	587,1	496,8	496,8	240,9	150,5
ML Medium vegetation-Lawn area	43,7	59,6	95,4	139,1	170,9	186,8	178,8	155,0	131,1	131,1	63,6	39,7
DL Dense vegetation-Lawn area	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
SX Sparse vegetation-Xeriscaping	2,7	2,7	4,0	6,7	8,0	9,3	8,0	8,0	6,7	5,3	2,7	1,3
MX Medium vegetation- Xeriscaping	11,2	11,2	16,7	27,9	33,5	39,1	33,5	33,5	27,9	22,3	11,2	5,6
DX Dense vegetation- Xeriscaping	20,5	20,5	30,8	51,3	61,6	71,9	61,6	61,6	51,3	41,1	20,5	10,3

Table 4: Monthly and Annual Water Consumption by Landscape Categories

There is a lack of lawns densely vegetated in the study area. According to the water consumption data, lawns are major consumers of water. Particularly during the warm season, from April to September, lawns exhibit a significant water demand. Among these months, June is notable for its exceptionally high water consumption. Moreover, water usage remains increased in September due to winter seeding. In contrast, xeriscaping landscapes minimize water usage regardless of plant density. These areas nearly eliminate water consumption during the winter months.

The total water used in the area was calculated based on various scenarios. To assess the impact of replacing lawns with xeriscaping on water usage, different conversion scenarios were examined. The study converted 25%, 50%,

75%, and 100% of the lawn area into xeriscaping while maintaining the same plant density. The results revealed that replacing all lawn areas with xeriscaping leads to an impressive water saving of 85.3%. Additionally, reducing the lawn area by 25% and 50% resulted in water savings of 21.3% and 42.6% respectively. It is important to note that the size of the lawn area directly influences water consumption, meaning that achieving zero water usage in landscape design is not feasible. Nevertheless, adopting xeriscaping significantly minimizes water consumption. Considering the significant contribution of lawn areas to high water consumption, it is advisable to reduce their size in landscape design as a means to conserve water resources. These study findings can provide valuable insights for effectively managing limited water resources in landscaping endeavors (Table 5).

	Current situation		**Lawn areas were reduced by 25%**		**Lawn areas were reduced by 50%**		**Lawn areas were reduced by 75%**		**No lawn area**	
	AS (m^2)	W(m^3)	AS (m^2)	W (m^3)	AS (m^2)	W (m^3)	AS (m^2)	W (m^3)	AS (m^2)	W (m^3)
SL	3,701.0	5,283.6	2,775.8	3,969.3	1,850.5	2,646.2	925.3	1,323.1	0.0	0.0
ML	977.0	1,394.9	732.8	1,047.8	488.5	698.6	244.3	349.3	0.0	0.0
DL	0,0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SX	1,459.0	65.4	2,384.3	95.4	3,309.5	132.4	4,234.8	169.4	5,160.0	206.4
MX	2,287.0	273.5	2,531.3	303.8	2,775.5	333.1	3,019.8	362.4	3,264.0	391.7
DX	2,404.0	503.1	2,404.0	504.8	2,404.0	504.8	2,404.0	504.8	2,404.0	504.8
TOTAL	**7,520.4**		**5,921.1**		**4,315.1**		**2,709.0**		**1,102.9**	
Abbreviations: Area Size (AS), Water Consumption (W)										

Table 5: Water Consumption for Different Scenarios

4. Conclusion

In the context of ecological sustainability, xeriscaping plays a significant role in water usage design (Ismaeil and Sobaih, 2022). With the pressing need to manage limited water resources effectively, both at national and international levels, it becomes crucial to address high water demands. Consequently, there has been a widespread increase in research focusing on efficient water utilization in landscaping across various fields. Numerous national and international studies have been conducted on arid landscaping, covering diverse topics in the literature (Welsh and Welch, 2015; Çetin and Mansuroğlu, 2018; Kısakürek et al., 2020; Pouya et al., 2020; Herkes and Korkut, 2021; Ismaeil and Sobaih, 2022; Nirmala and Jyothi, 2022).

The main focus of the conducted studies was to identify plant species suitable for xeriscaping based on their water consumption. Furthermore, some

studies aimed to evaluate users' perceptions of the xeric landscape. The results of these studies are valuable for establishing long-term water management plans, as they offer insights into users' preferences regarding various aspects of landscaping, such as landscape elements, plant colors, water-saving techniques, and resource management for residential and urban landscapes. These preferences are supported by scientific research. According to Hurd et al. (2006), residents in Arizona, specifically in Tucson and Phoenix, showed a preference for extensive lawns that require large amounts of water. In contrast, a survey conducted among urban dwellers in cities of New Mexico highlighted the importance of reducing lawns and promoting natural plant species, and water-efficient landscaping. In response to the global water crisis, New Mexico emphasized the replacement of lawns with drought-resistant plants and the expansion of xeriscaping efforts (Hilaire, VanLeeuwen, and Torres, 2010).

The importance of incorporating xeriscaping into heavily frequented locations like university buildings cannot be overstated when it comes to formulating regional approaches for tackling water scarcity in landscape studies. Consequently, the objective of this research was to examine the impact of increasing the proportion of xeriscape design on water usage across different landscape patterns within Arizona State University. This study aims to distinguish itself from prior investigations by offering unique insights into the changes in water consumption associated with the implementation of xeriscaping.

The study findings have significant implications for managing limited water resources in campus areas and urban landscaping. Future studies should consider irrigation zones and the water sources used for irrigation. Furthermore, it is important to determine the impact of proportional changes in arid landscapes on water conservation and quantify the variation in water usage resulting from different design applications.

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CHAPTER X

THE USAGE AREAS AND PRINCIPLES OF COMPOSITION OF RHODODENDRONS IN LANDSCAPE ARCHITECTURE

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1. Introduction

Rhododendrons, which belong to the *Rhododendron* genus in the of Ericaceae family are woody plants in the seed-bearing section of the plants, either evergreen or deciduous shrubs (Küçük and Topçu, 1993; Anşin et al., 2004).

Rhododendrons, which are represented by over 850 species in the Northern Hemisphere, have approximately 1200 taxa and 2000 varieties. These forest flowers, which are widely spread across the world, can be found in various regions such as the Alps in Europe, the Himalayas, and the Caucasus Mountains in the east, and Southeast Asia including Thailand, Vietnam, Malaysia, Philippines, as well as the Indonesian Islands and Northern Australia further south (Gelderen and Smith Hoey, 1982; Rotherham, 1983; Coombes, 1998; Avcı, 2004). They carry beautiful and brightly colored flowers in almost every shade. They can thrive in open areas as well as in sparsely wooded areas with semi-shaded conditions under a loose canopy. They rarely exceed a height of 4-5 meters (Gülen, 1965).

Rhododendrons generally have shallow roots. Shallow root systems create favorable conditions for moisture control and benefit the plant during dry summer months. The roots beneath the organic leaf layer develop with materials outside the soil, allowing for quick and extensive surface distribution. They reproduce through root and stem shoots, forming a dense layer (Clarke, 1982).

This situation, particularly in disturbed forests, prevents seeds from reaching the soil, thereby eliminating understory vegetation, and impeding the natural regeneration of tree species that form the upper layer (Şahin and Cevahir 1991; Küçük et al., 2008). Literature studies have investigated measures against the spread of *Rhododendron ponticum*, which is considered an invasive species in mixed forests, particularly oak and beech forests (Thomson et al., 1993; Erfmeier and Bruelheide, 2004; Esen et al., 2004; Tyler et al., 2006; Harris et al., 2009). Although mechanical and chemical controls have been used in forestry to eradicate it, *Rhododendrons* can also be utilized in Landscape Planning not only for their aesthetic purposes but also as functional elements such as boundary elements, flood barriers, and fence construction. Additionally, they can be used in highway slope stabilization and, especially in median plantings, to create stimulating effects through their colors and flower varieties (Var, 1992).

2. Usage Areas of Rhododendrons in Landscape Architecture

Rhododendrons have the ability to be used for various purposes in landscape planning due to their diversity in flower color, leaf texture, autumn coloring, flowering season, and plant form (Pulatkan, 2001). Due to these features, *Rhododendrons,* being a valuable plant, not only serve aesthetic purposes but also fulfill many functional uses.

2.1. Aesthetic Use

Plants possess aesthetic values through design components such as form, color, and texture found in their stems, leaves, and flowers. While hardscape materials create quick and lasting results in landscape design, plants enhance the aesthetic value of the landscape through their continuous growth and seasonal variations (Walker, 1985). *Rhododendrons* hold significant aesthetic values for landscape design. With their blooming flowers in spring, leaf textures in summer, leaf color changes in autumn, and winter silhouettes, *Rhododendrons* remain active throughout the year (Nelson, 2000).

The most impactful features of *Rhododendrons* in landscape planning are their flower quality and quantity. Their flowers remain on the plant for a long time. With their flowering characteristics, *Rhododendrons* stay active throughout the year (Figure 1).

Figure 1: *Rhododendrons* for their floral beauty and their use with other plants (Kyoto and Okoyama-Japan).

Rhododendrons are essential plant elements in landscape plans due to their leaf and flower beauty. They naturally grow with soft curves and do not require pruning (Reiley, 1995) (Figure 2).

Figure 2: *Rhododendrons* in a planting design with soft lines (Edinburgh-Scotland).

In landscape planning, open green spaces should be left for lawn areas. When these wide lawn areas are complemented with *Rhododendrons*, a very pleasing landscape emerges. Figure 3 shows *Rhododendrons* situated between tall plants, with their flower beauty and lawn areas.

Figure 3: *Rhododendrons* used at the border of lawns and in front of taller plants (Kyoto-Japan).

2.1.1. Use as an Accent Plant

Rhododendrons are highly successful as accent plants. In spring, they serve as excellent accent plants with vibrant and bright red, pink or pure white colors (Davidian, 1989).

Rhododendrons, which are effective throughout the year, create contrast and draw attention to the specific areas in the landscape when used in front of evergreen plants or on dark green lawn areas, with their flowers in different colors. They serve as accents, accent effect those areas (Reiley, 1995) (Figure 4).

Figure 4: *Rhododendrons* with accent effect (Kyoto and Okayama-Japan).

In Figure 5, *Rhododendrons* are seen creating attention-grabbing and accentuating effects for building entrances. *Rhododendron*s are effective as accent plants in building entrances.

Figure 5: *Rhododendrons* effective as accent plants at building entrances (Okayama-Japan).

2.1.2. Use as Solitary Plants

Solitary plants must excel in terms of form, texture, and flowers. Many species of *Rhododendrons* are suitable for evaluation as exemplary plants in landscaping due to their attractive beauty displayed throughout the year (Nelson, 2000). The leaves and flowers that bloom in their respective seasons create a harmonious blend from ground to top (Clarke, 1982). With these characteristics, *Rhododendrons* are successful as solitary plants (Figure 6). Solitary plants draw attention to themselves and the area they are located in. In landscaping, they should be positioned around pedestrian paths, near activity areas, or in a way that they are visible from buildings and roads (Reiley, 2004).

Figure 6: With its form and flowering, the *Rhododendron* is an exemplary solitary plant (Kyoto, Japan).

The difference between accent plants and solitary plants is that accent plants are used in conjunction with border plants or other plants, while solitary plants stand alone in the landscape (Reiley, 2004).

Great care should be taken in the selection of the *Rhododendrons* to be used as specimen plants. Each plant within a group can compensate for any deficiencies in other plants and complement them. However, when used alone, a plant does not have such an opportunity, so it must be perfect in itself (Reiley, 2004).

2.1.3. Group Usages

Rhododendrons display their most impressive performances in group plantings (Figure 7). Planting them in groups provides shade, acts as a windbreak, and the fallen leaves create a mulch layer that helps retain soil moisture. Group plantings can be used around buildings, along pedestrian walkways, or alongside roadsides. They can also be used to enclose or screen an area in the landscape or create a focal point (Reiley, 2004).

Figure 7: Group planting of *Rhododendrons* (London-England).

Rhododendrons are seen to be more effective when used in groups. They can create stunning visuals when different species are used together, as well as when a single species is planted in groups of 3, 5, or 7 (Davidian, 1989). Group plantings with a single variety produce more impressive results compared to mixed-color groups (Clarke, 1982) (Figure 8).

Figure 8: Group plantings of single species *Rhododendrons* next to the pedestrian path (Kyoto, Japan).

Group plantings consisting of a single species of *Rhododendron ponticum* can be seen along the pedestrian path, as shown in Figure 9. The impact of this group planting is enhanced by the reflection of flower colors in the water.

Figure 9: Group planting of *Rhododendron ponticum* at the water's edge (Leighton and Simonds, 1987).

Furthermore, different species of *Rhododendrons* are successfully used in the coloring of slopes. Figure 10 shows two different slope coloring created by group plantings of *Rhododendrons*. The use of *Rhododendrons* on these slopes is not only for aesthetic purposes but also serves a functional role in preventing soil erosion.

Figure 10: The slope coloring created by the blooming of *Rhododendrons* (Davidian, 1989).

In group plantings, the height of the selected plants should also be considered to ensure proper scale both within the group and in the landscape area. In areas where plants with widespread are planted, taller forms should be used in the center or background (Reiley, 1995).

2.1.4. Use in Rock Gardens

In well-designed rock garden examples, *Rhododendrons* stand out effectively and exhibit good compatibility with other plants that share similar growing conditions (Clarke, 1982). In plant arrangements within rock gardens, dwarf *Rhododendron* species are used. Due to their unique forms and the wide range of colors found in their flowers, *Rhododendron* species become indispensable and effective elements in rock gardens, capable of harmonizing with other plants through their floral characteristics (Leighton and Simonds, 1987) (Figure 11).

Figure 11: *Rhododendrons* used with rocks and water element (Kyoto-Japan).

2.1.5 Use in Bonsai Art

Evergreen, small-leaved, and dwarf Rhododendron species are ideal plants for bonsai. Particularly, mature plants with twisted and curved trunks are more suitable for bonsai cultivation (Nelson, 2000; Reiley, 2004) (Figure 12).

Figure 12: The use of *Rhododendrons* in bonsai art (Chelsea-England)

2.2. Functional Use

Although plants are mostly perceived as aesthetic elements in landscaping, they possess numerous functional properties beyond their potential. In Landscape Architecture, plants serve functional purposes in terms of architecture and engineering. They are used to create spaces in conjunction with architectural forms such as ceilings, floors, and walls. For example, ground cover plants create a floor effect, while plants used for screening and barrier purposes create a wall effect. Plants with broad canopy provide a ceiling effect with their covering properties. From an engineering perspective, plants are utilized for erosion control, screening of dazzling lights, directing movement, and controlling noise levels. Additionally, plants are important design elements in reducing air pollution, providing shade, and acting as windbreaks and directional guides (Walker, 1985; Austın, 2001; Ayaşlıgil, 2004).

Rhododendrons are used for both aesthetic and functional purposes in landscape planning.

2.2.1. Border Use

Border plantings are used in landscaping to define areas within the landscape. They are used to separate and create enclosed spaces for activity areas, pedestrian pathways, parking lots, or lawn areas, distinguishing them from the rest of the landscape (Reiley, 2004) (Figure 13, 14).

Figure 13: *Rhododendrons* used to separate the pedestrian pathway from the bicycle parking area (Okayama-Japan).

Figure 14: *Rhododendrons* separating the pedestrian path from the parking lot (Okayama-Japan).

The diversity of size, form, and color in *Rhododendrons* allows for the creation of various and interesting compositions in border plantings. In border plantings, trees, shrubs, and herbaceous plants are often used together (Clarke, 1982) (Figure 15).

Figure 15: A border used *Rhododendrons* along the edge of a pedestrian pathway, under the trees (Okayama-Japan).

2.2.2. Use as Screening and Hedge Plants

In landscape planning, plants are used to screen out disturbing views, block strong winter winds, and provide privacy. When continuous screening is desired throughout the year, evergreen plants are preferred. However, visual monotony should be avoided to maintain visual interest (Walker, 1985; Austın, 2001).

Well-branched, natural, and dense plants are preferred for creating screens and hedges. Dense and evergreen *Rhododendrons* are suitable plants used to screen undesired areas. While serving this purpose, they also provide aesthetically pleasing results (Figure 16). However, *Rhododendrons* are not recommended as windbreakers due to their limited resistance against strong winds (Clarke, 1982; Nelson, 2000; Reiley, 2004).

Figure 16: *Rhododendrons* are used to screen the unpleasant view between the building and the road (Okayama-Japan).

Rhododendrons are used in both formal and informal hedge plantings. Some species of *Rhododendrons* have dense, compact growth and upright forms, which can be pruned to create geometric shapes (Nelson, 2000). Evergreen shrubs are preferred for hedge plants, and *Rhododendrons* are particularly successful in this role due to their predominantly evergreen nature (Reiley, 1995). They can be combined with trees and taller shrubs in the background to break the monotony and create diversity in the landscape (Figure 17, 18).

Figure 17: *Rhododendrons* can be used in combination with other plant species in hedge plantings along roadsides (Okayama-Japan).

Figure 18: *Rhododendrons* can be used in combination with other plant species in hedge plantings along roadsides (Okayama-Japan).

Different species of *Rhododendrons* are selected either in an upright or sprawling manner, depending on the desired type of hedge. Small-leaved *Rhododendrons* are used to create small hedges. When a formal hedge appearance is desired, they are pruned regularly to achieve a neat and effective look (Reiley, 2004).

Rhododendrons are also effective in flood barrier construction, in addition to their use as borders, screens, and hedges. They can be utilized in riverbank plantings and in partially shaded areas of parks and gardens in polluted urban areas. Furthermore, they can be employed in roadways for slope stabilization and, especially, in median plantings to create stimulating effects with their blooms and autumn colors (Var, 1992).

3. Conclusion

The aesthetic qualities and functional uses of *Rhododendrons* make them highly important plants in Landscape Architecture. In our country, especially in the rural areas of the Black Sea region, native *Rhododendron* species exhibit significant color and form diversity with their flowers in shades of purple, pink, yellow, white, and more. Introducing *Rhododendron* taxa to urban spaces through seeds and cutting materials will increase the diversity in urban landscape projects, just like their counterparts in other parts of the world. In recent years, imported Rhododendrons have been preferred, especially in large cities in our country. By starting to use native *Rhododendron* taxa that possess the same aesthetic quality and color variety as the imported ones, the reliance on imports can be reduced, leading to a contribution to our country's economy.

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CHAPTER XI

THE EFFECTS OF CITY SQUARES ON URBAN IDENTITY: THE EXAMPLE OF AYDIN ATATÜRK CITY SQUARE

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1. Introduction

The concept of a square is the large gaps in the city scale that remain after the people and structures Decaying in the environment. Thanks to these large gaps that it has created, it can provide space for events such as ceremonies and celebrations. At the same time, squares are the most densely located and used public outdoor spaces by urbanites. They are the places that take into account the urban identity components of the city from an environmental and social point of view the most.

The aim of this study is to evaluate the criteria necessary for the areas to be challenged by examining the environmental and social identity components within the scope of the city. Together with the examinations and evaluation carried out, it is to determine the impact of these situations on the identity of the city. In this context; literature researches have been conducted, various concepts have been defined and evaluated. In the light of these evaluations, the center of Aydın City and Atatürk Square were evaluated.

During the evaluation, the table of 'Urban Identity Components' made by Ünügör (1996) was revised in accordance with the field and data.

Together with the table created, the components of environmental and social urban identity with the historical development of the field and the components of Aydın's urban identity were examined. As a result of the evaluations and examinations, the effects of the squares in the cities on the identity of the city have been revealed.

2. The Concept of the City

Conceptually, the city is a settlement unit that has a dynamic structure, is technically strong, economically, politically strong and culturally reflects very rich elements. Cities create a living space for individuals in terms of quality and comfort (Temiz and Sağlık, 2021).

According to Mumford, the city is a place located on a natural structure. This space is a mixed form of existence that includes structures, institutions and people. In this context; cities are places that are similar to each other, but have such a different texture. Therefore, it is possible to talk about the concepts of urban culture and urban identity.

Cities are not just an object perceived by individuals with different classes and characters. Besides, it is constantly changing for some reason. In other words, although there is a constancy in its general structure, there is a constant change and development in its details.

From an architectural point of view, according to AMos Papaport (1993), there is a sensory side to the concept of the city and the parts of the city that individuals can feel. This sensory side constitutes the quality and character of the city. These formations, on the other hand, enable cities to create unique environments.

3. City Venues

The city is not just structures that meet the need for housing for individuals. There are various common and personal needs due to the life that exists collectively. There are some situations that differ with these requirements. These are; degrees of civilization, cultural structures, sanction effects and economic structure. For this reason, there are qualitative and quantitative intensifications in society. These concentrations, on the other hand, reveal some equipment situations. These situations are; the desire for rest, the desire to have fun, the state of culture and education, health and trade, sports, management structure, transportation systems, public and infrastructure services can be given as examples. The whole of the spaces and structures created by taking all of these situations into account constitute the whole of the urban spaces (Bakan and Konuk, 1987).

Urban spaces can be classified into two groups. The first are private spaces, and the second are public spaces. In this context, the subheadings of private spaces and public spaces are given. The common feature of these two groups of places is that they are not separated from each other by clear and fixed lines on a city scale. There are transition spaces that provide the connection of the created areas with each other. These transitional spaces are known as semi-private and semi-public spaces that fall into the outdoor space class (Bakan and Konuk, 1987).

3.1. Urban Exteriors

The concept of urban outdoor space is a concept that has existed since the past. These are the areas where societies conduct various activities such as Sunday area, ceremony-celebration area. These areas have received various names throughout history. In addition to changing its names, it has not lost its purpose, even if some of its activity goals have changed. It has been located with the names of 'agora' in ancient Greece and 'forum' in Rome and has created a connecting place for pedestrians. Urban outdoor spaces constitute the image of cities in this period. In addition, it has created centers where individuals can do various activities (Özkan and al., 2003).

Conceptually, urban outdoor spaces include streets, squares, parks, children's playgrounds and gardens. It can be defined as Decoupling the space as a closed space by closing the gaps formed between these spaces. These places provide a community life as opposed to a private life. This lifestyle that it provides appeals to all ages, genders and professional groups in society and ensures that everyone benefits. With this situation, the spaces included in the open urban fabric are defined as urban outdoor spaces (Bakan ve Konuk, 1987). In this respect, urban outdoor spaces can be defined as public outdoor spaces.

Public outdoor spaces reflect the identity of the city. These places improve the physical and mental health status of individuals in society by positively affecting them. At the same time, it offers different service options by improving the quality of life (Sağlık and al., 2022). It is a physical reflection of the social and economic changes experienced throughout history in places. Public spaces reflect the personal beliefs and public values of societies. For this reason, the cultural changes experienced affect these places. It is important whether the landscape texture found in these places meets the culture completely or not. However, the design and management process should be able to answer questions about whether it can contribute to demographic life. This response has an important place in shaping the future in terms of the public landscape.

The public landscape is constantly in a state of change. For this reason, traditional places need to be able to adapt to these changes. They should be formable again according to the needs and wishes of every age group in society, every social group, changing individuals (Özkan and al., 2003).

4. Square

The concept of a square is open spaces that serve various purposes. Within the scope of these purposes are social, religious, commercial and various demonstrations of society. Squares that allow social activities to take place also provide individual users with a space for movement. For this reason, the squares reflect the identity of the city. As a result of this situation, squares are common heritage that need to be protected.

The most prominent urban element among the elements found in the city are the squares. Squares are one of the most important elements belonging to the urban fabric. These are the areas that carry and reflect the cultural structure, religious beliefs and other values of the society in which it is located, and reveal the changes taking place in society (Uçak, 2000). The squares located in the cities cause the unification of various structures and the formation of a variety of spaces. This situation shows that the connection and proportion between the different places in the urban fabric should be provided with squares. The squares consist of various zones. Thanks to the compositions created by these zones, more than one activity can be carried out in the same time period in the squares.

4.1. Functions of Squares

Squares have been used in many different and many functions from the past to the present. According to Altınçekiç (2000), squares are the most important in the city because of the functions they have gained and are housed within. It constitutes the section. Today, the functions of the squares are given below in the form of articles.

- To help the order in the traffic flow,
- To bring people together in line with various purposes (social, commercial, etc.),
- To emphasize by increasing the effects and functions of the structures located around,
- To meet the recreation needs of urban individuals,
- To bring together individuals who have various cultures Decoupling,
- It can be expressed in the form of bringing people of all ages and Decencies together so that individuals can breathe, hear their voice.

4.2. The Importance of Squares

Squares reflect the identity characteristics of the country and the city they are located in to the spaces. Together with this reflection, it causes people to feel belonging to this area. Besides the fact that individuals come to the squares to engage in certain activities, they come for some reasons that attract individuals to the squares and push them away from the squares. The measurement and proportion perceptions found in squares are sometimes repulsive to individuals. For example, in squares where there is a lot of hard ground, individuals are both tired and uncomfortable by perceiving the area as larger than normal. The Buddha makes the square repulsive for the user. With the speed of population growth, the need for berber city scale shows an increase (Kılıç, 2001).

The number of squares located in the country shows the level of development of that country. The reason for this is that squares are effective in the formation of social identity and urban identity. The population of a country where the number of squares is small, no matter how large the number of buildings, there is no social identity, urban identity and urban culture in the city.

4.3. Types of Square

Zucker (1959) classified squares according to their types. This classification is given in Table 1.

Table 1: Types of Challenges

Type of Square	Feature
Indoor Square	They are the squares that come into view with the plan. Which is bounded, square, rectangle, circle, etc. they are squares in geometric form.
The Dominant Square	They are spaces that have a relationship with other structural elements. The town hall, fountains, etc. it connects buildings and open spaces.
Central Square	These are the squares created thanks to the vertical emphasis at the midpoint of the squares located in a closed manner.
Group Square	Birden fazla farklı formlarda (büyük, küçük, kare, dikdörtgen gibi) bulunan meydanların tek bir yapı çevresine konumlandırılması ile oluşturulan meydanlardır.
Free-Form Square	From an aesthetic point of view, they are squares with low quality and do not have any features.

4.4. Kinsd of Square

According to Krier (1979); squares have shown shape according to some factors. These factors are basic forms, angular changes, divisions, additions, combinations, overlaps and deformation (Şahin, 2006). The types of squares that have emerged in this context are given in Table 2.

Table 2: Types of Challenges

Kind of Square	Feature
Aprile Type Squares	It is the expansion of spaces with Aprils in order for structures to achieve visual comfort.
Square Type Squares	The squares in which the accent element is located in the center are.
Rectangular Type Squares	It provides shooting on both sides of the squares. The accent element continues along the axle.
L Type Squares	It is formed by the combination of rectangular squares. They are squares with different perspectives at both different ends.
Semicircular Type Squares	These are the squares where perception is focused on the center.
Triangular Type Squares	The point and focal point of the shot vary depending on the angles and ratio of the shape. It is formed at the intersection of two roads.

4.5. Squares According to Their Functions

The purposes of use of the squares vary. For this reason, squares are classified according to their functions and characteristics. According to the resulting functions in this context, the squares are given in Table 3 (Altınçekiç, 2000).

Table 3: Squares According to Their Functions

Squares According to Their Functions	Feature
Historical Squares	They are squares that contain historical structures, religious structures and works of art.
Traffic Squares	They are squares that allow connecting more than one vehicle axle to each other.
Architectural Squares	These are the squares where there are architectural structures around.
The Official Squares	These are the squares where there are official structures around that serve for official ceremonies.

4.6. Elements Affecting the Formation of Squares

There are some elements that constantly affect the formation of squares and the continuity of squares. These elements are given in Table 4.

Table 4: Elements Affecting the Shaping of Squares

Elements	Feature
Trade	It is one of the functions of spaces in square formations. It has served this purpose from the past to the present. This situation increases the use of areas and gives a sense of challenge to the areas.
Dominant Structure	Squares that were affected by religious and administrative structures in the past are not so affected today.
Traffic	It is an element that causes the squares to disappear. This is because some squares are open to traffic. This situation closes the square.
Social Communication	The front of the square is the important task. It is a case of individuals communicating both between cats and with places. Dec. Squares have a different meaning for each user. With social communication, this situation can be shared by strengthening.
Functional Status	The function of the spaces is to create a social space and to meet some of the daily needs of individuals. However, it also affects the general physical structure and layout within the city.
Aesthetic Condition	Squares have an important role in the design stages. The difference of the user audience brings with it a difference in aesthetic perception. Therefore, it is necessary to pay attention in this element; to be able to make individuals feel the place, to ensure that they enjoy it and to create a desire to stay in the place for a long time.
Cultural Value	Squares are social spaces that bring together different user groups and cultures. Decadents are social spaces that bring different user groups and cultures together. Therefore, it leads situations such as the development and sharing of cultural values within the city.

5. City Identity

The concept of the city constitutes the living space of individuals. Cities are places where production and consumption are carried out, which are constantly growing, developing, have functions in which individuals live, work, have fun (Öztürk,2007).

The concept of urban identity is that the elements of identity derived from the natural and artificial environment of the city can change with certain factors and gain a characteristic of its own thanks to this change (Kaypak, 2010). Some

of these factors are as follows; spatial elements, historical background and textures, cultural values, architecture, social structure, geographical structure, way of life, climate, geological structure, sea route and land route connections, wars, natural disasters, situations such as whether there is a capital.

5.1. Components of Urban Identity

According to Ünügör (1996), the components of urban identity are grouped into two main groups. These two main groups that have been created are divided into branches within themselves (Öçal, 2008).

5.1.1. Natural Environment Identity Components

The natural environment forms the basis for the formation of the city. The location of the city causes its separation from other cities by determining the data such as climate, water resources, vegetation. One of the elements that has the most effective role in the formation of cities is natural data. Natural data also has a very important place in the daily functioning of cities (Sağlık and Çelik, 2021).

In the formation of urban identity, the components of natural environmental identity are divided into three groups. These;

- Geographical Formations and Topographical Features: These features affect identity in the artificial environment and structural scale at the urban scale.
- Climate and Vegetation Characteristics: These characteristics are effective in the materials and materials to be used to an architectural extent, in roof structures. At the same time, on the planning scale, it has an effect on whether street structures are narrow or wide. However, due to the climate, the green texture of the city is being formed. The formation of green tissue has an important place in the identity of the city.
- Geological Structure Effect: Geological structure is effective in the formation of the silhouette of cities and in the selection of building materials. It also affects the dimensions and heights of the structures. Building differences affect the identity of the city by making it different from other cities (Deniz, 2004).

5.1.2. Artificial Environmental Identity Components

Artificial environment; these are the areas where individuals form and add their own cultures on an urban scale (Deniz, 2004). Urban texture provides the understanding of spaces by people. For this reason, it is very important in terms

of urban identity (Uçkaç, 2006). There is the main physical element that makes a city permanent in the minds of individuals. These are; roads, boundaries, focal points, zones and signs. In this context, the artificial environment identity components are divided into three groups. These;

- Artificial Identity Components at the Settlement Scale: It is the most important part of the city. It is the placement of structural elements on the land with different purposes and forms. Within the scope of this component, there are some components that give the city an identity feature. These are; roads, structures (urban occupancy), open spaces (urban space), zones, boundaries and focal points.
- Artificial Identity Components on the Scale of Signs (Elements That have Become Symbols): They are reference points that are immediately noticed when viewed and can be permanently placed in the minds of individuals. It moves the city to a separate position from the environment (Deniz, 2004). These symbols contribute to the formation of urban identity, recognition of the city and financially contribute to the urban economy.
- Artificial Identity Components on the Reinforcement Scale: Urban furniture constitutes this component. Located on a city scale; boards, signs and advertisements, seating elements, etc. it is in the figure. These accessories should be compatible with the urban fabric and should be in such a way as to support the urban identity.

5.1.3. Socio-Cultural Environment Identity Components

Culture gives an identity to a group by defining the original state of a group of individuals and that group. Culture is a whole that encompasses the knowledge, skills, traditions, abilities acquired by individuals. At the same time, it creates a scheme that includes a worldview, values, lifestyle and actions.

All the elements within the socio-cultural structure of society are passed down from generation to generation. This transmission is provided by social experiences, opinions, beliefs, ceremonies. Thanks to this transfer, society's behavior is managed and stereotyped. Together with this stereotyping, the formation of a consistent urban identity is ensured (Deniz, 2004).

In this context, according to Ocakçı and Southworth (1995), there are socio-cultural environmental identity components. These;

- Demographic Structure: Population structure, majority, density, age groups, gender distribution, such as mortality rates.

- Institutional Structure: Such as political and managerial structure, economic situation, technological developments, religious structure, education and health services.
- Sub-Elements of the Cultural Structure: Technology, way of life, traditions and customs, language, such as art.

5.1.4. Socio-Economic Environment Identity Components

It is a component that is connected with the employment level and structure of society. It is an identity that emerges with the characteristics formed by this connection. It is formed by the distribution of individuals involved in society to various work forces and the wealth within society (Deniz, 2004). This situation distinguishes the city in terms of its level of prosperity by comparing it with other cities in the formation of urban identity.

6. The Example of Aydın City Center and Atatürk City Square

The city of Aydın has been evaluated in terms of urban identity components. Within the scope of the evaluation, the natural and cultural structure of the city, the socio-cultural and socio-economic situation were discussed.

The urban identity components were combined with the evaluations made. The literature data were evaluated by surveying and analyzing the land. In this context, the components that make up the identity of the city of Aydın, which is included in the boundaries of Aydın city center, Efeler, have been determined. Aydın Atatürk City Square has been evaluated which of these components are covered and the effects of the selected areas on the identity of the city.

6.1. Aydın City Center

6.1.1. Geographical Location

The city of Aydın is located between 37-38 north latitudes and 27-29 east Decencies. it has an area of 8.007 km2. Aydın is located in the western part of Anatolia, southwest of the Aegean Sea. There are Izmir and Manisa provinces in the northern direction; Denizli province in the eastern direction; Muğla province in the southern direction and the Aegean Sea in the western direction. The northern and southern parts are mountainous and hilly areas. Between these two axes there is the Büyük Menderes Plain, which is a Decadent area covered with alluviums. Region I. It is a highly earthquake area.

6.1.2. Touris

Aydın, located in the middle of Western Anatolia, where tourism is the most intense, has the most important sea border gate in terms of tourism. The provinces and districts located around the city of Aydın are highly developed places both as a historical structure and in terms of holidays. The fact that daily tourist trips are made to the areas dominated by the historical texture keeps the city of Aydın lively and open to development. At the same time, it is also a very lively province in terms of maritime trade and tourism. The presence of ports in the surrounding provinces also provides support to Aydın province. Due to the climatic characteristics, the tourist season in Aydın continues in the long term.

Tourism differences are observed in the east and west of the city. The western part has opened all its opportunities for foreign tourism and domestic tourism. It is preparing to open other possibilities by evaluating how efficiently. The eastern part is focused only on domestic tourism. But with the changes and arrangements that can be made, it is possible to open to foreign tourism in this sector.

6.2. Atatürk City Square

Ataturk City Square is located in the city center of Aydın province. There are Adnan Menderes Boulevard, Süleyman Bey Mosque, Station Building to the west, Metropolitan Municipality Building to the east, Old Provincial Bank building to the north (Figure 1).

Figure 1: Environmental Relationship of Atatürk City Square (Original, 2014).

Atatürk City Square is a city square with an area of 18,969 m2 and its construction was completed on 16.03.2014. Previously, Sulu Park was an urban park where urbanites could do recreational activities, while it was transformed into a square that responds to different needs of the city.

Atatürk City Square was formed in a triangular form within the scope of the formal classification made by Zucker (1959). Thanks to the structural elements located around it, it has formed a closed square. It is a core square because it has a connection with the Aydın Metropolitan Municipality Building and its surroundings. At the same time, it is the dominant square because there is a orientation of environmental structures. It is in an aesthetic square situation with the ornamental pool and the statue of Atatürk (Figure 2e) located inside. It is a recreational square that gives place to various activities due to the eating and drinking areas located in it.

There is a synthetic ice skating rink, an ornamental pool (Figure 2a), eating and drinking areas (Figure 2b), Suleyman Bey Mosque (Figure 2c) and a concert area (Figure 2d) in the square.

Figure 2a: Ornamental Pool

Figure 2b: Eating and Drinking Areas

Figure 2c: Suleyman Bey Mosque

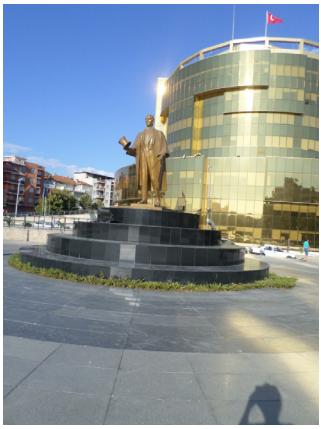

Figure 2e: Ataturk Statue

Figure 2d: Concert Area

6.3. Aydın's Urban Identity Components

6.3.1. Aydın's Natural Environment Identity Components

The city of Aydın has a Mediterranean climate due to its geographical location. Due to its climatic characteristics, it is located in the temperate zone. The mountain ranges around the city extend steeply to the sea. Depending on the climatic characteristics, the physical urban texture and vegetation, which is a natural component, show similarities with other temperate cities.

6.3.2. Aydın Artificial Environment Urban Identity Components

While examining the province of Aydın, the components of artificial environment urban identity were examined in detail.

6.3.2.1. Roads

Main roads and streets with grid plans prepared in 1925 were built in the entire city center. A large part of these streets and roads have survived to the present day. These; Adnan Menderes Boulevard, İstasyon Boulevard, Merkez Boulevard, Atatürk Boulevard, Yörük Ali Efe Boulevard, Doğu Gazi Boulevard, Batı Gazi Boulevard, Kızılçay Boulevard, Hükümet Boulevard, Efekent Boulevard, Efeler Boulevard, Osman Gazi Boulevard. There are roads that have a wide street structure and are open to vehicle traffic, as well as roads that are closed to traffic flow located on Cumhuriyet Street and Yağcılar district, which are only open to pedestrian use. These roads are the backbone of the city. In terms of the transportation network, their large size, types of flooring,

reinforcement elements, plant structures, structural materials found around them and other factors allow determining the identity of the city. The city has developed with the history it reflects from the past and the zoning that took place after the declaration of the Republic, and has structures that continue to develop and give the city an identity by continuing to develop.

The buildings built before the proclamation of the Republic, Aydın Public Library, Station building, Provincial Bank Building, old mosques reflect examples of old Turkish architecture. Aydın Metropolitan Municipality Building, Forum Aydın Shopping Mall, which was built after the proclamation of the Republic, shows the structural urban identity components of the city on a structural scale.

6.3.2.2. Open Spaces

Urban open spaces consist of urban spaces. In this context, parks, squares are the areas where urbanites share socio-culturally and socio-economically. In this case, it is a component in the formation of urban identity. In parallel, when the Aydın city center is examined, Atatürk City Square, Manzgirt Square and Zafer Square are public outdoor spaces. Public outdoor spaces are known as a component of urban identity.

Atatürk City Square is one of the important open areas of the city center where urban individuals gather. The fact that it is next to an important boulevard in Aydın makes this place the most preferred square by the public. It provides a gathering, meeting and event space for individuals with various social activities carried out continuously and various places located around it. In this respect, it is among the important open spaces reflecting the identity of the city. Dec. Ataturk square is one of the open spaces that make up the identity of the city thanks to the Aydın Metropolitan Municipality Building, Süleyman Bey Mosque, Martyrs Monument Monument, streets leading to bazaars, various reinforcement elements and plastic elements, water elements and stops that it has.

Malazgirt and Zafer Squares are located at the location of the discovery point of wide roads and the points where the distribution of traffic takes place. Atatürk meets the need for an important square in the city before it becomes a City Square. Today, the squares in the current state are the nodal points where traffic flow is ensured.

6.3.2.3. Regions

The city of Aydın has been managing its commercial functions in two main regions since the past. These regions are Yağcılar Içi – Adnan Menderes

Boulevard – Sevgi yolu shopping district and Astim organized industrial zone. Other industrial zones are other regions that affect the identity of the city. The industrial zones located around the city center are also the most important employment points of the urban population. At the same time, it is one of the most important elements affecting the identity of the city from trade to foreign trade.

6.3.2.4. Boundaries

Due to the geographical location of Aydın, Izmir and Manisa are located to the north. There is Muğla to the south, Denizli to the east and the Ege Sea to the west. The mountains that exist around the city determine the boundaries of the urban settlement.

6.3.2.5. Focal Points and Signs

Süleyman Bey Mosque, Metropolitan Municipality Building, Martyrs Monument Aydın and town square are the first places that come to mind when they are mentioned. These areas are known as focal points and beacons. These areas are the elements of the city symbol that attract user individuals to it, remain in their minds. At the same time, they demonstrate the identity of the city to incoming tourists.

6.3.3. Aydın's the Social Identity Components

The city of Aydın is a city preferred by local and foreign tourists due to the people who migrate from the countryside to the city due to its commercial activities and its natural beauties. For this reason, the population is constantly increasing, and the need for space for use is increasing at the same rate. This diversity in the population of Aydın has a positive impact on the formation of the city identity compared to other cities in our country.

6.4. The Effect of Research Space on the Identity Aydın City

6.4.1. Atatürk City Square

Ataturk City Square is one of the newest squares located in the city center, considering the development of the city of Aydın in the historical process. As a solution to the changing needs with the developing city and increasing population, the area formerly used as a park has been transformed into a square. With its new form, the square has responded to many different needs such as concert area, ceremony area, eating and drinking areas. Due to the location of the square, the ornamental pool located inside has become an important focal

point of the city of Aydın in a short time. It is the first and only ornamental pool with a surface area of 2969 m^2 in Aydın. The fact that the water show is constantly being held has made it a remarkable venue. The station building and Süleyman Bey Mosque are other focal points located in Atatürk City Square. Atatürk City Square constitutes the historical identity and basic characteristic of the city due to its historical texture.

The Metropolitan Municipality building square, which borders the Atatürk City Square, increases its administrative influence. For this reason, Atatürk City Square has the characteristics of a public outdoor space where official ceremonies and various celebrations are held. It meets the needs of urban residents such as a gathering and meeting place. And by strengthening the awareness of being an urban citizen, it has a positive impact on creating an urban identity.

They are located in the western and northern areas of Ataturk City Square and are constantly used by urban individuals with their proximity to Adnan Menderes Boulevard and Yağcılar Içi district, which are the commercial and shopping centers of Aydın. With its features and functions, Atatürk City Square is a public outdoor space in the central location of the city.

7. Conclusions and Recommendations

Different changes are effective in urban settlements. These changes that are experienced also cause the spaces and their functions to change. Along with these, it also has an important place in the formation of the identities of cities. As a result of these uses, squares are one of the places that have acquired their own identity and are located at an important point in the identity of the city. Squares are included in the open spaces class at the point of creating an urban identity. Socio-cultural and socio-economic activities experienced in squares strengthen the social aspect of urban identity. The artificial environmental identity components that squares have are known as other physical elements.

The preferred square within the framework of the city center is the public outdoor spaces where urbanites gather together. Atatürk City Square meets different functions with its location, size, plastic material elements, reinforcement elements, historical monuments. It is the place where individuals gather physically, recreationally, culturally, socially, economically and politically due to various activities of individuals.

Urban identity is a phenomenon that is constantly changing and developing throughout history. Ataturk City Square is the best example of this situation. It

is the square that urbanites use most actively. Inside; It is memorable because of the ornamental pool and various objects. This situation has caused the square to become the symbol of Aydın. With this situation, new studies that will be carried out by analyzing environmental identities, social identities and existing data will positively affect the identity of the city.

The squares are included in the public outdoor space class. It can positively or negatively affect the identity of the city both physically, socio-culturally and socio-economically. In this context, considering the example of Aydın, squares are public outdoor spaces that unite urban individuals, enable them to communicate and interact. Public outdoor spaces are spaces that have a positive impact on the formation of urban identity. When all these situations are taken into account, the most important among the components of urban identity in almost every city on earth can be decried as squares. When the planning and design stages of the square areas are approached systematically and logically, they will find the place they deserve in the eyes of individuals.

Cities are distinguished from each other by the features they have. Over time, cities have begun to resemble each other. This similarity situation has been realized with the development of my cities. As a result of this situation, cities without identity were formed. The most important area that allows the city's identity to be exhibited is public outdoor spaces. These places should be processed as a whole within the scope of the planning studies carried out within the scope of the city as a whole. This is a situation that can ensure that cities without identity are prevented.

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CHAPTER XII

INVESTIGATION OF THE FACTORS AFFECTING THE VISUAL LANDSCAPE QUALITY ASSESSMENT IN TERMS OF VISUAL PERCEPTION; EXAMPLE OF İNCİLİPINAR PARK (DENİZLİ/TÜRKİYE)

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1. Introduction

A person sees, hears, feels, smells and touches surrounded by many stimuli at every stage of his life. Immediately after these basic sensory states, the perception process begins. Because people need to make sense of and interpret the environment they live in with their sense organs. The way a person perceives a stimulus depends on that person's character, past experiences, race or social environment, religious beliefs, political views, etc. varies according to many characteristics. Therefore, the perception process shows relativity from person to person (Çoğal, 2021). For example, while the winter season reminds many people of cold, poverty and death; on the other hand, it can mean peace, cleanliness, happiness and health.

87% of perception is visual perception (Basic, 2016). Visual perception is the aesthetic image it creates in the human mind. The emotional state in which

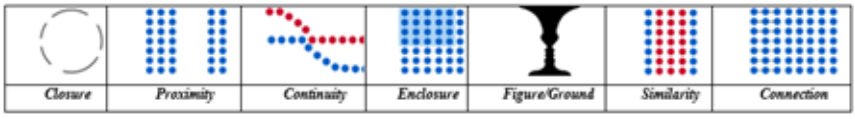
these images are evaluated with contrasts such as good or bad, beautiful or ugly is expressed as liking (Aytaş and Uzun, 2015). According to this definition, the eye and the brain are two inseparable parts of the visual perception process. The human brain very quickly groups, organizes and organizes what we see haphazardly before us. In this context, one of the most common perception theories is "Gestalt theory".

The human mind (perception system) creates the perception that reality itself has an integrity independent of its constituent parts. In this context, the famous phrase of Gestalt psychologist Kurt Koffka is as follows: "The whole is something different from the assembly of its parts." (Tuck, 2010). In some definitions "One of the important Gestalt claims is that the whole is more than the sum of the parts" (Arioka, 1986). It is also stated that these definition differences are caused by translation errors from time to time. Because Koffka states that "This principle is not an addition operation, it has a wholly independent existence" (Heider, 1977).

The main principle of Gestalt theory is that the mind organizes itself to see a whole in what it perceives. The Gestalt effect is the brain's ability to draw familiar and whole figures, especially by visually combining simple and disconnected elements (lines, dots, curves, etc.) (Anonymous 2022d).

The main goal of the theory is based on visual perception. This theory reveals that problem solving is not a random but a conscious process (Erkan, 2006; Atakan 2014; Çiçek Kurdoğlu and Bekar, 2018). Table 1 shows the detection principles according to this theory.

Table 1: Gestalt Principles (Çoğal, 2021)



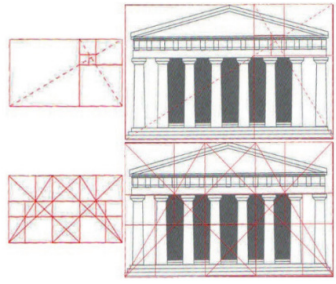
Since the individual is an installation element in the space, the differences in perception are undoubtedly more pronounced. However, when perception is questioned on a photographic setup, that is, on a 2nd dimension image, the photographer's perception and focus become more subjective. Many design training talk about the difference between "looking" and "seeing". How the brain perceives the image is more important than what the eye sees. Seeing from this aspect requires a conscious effort and perception starts with noticing. The perception of the person who comments on the fiction that is noticed and

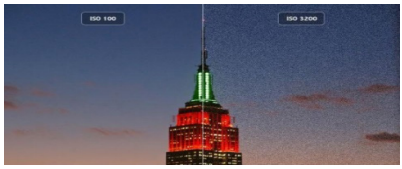
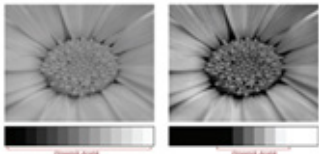
consciously directed by the person who constructs a visual in the 2nd dimension also involuntarily leans towards this orientation.

1.1. Visual Perception in Photo Shoots

Perception in photography first starts with the perception of the photographer. Those who interpret the photograph also make comments by taking this point of view first. There are various methods of increasing the visual impact in photo shoots. These have an impact on the perception of photography, just as basic design principles make a positive contribution to any design. When technical information comes together with general design principles, optimum expectation in photography is realized. In short, shooting parameters play an important role in determining visual perception in photography. These parameters are; frame, exposure, white balance, clarity & sharpness, ISO & ASA, diaphragm and depth of field, angle effect, perspective effect and light effect (Table 2).

Table 1: Shooting Parameters and Example Displays

	Shooting Parameters	Sample Photo
FRAME	The rectangular image called "Frame" determined by the photographer; it is expected to frame the problem of balance, unity and measure in the most compatible way with the visual system. This is a composition problem and framing ratios are shaped according to the "golden ratio". The ratios formed by the golden ratios are also called the "Rule of Thirds". When the object in the frame complies with these rules, a complete composition is created in visual perception. However, the perception may vary depending on whether the frame is vertical or horizontal. For example, in architectural photography, skyscrapers are shot vertically, while nature photos are shot horizontally because they offer more opportunities to relate to the environment.	 The architectural relationship to golden section (Elam 2011)  Placements of the rule of thirds in the frame (Anonymous 2022e)

EXPOSURE	The amount of light needed by a camera to create an image is called exposure. There are 3 types of exposure; It is (1) Freeze Motion, (2) Exposure Motion (Long Exposures), (3) HDR (HIGH DYNAMIC RANGE).	 Taken with long-exposure technique / With HDR technique
ISO & ASA	ISO; is the sensitivity to light. If the ambient light is low, high ISO values are used. However, the sensitivity of the obtained image is low or the image becomes noisy. For this reason, high ISO values are not preferred unless necessary in terms of photo quality.	 Noise and Grain Effects – ISO:100 (on left); ISO:3200 (on right)
WHITE BALANCE	In digital photography, the process of adjusting colors to make images look more natural is called white balance. Although the brain-eye coordination makes this adjustment automatically; sun, light bulb, flashlight etc. most light sources do not emit a purely white color. For this reason, adjusting these light settings to be closest to our eyes is effective in perception.	 Color Accuracy (Auto & Manuel WB)(Mostafazadeh, 2009)
CLARITY & SHARPNESS	Sharpness adjustment is the creation of the image by making the plans of the areas in the photograph more prominent (Demir 2018). Sharpness is related to the contrast level (dynamic range level) or the resolution of the photo. In addition to these features, resolution and grain effect are the shooting features that significantly affect the perception of the photo.	 Dynamic Range and Contrast  Sharpness and Resolution

ANGLE EFFECT	Photographs are mostly taken at eye level, but shooting the same object from the front, from below or from above changes the perception of the photograph. Facade Shooting; These are the shots where the captured image is at eye level of the photographer. These photographs are known as "objective photographs" due to the lack of perspective effects. Bottom Shot; These are the shots that are obtained when the image taken is below eye level and that makes the objects in the photo feel larger than they are. Top Shot; These are the shots that are obtained when the image taken is above eye level and that makes the objects in the photo feel smaller (contemptuous) than they are.	 Facade - lower angle - upper angle effect (Öztunalı Demir et al.2020)
DIAPHRAG M & DEPTH OF FIELD	Diaphragm (F); It is a mechanism that can be expanded and contracted on the lens, adjusting the intensity of the light passing through it. Depth of field, on the other hand, is the area seen clearly, including the front and back of the focus point. If this region is large, it is called "wide depth of field". If the sharpness covers a small area, it is defined as a "narrow depth of field".	
 Depth of Field (Anonymous, 2022e)
LIGHT EFFECT	Light is examined in two groups as natural and artificial in photography. In outdoor photography, where natural light is preferred, the visual effect may vary with the use of various filters or parachutes. Parachute; It is a device that prevents unwanted light and glare coming from the edge or end angles.	 Taken with ND Filter Tone Values / Taken With & Without Lense Hood Photograph (Mostafazadeh 2009)

PERSPECTIVE EFFECT	Perspective enhances reality, depth and vitality in photography. The perspective types used in photography are divided into three as linear, aerial and spherical (Öztunalı Demir et al. 2020). Linear (Linear) Perspective; It is called the appearance of non-parallel lines on the picture plane as if they converge as they move away from the eye. In these shots, the terms "reducing perspective" and "perspective clutter" are also frequently used. Aerial perspective; It is a perspective form formed by the effect of the atmosphere and the fading of the colors as they move away. The spherical perspective, is formed as a result of fisheye lenses.	  Spherical perspective Stacked perspective  Diminished perspective (Öztunalı et al.2020)

1.2. Visual Landscape Quality Assessment

The visual landscape is the sum of the visible landscape features formed in the human mind versus the natural and cultural landscape of the perception shaped by human psychology over time (Kaplan and Kaplan 1989; Daniel, 2001; Arı, 2005; Müderrisoğlu and Eroğlu, 2006; Oktay and Erdoğan, 2020). Landscape quality is the aesthetic visual character of the landscape, which is relative and objective, measured by people's taste (Lothian, 1999; Daniel, 2001; Winchcombe and Revell, 2004; de la Fuente de Val et al., 2006; Kıroğlu, 2007; Elinç, 2011). Visual landscape quality assessment, which was developed in the 1950s, is the holistic visual character of the landscape in which the individual interacts with his perceptual processes (Daniel, 2001; Winchcombe & Revell, 2004).

Visual landscape quality assessment, which was first included in the Addison Report in 1929, is now used in almost every study from rural and urban planning to spatial planning, from environmental management to land use decisions (Wright, 1974; Arthur et al., 1977; Williamson and Calder, 1979; Steinitz, 1979; Dearden, 1981; Kaplan and Talbot, 1988; Brown, 1994; Parsons,

1995; Daniel, 2001). This assessment rests on the subjective (visual quality specific to landscape features) and objective (landscape quality in the observer's perception) paradigm (Daniel, 2001; de la Fuente de Val et al., 2006). In 5 different perceptions (touch, hearing, smell, hearing and sight) visuality (sight) is usually a dominant element (Ode and Fry, 2002).

In this assessment based on perception, the observers are asked to choose among them by showing photographs containing landscape views. This approach is derived from the psycho-physiological tradition in psychology, where there are perceptual indicators directly related to objects, and numerical indicators based on one's perceptual responses are used as a measure of the properties of objects (Meitner, 2004). However, visual perception of the landscape and making evaluations about it may differ between individuals and communities according to the individual's habitat, intellectual knowledge, aesthetic concept in his mind and the cultural environment to which he is attached (Arriaza et al., 2004; Kaplan and Kaplan, 1989; Müderrisoğlu and Eroğlu, 2006). Because different people who look at any landscape value from the same point at the same time see the same elements in terms of number, shape, size, color and texture, but find meaning by interpreting them differently in their minds (Meinig, 1979).

Visual landscape quality assessment, which is closely related to environmental psychology, has an organic relationship with the formation of natural or non-natural resources, the socio-demographic structures of the people using these resources (sociocultural, educational status, etc.) and environmental factors (weather, climate, etc.). (Acar 2003; Ak 2010). In this context, the characteristic structures of the components of the related landscape element play an important role in determining the visual quality (Tüfekçioğlu, 2008; Elinç 2011).

Visually rich landscape areas strengthen the quality of life on the one hand, and on the other hand, dominate the instinct of protection and provide added value to the area economically. For this reason, objective, reliable and accurate numerical measurements and models are needed when revealing the visual quality value of an area (Palmer and Hoffman, 2001, Roth, 2006; Tveit et al., 2006). In this perception-based evaluation method, many studies have been conducted on the need for sufficient and qualified photographs to replace the real landscape (Bergen et al., 1995; Palmer and Hoffman, 2001; Meitner, 2004). Therefore, since the basis of the visual landscape quality assessment method is the participant ratings based on photographic presentation, the photographs to be evaluated must be taken correctly with certain techniques and correctly screened and presented to the opinions of the participants.

From this point of view, in this study, in order to minimize the concept of relativity, which is the most important disadvantage of visual landscape quality assessment, the recreational use types in İncilipınar Park (Denizli) were photographed in line with different shooting parameters and shooting characteristics. The best photograph representing the relevant recreational use type was determined by an expert survey by a group of 22 experts from different professions. Then, the level of perception between visual arts and engineering-based occupational groups was revealed with chi-square and crosstab analyzes.

2. Material & Methodology

2.1. Material

In the scope of the study, Incilipınar Park, which was built in Denizli in 2006, was chosen as a material because it is one of the important recreational areas for the citizens with its location and size and various activity areas it contains (Figure. 1).

Figure 1: Location of the Denizli City and Study area

Inside the Incilipinar Park, which has an area of 174 000 m^2; There are 1 main pond, 3 small ponds, various sports fields, camellias, jogging tracks, pet-friendly areas, children's playgrounds and recreation areas (Anonymous 2022a). In addition, within the scope of the Green Flag program, Incilipınar Park, which was evaluated by the independent non-governmental organization

Keep Britain Tidy in the 2020-2021 period, has been awarded the title of green space in Turkey to receive the first and only Green Flag award (Anonymous 2022b).

Incilipinar Park (Figure 2), which has the 'Green Flag' award waving in 2101 parks around the world, is one of the largest parks not only in Denizli but also in the Aegean Region. Incilipınar Park has different features from other parks in Turkey with its abundance of water resources and its lush nature (Anonymous 2022c).

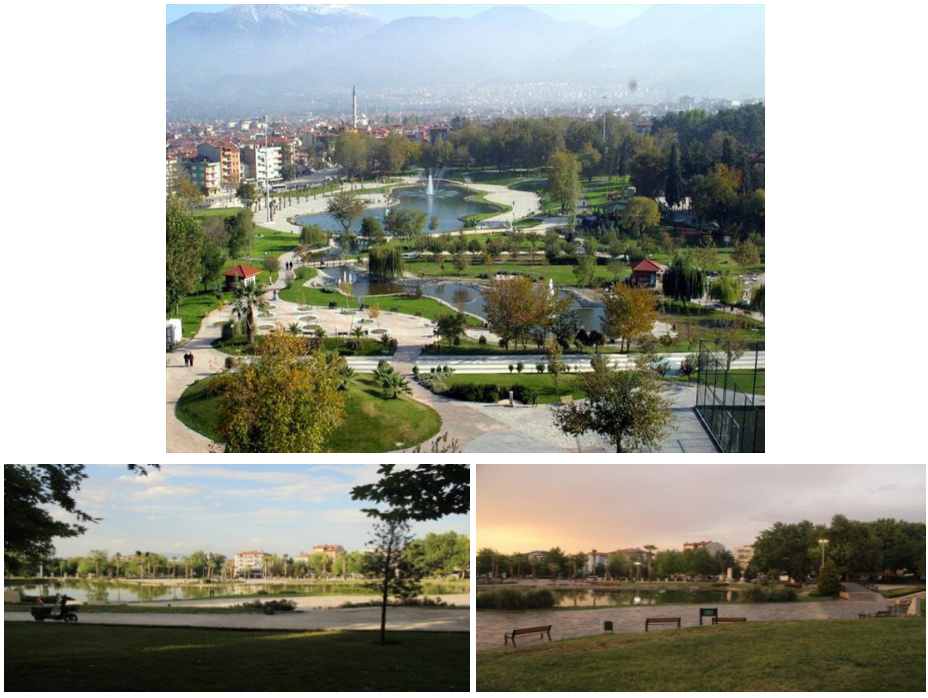


Figure 2: Incilipinar Park (Study Area)

2.2. Methodology

The method of the study consists of 4 stages.

In the first stage, the recreational usage types of Incilipınar Park were determined by using the on-site observation technique as a result of field studies. The 6 identified recreational usage types are given in Table 3.

Table 2: Recreational use types and codes of the study area

No	Recreational Usage Type	Code	No	Recreational Usage Type	Code
1	Urban Equipment	UE	**4**	Playground	P
2	Thematic Area	TA	**5**	Aquatic Area	AA
3	Sports Field	SA	**6**	Walking Trail	WT

In the second stage, 137 photographs were taken with the Canon 600D Digital Camera with 18-megapixel resolution between 14:00 and 19:00 in May 2022, representing 6 recreational use types, using different shooting parameters and features. Attention was paid to the presence of components (type of vegetation and the area it covers, topography type, degree of naturalness, variety of colors) that affect recreational use types in photography. The acquisition specifications showing the different versions of the acquisition parameters are shown in Table 4.

Table 3: Shooting Parameters and Shooting Features

Shooting Parameter	Code	Shooting Characteristic 1	Shooting Characteristic 2	Shooting Characteristic 3	Shooting Characteristic 4
Frame	F	Compliant with the One-Third Rule _ Horizontal	Inconsistent with the One-Third Rule_Horizontal	Compliant with the One-Third Rule _Vertical	Inconsistent with the One-Third Rule _Vertical
Exposure	E	Long exposure	Freeze Movement	HDR Technique	
White Balance	WB	Automatic	Manual	-	-
Clarit & Sharp-ness	C&S	Dynamic Range Low (Low contrast)	Dynamic Range High (High Contrast)	-	-
ISO & ASA	ISO&ASA	ISO Value Under_100	ISO Value High_6400	-	-
Diaphragm & Depth of Field	D&AD	Large Depth of Field (f=22)	Depth of Field Medium (f=8)	Low Depth of Field (f=1.8)	-
Angle Effect	AE	Bottom Shot	Top Shot	Facade Shooting	-
Light Effect	IE	With Filter	No Filter	With Parole	Without Parole
Perspec-tive Effect	PE	Diminishing Perspective	Stacked Perspective	Spherical Perspective	-

In the third stage, the best photograph representing the related recreational use type was determined by an expert survey by a group of 22 experts from different professions. Occupational distribution and numbers of experts are given in Table 5.

Table 4: Occupational Distribution of the Expert Group

Profession	Number	Profession	Number
Landscape architect	3	Sculptor	2
Architect	3	Artist	2
City and Regional Planner	3	Ecologist	2
Forest engineer	2	Hydrologist	2
Photographer	3		

At the last stage, the results of the frequency distribution of the photographs evaluated by the experts were given and the perception level among the occupational groups was determined in line with the selected photographs and recreational use types by chi-square and crosstab analysis.

3. Findings

137 photographs photographed with shooting parameters and shooting characteristics of 6 different recreational use types are shown in Table 6.

Then the experts were asked to choose the best photograph representing the relevant recreational usage type. Accordingly, the frequency distributions of photographs representing each recreational use type in line with different shooting parameters and characteristics are given in Table 7. In this context, the most preferred photographs and shooting characteristics are shown in Table 8.

Table 6: Photographs that vary according to shooting parameters and shooting characteristics of 6 different types of recreational use

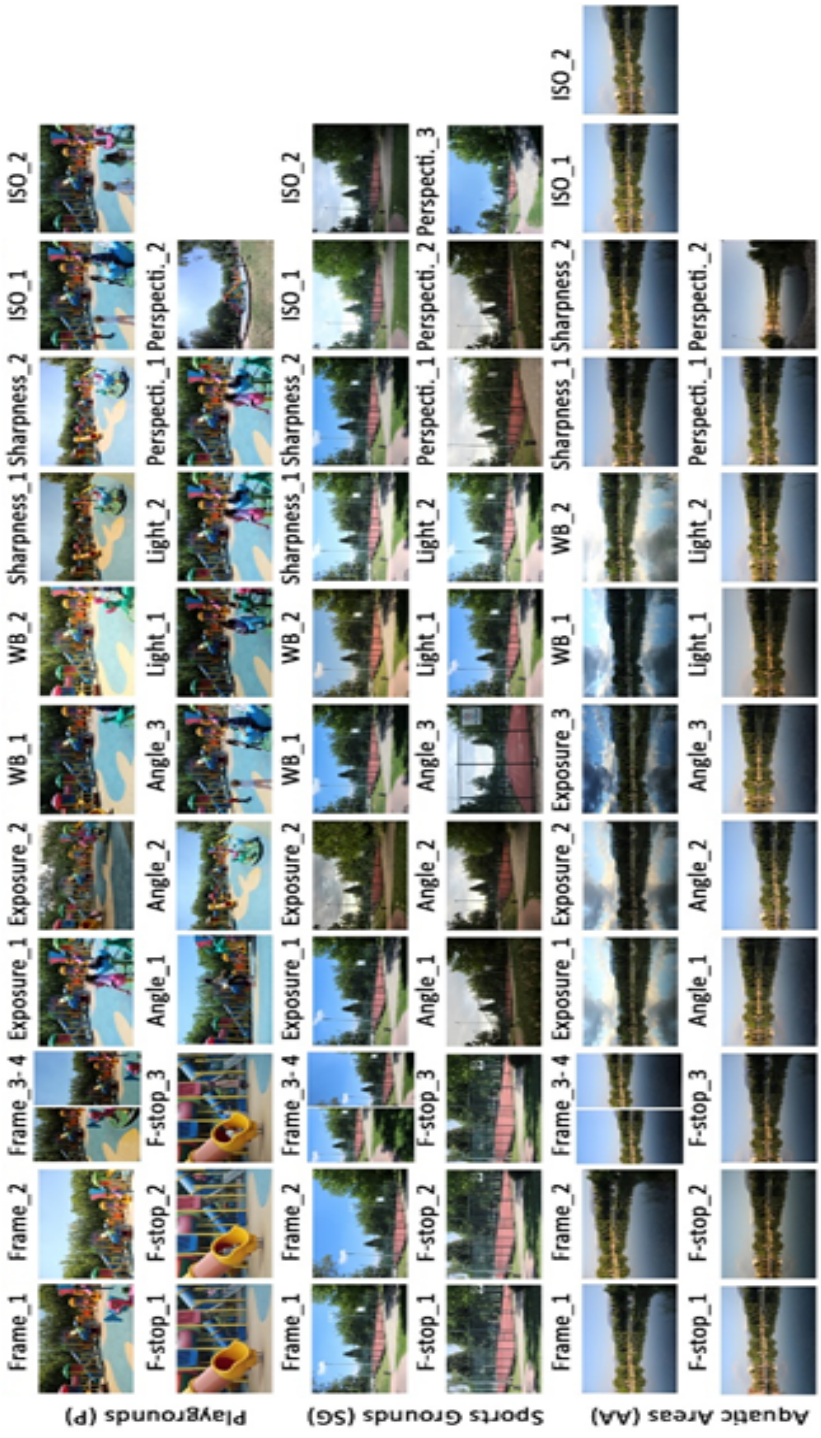

Playgrounds (P)
Frame_1
Frame_2
Frame_3- 4
Exposure_1
Exposure_2
WB_1
WB_2
Sharpness_1
Sharpness_2
ISO_1
ISO_2
F-stop_1
F-stop_2
F-stop_3
Angle_1
Angle_2
Angle_3
Light_1
Light_2
Perspecti._1
Perspecti._2
Sports Grounds (SG)
Frame_1
Frame_2
Frame_3- 4
Exposure_1
Exposure_2
WB_1
WB_2
Sharpness_1
Sharpness_2
ISO_1
ISO_2
F-stop_1
F-stop_2
F-stop_3
Angle_1
Angle_2
Angle_3
Light_1
Light_2
Perspecti._1
Perspecti._2
Perspecti._3
Aquatic Areas (AA)
Frame_1
Frame_2
Frame_3- 4
Exposure_1
Exposure_2
Exposure_3
WB_1
WB_2
Sharpness_1
Sharpness_2
ISO_1
ISO_2
F-stop_1
F-stop_2
F-stop_3
Angle_1
Angle_2
Angle_3
Light_1
Light_2
Perspecti._1
Perspecti._2

Table 7: Percentages of preference for photographs according to shooting parameters

Shooting Parameter Code	Photo Number and Preference Percentage				Shooting Parameter Code	Photo Number and Preference Percentage			
	1	2	3	4		1	2	3	4
UE_F	**40,9**	27,3	31,8	0	**P_F**	36,4	**54,5**	4,5	4,5
UE_E	**54,5**	45,5	-	-	**P_E**	**81,8**	18,2	-	-
UE_WB	40,9	**59,1**	-	-	**P_ WB**	**54,5**	45,5	-	-
UE_C&S	36,4	**63,6**	-	-	**P_ C&S**	**72,7**	27,3	-	-
UE_ISO&ASA	**72,7**	27,3	-	-	**P_ISO&ASA**	**77,3**	22,7	-	-
UE_D&FD	36,4	22,7	**40,9**	-	**P_ D&FD**	9,1	**54,5**	36,4	-
UE_AE	**59,1**	13,6	27,3	-	**P_AE**	22,7	**72,7**	4,5	-
UE_LE	31,8	**68,2**	-	-	**P_ LE**	9,1	**90,9**	-	-
UE_PE	22,7	22,7	**54,5**	-	**P_PE**	18,2	**81,8**	-	-
TA_F	36,4	**45,5**	18,2	0	**AA_F**	**59,1**	36,4	4,5	0
TA_E	18,2	**54,5**	27,3	-	**AA_E**	31,8	4,5	**63,6**	-
TA_ WB	**54,5**	45,5	-	-	**AA_ WB**	36,4	**63,6**	-	-
TA_ C&S	27,3	**72,7**	-	-	**AA_C&S**	4,5	**95,5**	-	-
TA_ISO&ASA	**72,7**	27,3	-	-	**AA_ISO&ASA**	**81,8**	19,2	-	-
TA_ D& FD	9,1	36,4	**54,5**	-	**AA_ D&FD**	13,6	36,4	**50,0**	-
TA_AE	36,4	**40,9**	22,7	-	**AA_AE**	4,5	**90,9**	4,5	-
TA_IE	13,6	**86,4**	-	-	**AA_ LE**	27,3	**72,7**	-	-
TA_PE	27,3	4,5	**68,2**	-	**AA_PE**	31,8	**68,2**	-	-
SF_F	**81,8**	4,5	9,1	4,5	**WT_F**	18,2	4,5	**77,3**	0
SF_E	**50**	**50**	-	-	**WT _E**	40,9	**59,1**	-	-
SF_ WB	40,9	**59,1**	-	-	**WT _ WB**	**54,5**	45,5	-	-
SF_ C&S	27,3	**72,7**	-	-	**WT_ C&S**	18,2	**81,8**	-	-
SF_ISO&ASA	**81,8**	18,2	-	-	**WT_ISO&ASA**	**63,6**	36,4	-	-
SF_ D&FD	**36,4**	27,3	**36,4**	-	**WT _ D&AD**	**45,5**	**45,5**	9,1	-
SF_AE	22,7	**54,5**	22,7	-	**WT _AE**	27,3	**45,5**	27,3	-
SF_ LE	**86,4**	13,6	-	-	**WT _ LE**	27,3	**72,7**	-	-
SF_PE	**68,2**	13,6	18,2	-	**WT _PE**	45,5	**54,5**	-	-

Table 8: Preferred photographs according to shooting parameters

Shooting Parameter Code	Photo Number	Shooting Characteristic	Shooting Parameter Code	Photo Number	Shooting Characteristic
UE_F	1	Compliant with the One-Third Rule-Horizontal	**P_F**	2	Inconsistent with the One-Third Rule-Hori.
UE_E	1	Freeze Movement	**P_E**	1	Freeze Movement
UE_WB	2	Manual	**P_ WB**	1	Automatic
UE_C&S	2	Dynamic range high (High Contrast)	**P_ C&S**	1	Dynamic range low (low contrast)
UE_ISO&ASA	1	ISO value under_100	**P_ISO&ASA**	1	ISO value under_100
UE_D&FD	3	Low depth of field	**P_ D&FD**	2	Medium depth of field
UE_AE	1	Bottom shot	**P_AE**	2	Top shot
UE_LE	2	No filter	**P_ LE**	2	No filter
UE_PE	3	Spherical Perspective	**P_PE**	2	Stacked perspective
TA_F	2	Inconsistent with the One-Third Rule-Horizontal	**AA_F**	1	Compliant with the One-Third Rule- Hori.
TA_E	2	Freeze movement	**AA_E**	3	HDR technique
TA_ WB	1	Automatic	**AA_ WB**	2	Manual
TA_ C&S	2	Dynamic range high (High Contrast)	**AA_NK**	2	Dynamic range high (high contrast))
TA_ISO&ASA	1	ISO value under_100	**AA_ISO&ASA**	1	ISO Value Under_100
TA_ D& FD	3	Low depth of field	**AA_ D&FD**	3	Low depth of field
TA_AE	2	Top shot	**AA_AE**	2	Top shot
TA_IE	2	No filter	**AA_ LE**	2	No filter
TA_PE	3	Spherical Perspective	**AA_PE**	2	Stacked perspective
SF_F	1	Compliant with the One-Third Rule-Horizontal	**WT_F**	3	Compliant with the One-Third Rule-Vertical
SF_E	1, 2	Freeze Movement, HDR	**WT _E**	2	HDR
SF_ WB	2	Manual	**WT _ WB**	1	Automatic
SF_ CS	2	Dynamic range high (High Contrast)	**WT_ C&S**	2	Dynamic range high (high contrast)
SF_ISO&ASA	1	ISO value under_100	**WT_ISO&ASA**	1	ISO Value Under_100
SF_ D&FD	1, 3	Large depth of field, low depth of field	**WT _ D&AD**	1, 2	Large depth of field depth of field medium
SF_AE	2	Top shot	**WT _AE**	2	Top shot
SF_ LE	1	With filter	**WT _ LE**	2	No filter
SF_PE	1	Diminishing perspective	**WT _PE**	2	Stacked perspective

In order to reveal the perceptual differences of the occupational groups, first of all, occupations were grouped under two main headings, namely visual arts and engineering-based, and then the perceptual differences of these occupational groups were revealed by chi-square and crosstab analyzes (Table 9). Accordingly, there was a statistically significant difference between the distributions of DE_PE ($p=0.014$) and TA_I ($p=0.023$), while no significant difference was found in other extraction parameters.

Table 9: Perception Levels of Occupational Groups

Shooting Parameter Code	Shooting Characteristic	Engineering	Visual Arts	Total	Test İs.	p*
UE_F	1	5(33.3)	4(57.1)	9(40.9)	1.660	0.436
	2	4(26.7)	2(28.6)	6(27.3)		
	3	6(40.0)	1(14.3)	7(31.8)		
UE_E	1	10(66.7)	2(28.6)	12(54.5)	0.000	0.172[2]
	2	5(33.3)	5(71.4)	10(45.5)		
UE_WB	1	7(46.7)	2(28.6)	9(40.9)	0.000	0.648[2]
	2	8(53.3)	5(71.4)	13(59.1)		
UE_C&S	1	7(46.7)	1(14.3)	8(36.4)	0.000	0.193[2]
	2	8(53.3)	6(85.7)	14(63.6)		
UE_ ISO&ASA	1	11(73.3)	5(71.4)	16(72.7)	0.000	1.000[2]
	2	4(26.7)	2(28.6)	6(27.3)		
UE_ D&FD	1	4(26.7)	4(57.1)	8(36.4)	3.152	0.207[2]
	2	3(20.0)	2(28.6)	5(22.7)		
UE_AE	1	8(53.3)	1(14.3)	9(40.9)	1.671	0.434[1]
	2	8(53.3)	5(71.4)	13(59.1)		
	3	3(20.0)	0(0.0)	3(13.6)		
UE_LE	1	4(26.7)	2(28.6)	6(27.3)	0.000	1.000[2]
	2	5(33.3)	2(28.6)	7(31.8)		
	3	10(66.7)	5(71.4)	15(68.2)		
AA_F	1	8(53.3)	5(71.4)	13(59.1)	0.903	0.637[1]
	2	6(40.0)	2(28.6)	8(36.4)		
	4	1(6.7)	0(0.0)	1(4.5)		
AA_E	1	4(26.7)	3(42.9)	7(31.8)	3.233	0.199[2]
	2	0(0.0)	1(14.3)	1(4.5)		
	3	11(73.3)	3(42.9)	14(63.6)		
AA_ WB	1	5(33.3)	3(42.9)	8(36.4)	0.000	1.000[2]
	2	10(66.7)	4(57.1)	14(63.6)		
AA_ C&S	1	1(6.7)	0(0.0)	1(4.5)	0.000	1.000[2]
	2	14(93.3)	7(100.0)	21(95.5)		
AA_ ISO &ASA	1	12(80.0)	6(85.7)	18(81.8)	0.000	1.000[2]
	2	3(20.0)	1(14.3)	4(18.2)		
AA_PE	1	5(33.3)	2(28.6)	7(31.8)	0.000	1.000[2]
	2	10(66.7)	5(71.4)	15(68.2)		
AA_ D&FD	1	2(13.3)	1(14.3)	3(13.6)	0.279	0.870[2]
	2	6(40.0)	2(28.6)	8(36.4)		
	3	7(46.7)	4(57.1)	11(50.0)		
AA_LE	1	4(26.7)	2(28.6)	6(27.3)	0.000	1.000[2]
	2	11(73.3)	5(71.4)	16(72.7)		

UE_PE	1	3(20.0)	2(28.6)	5(22.7)	8.556	**0.014**[2]	**AA_AE**	1	0(0.0)	1(14.3)	1(4.5)	2.640	0.267[2]
	2	1(6.7)	4(57.1)	5(22.7)				2	14(93.3)	6(85.7)	20(90.9)		
P_F	1	11(73.3)	1(14.3)	12(54.5)	2.986	0.394[2]		3	1(6.7)	0(0.0)	1(4.5)		
	2	5(33.3)	3(42.9)	8(36.4)			**TA_F**	1	3(20.0)	5(71.4)	8(36.4)	5.982	0.050[2]
	3	9(60.0)	3(42.9)	12(54.5)				3	8(53.3)	2(28.6)	10(45.5)		
P_E	1	1(6.7)	0(0.0)	1(4.5)	0.000	0.263[2]		4	4(26.7)	0(0.0)	4(18.2)		
	2	0(0.0)	1(14.3)	1(4.5)			**TA_E**	1	3(20.0)	1(14.3)	4(18.2)	1.257	0.533[2]
	3	11(73.3)	7(100.0)	18(81.8)				2	9(60.0)	3(42.9)	12(54.5)		
	4	4(26.7)	0(0.0)	4(18.2)				3	3(20.0)	3(42.9)	6(27.3)		
P_WB	1	8(53.3)	4(57.1)	12(54.5)	0.000	1.000[2]	**TA_WB**	1	8(53.3)	4(57.1)	12(54.5)	0.000	1.000[2]
	2	7(46.7)	3(42.9)	10(45.5)				2	7(46.7)	3(42.9)	10(45.5)		
P_C&S	1	12(80.0)	4(57.1)	16(72.7)	0.000	0.334[2]	**TA_C&S**	1	2(13.3)	4(57.1)	6(27.3)	0.000	0.054[2]
	2	3(20.0)	3(42.9)	6(27.3)				2	13(86.7)	3(42.9)	16(72.7)		
P_ISO&ASA	1	12(80.0)	5(71.4)	17(77.3)	0.000	1.000[2]	**TA_ISO&ASA**	1	11(73.3)	5(71.4)	16(72.7)	0.000	1.000[2]
	2	3(20.0)	2(28.6)	5(22.7)				2	4(26.7)	2(28.6)	6(27.3)		
P_D&FD	1	1(6.7)	1(14.3)	2(9.1)	0.681	0.711[2]	**TA_LE**	1	0(0.0)	3(42.9)	3(13.6)	0.000	**0.023**[2]
	2	9(60.0)	3(42.9)	12(54.5)				2	15(100.0)	4(57.1)	19(86.4)		
	3	5(33.3)	3(42.9)	8(36.4)									
P_AE	1	5(33.3)	0(0.0)	5(22.7)	4.714	0.095[2]	**TA_D&FD**	1	2(13.3)	0(0.0)	2(9.1)	1.641	0.440[2]
	2	10(66.7)	6(85.7)	16(72.7)				2	6(40.0)	2(28.6)	8(36.4)		
	3	0(0.0)	1(14.3)	1(4.5)				3	7(46.7)	5(71.4)	12(54.5)		

P_PE	1	2(13.3)	2(28.6)	4(18.2)	0.000	0.565[2]	**TA_AE**	1	6(40.0)	2(28.6)	8(36.4)	0.335	0.846[2]
	2	13(86.7)	5(71.4)	18(81.8)				2	6(40.0)	3(42.9)	9(40.9)		
P_LE	1	2(13.3)	0(0.0)	2(9.1)	0.000	1.000[2]		3	3(20.0)	2(28.6)	5(22.7)		
	2	13(86.7)	7(100.0)	20(90.9)			**TA_PE**	1	4(26.7)	2(28.6)	6(27.3)	0.489	0.783[2]
SF_F	1	11(73.3)	7(100.0)	18(81.8)	2.281	0.516[1]		2	1(6.7)	0(0.0)	1(4.5)		
	2	1(6.7)	0(0.0)	1(4.5)				3	10(66.7)	5(71.4)	15(68.2)		
	3	2(13.3)	0(0.0)	2(9.1)			**WT_F**	1	2(13.3)	2(28.6)	4(18.2)	1.122	0.571[2]
	4	1(6.7)	0(0.0)	1(4.5)				3	1(6.7)	0(0.0)	1(4.5)		
SF_E	1	8(53.3)	3(42.9)	11(50.0)	0.000	1.000[2]		4	12(80.0)	5(71.4)	17(77.3)		
	2	7(46.7)	4(57.1)	11(50.0)			**WT_ WB**	1	8(53.3)	4(57.1)	12(54.5)	0.000	1.000[2]
SF_WB	1	7(46.7)	2(28.6)	9(40.9)	0.000	0.648[2]		2	7(46.7)	3(42.9)	10(45.5)		
	2	8(53.3)	5(71.4)	13(59.1)			**WT_ C&S**	1	3(20.0)	1(14.3)	4(18.2)	0.000	1.000[2]
SF_C&S	1	5(33.3)	1(14.3)	6(27.3)	0.000	0.616[2]		2	12(80.0)	6(85.7)	18(81.8)		
	2	10(66.7)	6(85.7)	16(72.7)			**WT_E**	1	5(33.3)	4(57.1)	9(40.9)	0.000	0.376[2]
SF_ISO &ASA	1	11(73.3)	7(100.0)	18(81.8)	0.000	0.263[2]		2	10(66.7)	3(42.9)	13(59.1)		
	2	4(26.7)	0(0.0)	4(18.2)			**WT_ ISO& ASA**	1	9(60.0)	5(71.4)	14(63.6)	0.000	1.000[2]
SF_ D&FD	1	6(40.0)	2(28.6)	8(36.4)	1.257	0.533[2]		2	6(40.0)	2(28.6)	8(36.4)		
	2	3(20.0)	3(42.9)	6(27.3)			**WT_ D&FD**	1	6(40.0)	4(57.1)	10(45.5)	1.257	0.533[1]
	3	6(40.0)	2(28.6)	8(36.4)				2	7(46.7)	3(42.9)	10(45.5)		
SF_AE	1	3(20.0)	2(28.6)	5(22.7)	0.489	0.783[2]		3	2(13.3)	0(0.0)	2(9.1)		
	2	8(53.3)	4(57.1)	12(54.5)			**WT_ AE**	1	3(20.0)	3(42.9)	6(27.3)	1.564	0.457[2]
	3	4(26.7)	1(14.3)	5(22.7)				2	7(46.7)	3(42.9)	10(45.5)		
SF_LE	1	12(80.0)	7(100.0)	19(86.4)	0.000	0.523[2]		3	5(33.3)	1(14.3)	6(27.3)		
	2	3(20.0)	0(0.0)	3(13.6)			**WT_PE**	1	6(40.0)	4(57.1)	10(45.5)	0.000	0.652[2]
SF_PE	1	11(73.3)	4(57.1)	15(68.2)	0.796	0.672[1]		2	9(60.0)	3(42.9)	12(54.5)		
	2	2(13.3)	1(14.3)	3(13.6)			**WT_LE**	1	5(33.3)	1(14.3)	6(27.3)	0.000	0.616[2]
	3	2(13.3)	2(28.6)	4(18.2)				2	10(66.7)	6(85.7)	16(72.7)		

4. Conclusion

When recreational use types are evaluated in terms of framing, it is observed that horizontal shots and shots that comply with the rule of thirds are generally preferred. However, horizontal shots incompatible with the one-third rule were preferred for thematic areas and playgrounds. The reason for this is considered to be the emergence of the main theme. In this case, while the presence of golden ratios in visual perception is important in general shots, it may not be necessary to look for this feature in-focus shots. In addition, vertical framing in compliance with the one-third rule was preferred only on the walking trail. This is due to the fact that the road appears more with the single escape perspective effect. In this case, it is possible with vertical framing to reveal a stronger perception in photographs with road effects.

When the usage types are examined in terms of exposure, shots in which the motion is frozen, that is the perception of motion is not created, are generally preferred. However, long exposure was preferred in the urban equipment and playground. In the example of aquatic area usage type, HDR shooting technique was preferred. Because HDR shooting techniques affect perception positively, especially in the presence of aquatic area. In the sports field, both long exposure and motion freezing options were equally preferred.

When the usage types are examined in terms of exposure, shots in which the motion is frozen, that is, the perception of motion is not created, are generally preferred. However, HDR shooting technique was preferred in the aquatic area usage type and walking trail example. HDR photographs, which can be explained as the difference in light intensity between the light and dark surface, are generally preferred in very light or shadowy places. Kaptan and Ünalan (2018) stated that HDR photographs are widely used and appreciated in the tourism, promotion and advertising sectors. In this study, HDR shooting techniques affect perception positively, especially in the presence of water areas. In addition, both the contrast effect of the sports areas with the green area and the contrast with the walking path and the green area around it have increased the HDR shooting preferences.

In terms of white balance, manual balance is preferred in equipment, sports and aquatic areas; Automatic adjustment is preferred in thematic areas, children’s playgrounds and walking trails. Considering that the automatic setting supports a little more contrast and the white balance is more intense, it was a better perception to obtain children’s playgrounds with more colors with these shots.

In the balance of clarity & sharpness in usage types, the excess of contrast was preferred in all uses except for playground. However, it is thought that the low contrast preference in playground is due to the fact that playground is already multicolored and do not need an extra presence of contrast.

When photo shoots are evaluated in terms of ISO values, it is seen that all preferences are low ISO values. As the ISO value increases, especially after 1600, graininess occurs in the photo. This situation also affects the survey photos. The fact that all of the preferences take this situation into account reveals the difference in perception even when the photograph is small.

When the survey photographs are evaluated in terms of the diaphragm feature, it is observed that some photographs prefer the depth of field and medium depth of field in some usage types, while the depth of field of some photographs is less preferred. Thematic area, urban equipment, etc. Since the focal point is directly on these elements in usage types, the aperture value of 1.8, that is, the background being more blurred, draws attention directly to these objects. It was found to be important in terms of increasing the selectivity in perception, separating the elements from the background and in terms of results, it was preferred that the depth of field be less in such areas.

In the angle effect, preferences are mostly listed as top shot. Bottom drafting was preferred more in the drafting preferences of only reinforcement elements. It can be explained by the fact that the urban equipments are already below the eye level and therefore the preferences are more perceptible with the bottom shooting technique.

In the effect of light, filtered and unfiltered shooting techniques were used. Unfiltered shots are preferred in all usage types except sports field. The light effect also varies with the time of the photo shoots. However, in order to reduce this perception difference, shootings were made after 14.00 in the afternoon within the scope of this study. Some shots were taken within an hour before sunset, also known as the “Golden Hour & Blue Hour”. It is important to know these hours in terms of photo saturation, shadow length or white balance.

The blue hour, also called the magic or golden hour (English: Magic hour or Golden hour) by photographers, is actually the most convenient time period for creating beautiful compositions after sunset. With various applications, it can offer the photographer the best time slots according to your location.

When the perspective effects are taken into consideration, the stacked perspective is generally preferred in the area. While the decreasing perspective

was preferred only in the sports field, the spherical perspective was preferred in the urban equipment and thematic area.

When the perspective effects are taken into consideration, the stacked perspective is generally preferred in the area. Öztunalı Demir et al. (2020) emphasized that the facade shots were created in order not to give a different meaning to the captured object or to obtain a different image than it is, and therefore the accuracy of shooting from eye level. Here, the fact that the stacked perspective comes to the fore with the force of the facade supports the studies as well. While the decreasing perspective was preferred only in the sports area, the spherical perspective was preferred in the reinforcement element and thematic area. The rectangular shape of the sports areas cannot be understood by the facade effect. For this reason, strengthening the perspective perception makes the space perceived better. In thematic areas, a photographic technique was preferred to see and perceive each object separately, which is only possible with fish-eye lenses with a spherical perspective.

In addition, the professions of the experts who participated in the survey were grouped into two main classes as visual arts and engineering-based. When the perception level between the occupational groups and the selected photographs was examined, no significant difference was found except for UE_PE and TA_LE. This situation indicates that there is no difference between art-based professions and engineering-based professions in terms of photography and visual perception when examined from a professional point of view.

The findings point that shooting techniques have a very important effect on affecting visual perception. For this reason, it is extremely important to use the right shooting techniques in order to minimize the disadvantage caused by the difference in perception from the individual's growing environment to cultural difference, from intellectual knowledge level to landscape value. It is important to include the visual aesthetic structure of the landscape in design and planning decisions. Because it has a guiding role in decision-making and finding solution stages. In the design and planning process of an area, it should be in parallel with the evaluation of the biophysical landscape characteristics of the area along with the natural and socio-cultural landscape features and the presence of visual landscape resources of the region. In this context, this study constitutes an important base for design and planners and local governments responsible for such areas.

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