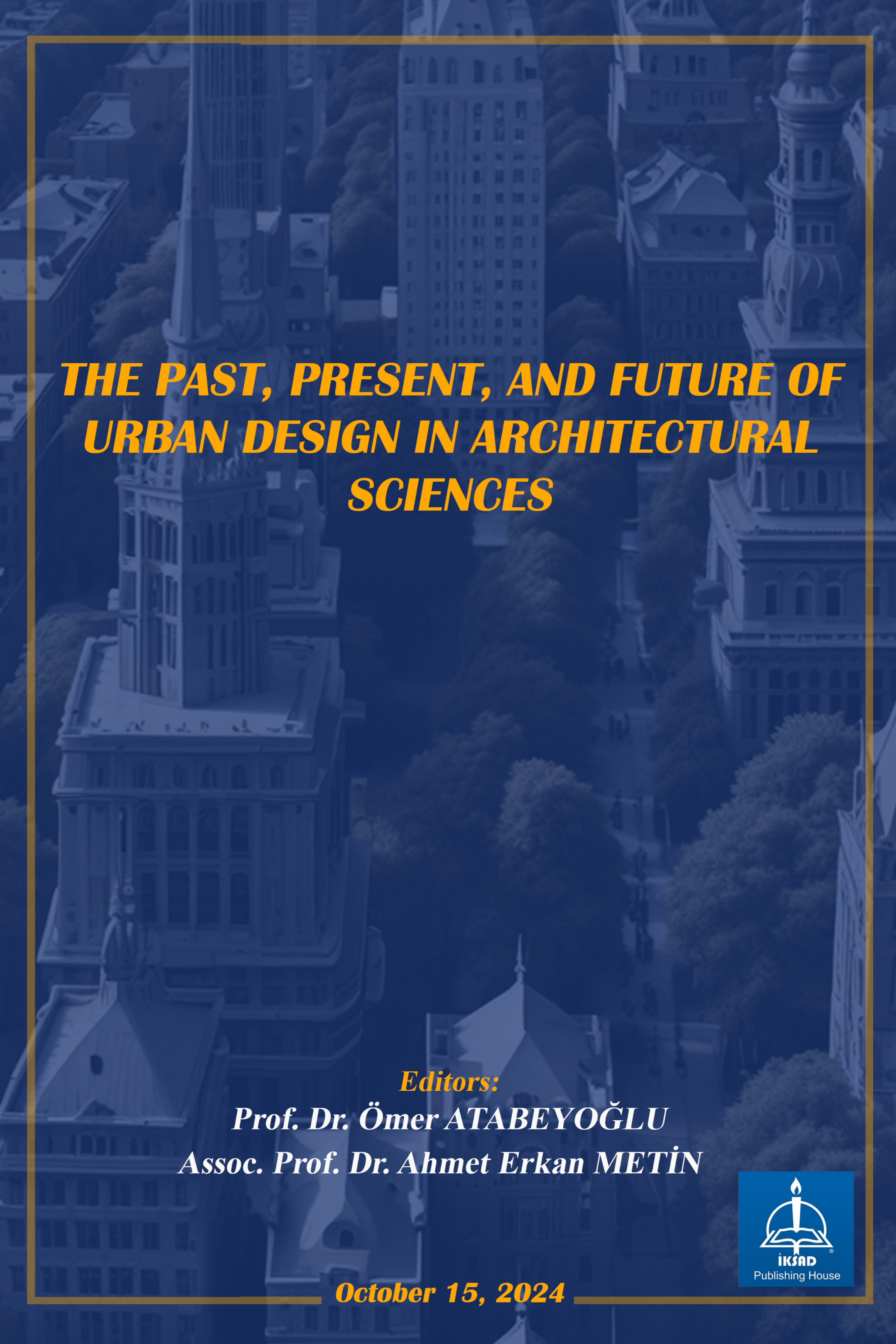

THE PAST, PRESENT, AND FUTURE OF URBAN DESIGN IN ARCHITECTURAL SCIENCES

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PREFACE

The editors of this book believe that a more livable world can be created by conducting interdisciplinary studies of spatial planning and design disciplines together under the umbrella of "Architectural Sciences". In this context, the "Journal of Architectural Sciences and Applications (JASA)," which is a pioneer in the collective studies of related disciplines was published for the first time in 2016. Afterward, JASA Editors make significant contributions to the creation of various books containing original works and to bring the latest developments in the field to the reader.

This book named “THE PAST, PRESENT, AND FUTURE OF URBAN DESIGN IN ARCHITECTURAL SCIENCES” consists of twelve chapters. In the book, the topics named “Sustainability Approach in 3D Printed Urban Furniture”, “Solid Waste Landfill Rehabilitation in Urban Renewal”, “Urban Design Project Competitions: An Evaluation on Design Approaches and Sustainable Solutions”, “Integration of Cultural Landscape Values and Preservation of Industrial Heritage”, “Approaches to Ecosystem Service Assessment”, “VISUAL QUALITY ON STREETS IN THE CONTEXT OF SEASONAL DIFFERENCES”, “Landscape Design Process in Historical Environments: The Case of Hacı Bektaş Veli Shrine”, “Xeriscape Landscaping and Roof Garden Design”, “Next-Generation Urban Furniture Design: Tekno Bicycle Stand”, “One size doesn’t fit all: Generative Approaches in Response to Vulnerable Cities Through

Thematic Urban Design Guides", "Student Experiences at the Intersection of Upcycling-Interior Design: An Evaluation on Upcycled Furniture Examples", "Dynamics of Urban Ecosystems: Inputs, Outputs, and Management Strategies" were discussed in detail. We would like to thank all those who contributed to the completion of the book, the authors, the referees of the chapters, IKSAD Publishing House, and Professor Atila GÜL, who is the General Coordinator of the Architectural Sciences book series.

We hope that our book "THE PAST, PRESENT, AND FUTURE OF URBAN DESIGN IN ARCHITECTURAL SCIENCES" will be useful to readers.

15.10.2024

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Sustainability Approach in 3D Printed Urban Furniture

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1. Introduction

Sustainability has been an important research topic in many disciplines since the emergence of sustainable development concepts in the late 1980s (Ceschin and Gaziulusoy, 2016; Bhamra and Hernandez, 2021; Imert, 2023). Today, increasing industrialization, population growth, globalization and people's search for a more comfortable life lead to a rapid increase in energy consumption. This increasing energy demand and the inadequacy of the energy produced over time bring along various problems. In order to find solutions to these problems, the concept of sustainable architecture has started to be used with the aim of protecting energy, material, waste production and consumption and producing more energy (Tavşan et al., 2022). The concept of sustainability gained clarity in Our Common Future or the Brundtland Report published by the World Commission on Environment and Development in 1987 (Tavşan and Bal, 2021). Sustainable-oriented buildings in architecture have been referred to by various names in different periods in the literature. It was called “environmental design” in the 1970s, “green design” in the 1980s, “ecological design” in the late 1980s and 1990s, and “sustainable design” since the mid-1990s (Durmuş Arsan, 2008). In the transition period between 2000 and 2010, technological developments such as computer-aided product design and three-dimensional printing contributed to the realization of the fourth industrial revolution and enabled the diversification of production methods in terms of sustainable design (Ogbemhe, Mpofu, & Tlale, 2017; Xu, David, & Kim, 2018). Recently, increasing environmental pressures at the urban scale have led people to develop and implement environmentalist approaches. For this reason, sustainable urban approaches have also come to the agenda (Tavşan et al., 2023). In order for furniture to be sustainable, it should be made of recyclable materials, use production techniques that do not disturb the balance with nature, minimize energy consumption in the ecosystem, use renewable energy sources and be produced from waste materials in nature (Bal, 2017).

Current needs in the production of space, furniture and products make robotic production important in order to increase efficiency, reduce costs and realize high-performance productions (Ogbemhe et al., 2017). The main reason why robots have recently become more common in architectural design and production is thought to be the processes that allow architects, interior designers and industrial designers to work flexibly (Braumann & Brell-Cokcan, 2012). One of the advantages of 3D printing production devices is that they can work with specialized end effectors that are suitable for a variety of tasks. These end effectors are designed to be used in a wide range of applications, rather than focusing only on a specific task (Gramazio and Kohler, 2008; Weissenböck, 2015). Additive manufacturing describes the process of creating three-dimensional (3D) objects through the addition of successive layers of materials such as casting, molding, screen printing, and 3D printing (Wallin, Pikul, & Shepherd, 2018; Imert, 2023). In this process, 3D printing involves a method of quickly applying material in layers with minimal loss using data from the CAD environment (Hossain, Zhumabekova, Paul, & Kim, 2020; Yap, Sing, & Yeong, 2020).

Among the materials used in the additive manufacturing process, plastic stands out due to its easy shaping, low cost, lightness and durability (İmert, 2023). However, plastic materials pose a significant threat to the ecosystem as they cause waste pollution (Hopewell et al., 2009). Considering sustainability and the protection of nature and the future of the ecosystem, it is seen that recycling and utilization of plastic wastes is becoming increasingly important. In addition, it is necessary to integrate renewable energy sources into production or final products and to adopt a policy of conservation of existing energy. Recycling waste plastic packaging and bringing it into production is of great importance in terms of sustainable and ecological production. The collected or acquired plastics must be ground into particles through an industrial waste plastic granulator and then processed into filaments suitable for 3D printing production devices using a recycling robot. The plastic filaments obtained in this way can be used in the production of furniture and products. It is seen that recycled products, biodegradable environmentally friendly materials and materials suitable for reuse are preferred in the production of urban furniture with filaments obtained from waste for sustainability approach. Thanks to these materials, environmental damage is minimized and carbon footprint is reduced. Paying attention to the use of energy efficient devices in production technologies as well as materials and preferring technologies that support energy conservation have been among the situations observed in 3D printed urban furniture within the scope of sustainability approach. With the rapid development of digital and artificial intelligence technologies, it is thought that the use of smart technologies in public furniture will contribute to the environment in terms of sustainability. Watering the plants in the pots in 3D printed furniture designed for public spaces with smart technologies can also support water efficiency.

The aim of this study is to examine how urban furniture produced with 3D printing method is adopted on the basis of sustainability. In this direction, 10 pieces of urban furniture produced with 3D printing method were determined as the sample group by scanning various examples as these furniture can be integrated into other functions or function as furniture alone. The examples were evaluated under the headings of material selection and recycling, energy efficiency, waste management, integration of smart technologies, life cycle analysis and design flexibility-modularity under the sustainability approach and general conclusions were made. In this study, in our world where consumption is increasing day by day, each product produced for the society can serve the society for many years as more sustainable, durable and long-lasting, as well as being transformable for reuse at the end of its useful life.

2. Material and Method

In the study, a qualitative research method was adopted in order to examine the sustainability approaches of urban furniture produced by 3D printing method under the heading of Additive Method Vehicles among the digital fabrication tools discussed under 6 headings. In this context, using the literature review method, a total of 10 3D printed urban furniture designed and produced by designers, design companies, companies or institutions were identified. In the selection of these furnitures, projects that take into account or aim at sustainability criteria in the design-production-implementation processes were taken into consideration. During the examination process, literature and internet searches were conducted and written and visual sources on these furniture and sustainability approaches were analyzed in detail using the "document analysis" method, which is one of the sub-headings of the qualitative research method. The data obtained were systematically analyzed through a table consisting of 6 main and 14 sub-headings that evaluate the sustainability decisions taken in the design-production-implementation stages of urban furniture. The analyzed headings are as follows: Material Selection and Recycling, Energy Efficiency, Waste Management, Integration of Smart Technologies, Life Cycle Analysis and Design Flexibility and Modularity. In this process, a sample group was formed by evaluating criteria such as the use of sustainable materials, reduction of energy consumption, waste management and recycling, and the sustainability approaches of the analyzed furniture were comprehensively evaluated.

3. Findings and Discussion

In this section, sustainability approaches in 3D printed urban furniture of 10 examples are included and a general evaluation is made over the examples.

MASAU Urban Furniture (2022, Caracol and partners): MASAU urban furniture is produced with 3D printing technology using recycled polypropylene material with glass fiber reinforcement to promote environmental sustainability. The use of 3D printing in the production process minimizes the impact of the process in terms of printing time, energy consumption, materials used and waste generated. In addition, Internet of Things (IoT) devices are used to integrate smart functions into MASAU furniture. In this way, the plants in the pots in the urban furniture can be watered automatically when needed through smart sensors. The use of recycled materials in MASAU urban furniture contributes to waste management, while the operation of smart devices with solar energy supports sustainability. Some approaches to sustainability have been influential in the design process of the furniture (Caracol, 2024) (Figure 1). These are;

- Minimizing material and energy use,
- Supporting energy efficiency by shortening production time,
- The use of durable and long-lasting materials that allow the product to withstand external environmental conditions for many years,
- Eliminating the need for fasteners and assembly and producing in one piece,
- Reducing waste in the supply chain by using recycled materials,
- It has been the use of new 3D printing technologies that will be more efficient.

Figure 1. 3D printed MASAU urban furniture (Hannah, 2023)

ACCIONA Urban Furniture (2022, Espiau ve Muñoz): The curved form urban furniture was produced in Italy using the 3D printing technique known as contour craftsmanship. In the furniture made of concrete material, after the concrete mixture is prepared, it is pumped into the robot head of the printing device by means of gunite mixers. One of the mixers is mounted on a fixed bed while the other moves along a twenty-three meter long rail. Twenty minutes later, the furniture is fully formed and ready for transportation the following day (Acciona, 2024) (Figure 2). Within the scope of sustainability, some approaches have been effective in the design process of the furniture. These are;

- The absence of any mold in the production of furniture,
- The ability to produce modules on-site reduces the carbon footprint of the transportation process.
- The flexibility of 3D printing allows experimentation with different concrete mixes, aiming to combine waste and recycled materials to further increase the sustainability of the project.

Figure 2. 3D printed ACCIONA urban furniture (Acciona, 2024)

XXX Bench Urban Furniture (Print Your City – The New Raw): The company uses 3D printing technology to produce urban furniture by recycling plastic waste. In this process, the aim is to collaborate with local citizens to shape their environment and recycle plastic waste. The main goal of the project is to create a closed-loop system for plastic waste in cities around the world. For example, the amount of plastic waste used in the production of a single bench made from recycled plastic bags is equal to the amount of plastic waste produced by two Amsterdam citizens every year. In the Zero Waste Laboratory, donated plastic waste is sorted, washed and shredded. After this process, a robotic 3D printing arm that melts the plastic and combines it with color pigment is used to turn the mixture into furniture (Designboom, 2017) (Figure 3). Although the recycled plastics used in the project are not considered biodegradable and environmentally friendly materials, the reuse of these materials makes significant contributions to sustainability goals such as minimizing waste and reducing energy consumption in the production process. The processes of sorting, washing and shredding plastic waste make it possible to effectively manage and recycle waste. Modular design, customization possibilities and flexible usage approaches make significant contributions to the sustainability of the project by supporting recycling and reuse possibilities at the end of the design's lifecycle. This approach aims to reduce the environmental footprint of cities and use resources more efficiently by utilizing plastic waste in closed-loop systems.

Figure 3. 3D printed XXX Bench urban furniture (Designboom, 2017)

USE Urban Furniture (2022, R3direct): It is a 3D printed public furniture design for the small town of Lucca, Italy, made from plastic waste, which will serve as a second skin for a city bench as well as concrete barriers. In this 3D printing project, a team of architects, engineers and designers took a sustainable approach, using recycled plastic from milk cartons and other similar plastic containers. These plastics were used to create a design that can be slid onto concrete barriers. The main purpose of the furniture is to hide the traffic barriers used to keep cars in their lanes and prevent car bombs and other threats (Listek, 2022) (Figure 4). In addition, the fact that this furniture is easy to transport, does not require any manpower for installation or assembly, is lightweight and recyclable are important considerations in terms of sustainability. It also makes a significant contribution to sustainability in terms of reusing waste and preferring environmentally friendly materials. This design, which can be placed slidingly on concrete barriers, aims to hide traffic barriers both functionally and aesthetically, while at the same time offering practical advantages thanks to its light weight and recyclability. In addition, the modular structure and easy assembly of the design provides flexibility of application without the need for manpower for assembly operations. The design also contributes to sustainability goals such as reducing energy consumption in the production process, minimizing waste and increasing recycling opportunities.

Figure 4. 3D printed USE urban furniture (Listek, 2022)

MODULUS Urban Furniture (2021, Mean Design- Riyad Joucka): Modulus is a prototype that combines design and technology to revitalize public spaces in line with the Dubai 2040 Urban Master Plan. The design aims to develop infrastructure systems using sustainable construction methods to improve the quality of life for residents. Each module is digitally fabricated using fast, efficient and environmentally responsible manufacturing techniques. The modules are 3D printed on white concrete using robotic arms. Many pioneers have adopted this rapidly growing technology in the UAE as an innovative construction method that is both cost-effective and minimizes industrial waste generation. It provides a clean and sustainable construction site; prefabricated parts can be assembled with minimal residue or pollution. Furthermore, 3D printing is considered an efficient production method as materials can be quickly produced where they are needed without the need for molds (Mean Design, 2024) (Figure 5). Looking at the sustainability approach of the Modulus project, it encompasses several important elements. First of all, it is aimed to reduce energy consumption in the production process by using energy efficient production technologies and robotic arms. The minimization of waste in the production process and the ability to assemble prefabricated parts with minimal residue or pollution ensures a clean and sustainable construction site. In addition, the modular design and easy assembly of the modules offers flexible and multi-purpose use. The rapid production of materials where they are needed without the need for molds is considered an efficient production method, thus encouraging material reuse.

Figure 5. 3D printed MODULUS urban furniture (Mean Design, 2024)

SANDWAVES Urban Furniture (2019, Mani Architects- Precht ve Mamou): The furniture consists of 58 3D sand-printed pieces connected together to form a continuous seat that curves around palm trees in the Al-Turaif District of Diriyah. Designers Precht and Mamou combine local materials with state-of-the-art technology to create the furniture they call Sandwaves, which is ecologically friendly and responds to a local culture and building traditions (Crook, 2020; Mamou-Mani Architects, 2024) (Figure 6). Looking at the sustainability approach of the Sandwaves project, it is seen that a biodegradable and environmentally friendly material is preferred thanks to the use of local materials. These local materials also provide advantages in terms of reducing energy consumption and minimizing waste in the production process. The 3D sand printing technology used in the project is one of the energy efficient production techniques and produces less waste compared to traditional methods. In addition, the modular design and easy assembly feature allows parts to be easily assembled and disassembled and reused when necessary. This also offers a significant advantage in terms of recycling or reuse possibilities at the end of the design's lifetime. Finally, the Sandwaves project is able to respond to different needs in public spaces with its flexible and multi-purpose usage possibilities. This approach to sustainability offers a solution that is both ecological and sensitive to local culture.

Figure 6. 3D printed Sandwaves urban furniture (Mamou-Mani Architects, 2024)

Pots Plus Urban Furniture (2018, The New Raw- Panos Sakkas ve Fonteini Setaki): Residents of the Greek city of Thessaloniki are able to turn their plastic waste into 3D printed furniture for the city using a lab set up by Rotterdam-based studio The New Raw. The options for each piece of urban furniture to be designed include planters, bike racks, dog bowls and bookshelves. The founders of The New Raw, Panos Sakkas and Fonteini Setaki, have stated that plastic is a design flaw because it is designed to last forever but is usually discarded after one use. Therefore, they aimed to show a better way to use plastic in long-lasting and high-value applications. The furniture is made from polypropylene (PP) and polyethylene (PE) plastics commonly used in food packaging, which are obtained directly from plastic waste donated to the lab. The waste is sorted, washed and shredded before being melted, then combined with pigments to create a printable material. When recycled over time, the furniture can be shredded and the newly designed furniture can be printed again. (The New Raw, 2024) (Figure 7). In terms of sustainability approach, the use of recycled materials is emphasized. Because the furniture is produced directly from plastic waste. This contributes significantly to the minimization of waste during the production process and the management and recycling of waste after production. Looking at the use of energy efficient production technologies; 3D printing technology consumes less energy compared to traditional production methods. The modular design and easy assembly feature of the furniture provides opportunities for recycling or reuse at the end of its lifetime. This flexible and multi-purpose use makes it possible to adapt the furniture to different needs in various public spaces. This sustainability approach is of great importance both in terms of preserving the ecological balance and ensuring the efficient use of resources. As a result, it helps cities become greener, cleaner and more livable and sets an example for future sustainable urban planning.

Figure 7. 3D printed Pots Plus urban furniture (Designwanted, 2024)

Flow Urban Furniture (2023, Salt and Pepper Studio): Designed in Thailand, the benches are produced using 3D printing and no matter how many pieces of various shapes are combined, the design exhibits a continuous and connected integrity, providing an aesthetic flow. The benches, tables and chairs developed under the Flow concept are modular pieces that offer various looks and functions according to users' preferences. This design approach responds to the different usage needs of users by providing both aesthetic and functional flexibility. While the production of urban furniture with 3D printing technology takes approximately 20 hours, the assembly process is completed in 2-3 hours. This technology increases functionality by allowing parts to be placed in different positions and reassembled. Users can freely arrange and customize these pieces according to their needs. Supporting environmental sustainability, this technology aims to reduce pollution and works in harmony with recycling processes and 'Be Green ESG4+' practices (Bunyayothin, 2023) (Figure 8). Flow urban furniture exhibits a sustainable approach with the use of recycled materials and modular design features. The furniture is produced using environmentally friendly and biodegradable materials, thus contributing to waste management and recycling processes. The 3D printing technology used in the production process is an energy efficient method, reducing energy consumption and minimizing waste. In addition, this technology makes it possible to produce materials quickly and efficiently in the required locations, eliminating the need for molds. The flexibility and modular nature of the design allows parts to be rearranged and customized in different locations, increasing the possibilities for reuse or recycling at the end of the product's life cycle.

Figure 8. 3D printed Flow urban furniture (Bunyayothin, 2023)

Ermis Urban Furniture (2020, The New Ran – Panos Sakkas ve Foteini Setaki): The designers have developed strategies to reuse the materials used and reduce the volume of waste generated in the studio's R&D process. Ermis furniture is produced by using different colored waste from the production process, which gives each piece of furniture a unique aesthetic identity. The seating part of the furniture has simple and ergonomic lines and is processed by robotic methods using a single spiral plastic thread. Designed without the use of adhesives, resins and additional coatings used in traditional furniture production, this product is fully recyclable at the end of its life. The furniture is made from both recyclable and recycled materials, making a significant contribution to sustainability and environmental impact (Hitti, 2021) (Figure 9). Designers have developed a sustainable production process by aiming to reduce material management and waste volume. Ermis furniture not only reduces environmental impact by using recycled materials generated during the production process, but also pays attention to the use of biodegradable and environmentally friendly materials. By not using traditional adhesives, resins and additional coatings in the design of the furniture, recycling processes are facilitated and the product can be fully recycled at the end of its life. This approach supports the minimization of waste and the reduction of energy consumption in the production process, while at the same time encouraging the reuse of materials. In addition, modular design features and customization possibilities enable flexible and multi-purpose use of furniture and increase sustainability performance. Ermis furniture is an example of environmental sustainability, both because it is made from recycled materials and because it offers recycling opportunities throughout the life cycle of the design.

Figure 9. 3D printed Ermis urban furniture (Hitti, 2021)

Generation 3D Urban Furniture (The year was not available. Generation 3D): It is also aimed to minimize the ecological footprint of furniture produced using 3D printing technology using recycled plastics and plant-based environmentally friendly materials (Generation 3D, 2024) (Figure 10). Strategies such as using recycled materials in the production process, preferring biodegradable and environmentally friendly materials and reducing energy consumption in the production process are implemented. In addition, waste is minimized in this process and effective management and recycling of post-production waste is ensured. Opportunities for recycling or reuse at the end of the design's life cycle can be another important feature to reduce environmental impacts. By offering modular design and flexible use, this furniture supports environmental sustainability and offers both an aesthetic and functional solution through the functional use of recycled materials.

Figure 10. 3D printed Generation 3D urban furniture (Generation 3D, 2024)

4. Conclusion and Suggestions

All examined 3D printed urban furniture designs were analyzed through the main and sub-headings determined within the scope of sustainability approaches. The sustainability approach of each 3D printed urban furniture is given in Table 1.

Table 1. Sustainability approach in 3D printed urban furniture design

Sustainability Approaches	**3D Printed Urban Furniture**									
	Masau	**Acciona**	**Xxx Bench**	**Use**	**Modulus**	**Sandwaves**	**Pots Plus**	**Flow**	**Ermis**	**Generation 3d**
Material Selection and Recycling										
Use of recycled materials	X	X	X	X			X	X	X	X
Use of biodegradable and environmentally friendly materials						X		X	X	X
Material reuse			X	X			X	X	X	X
Energy Efficiency										
Reducing energy consumption in the production process	X	X	X	X	X			X		
Use of renewable energy sources	X									

Use of energy efficient production technologies	X		X		X	X	X	X		X
Waste Management										
Minimizing waste in the production process	X	X	X		X	X	X	X	X	X
Post-production waste management and recycling					X		X		X	X
Integration of Smart Technologies										
Monitoring and optimizing energy and resource use with smart technology devices	X									
Integration of smart irrigation systems and other environmental sensors	X									
Life Cycle Analysis										
Possibilities for recycling or reuse at the end of the design's life cycle	X	X	X	X			X	X	X	X
Design Flexibility and Modularity										
Modular design and easy assembly	X	X	X	X	X	X		X	X	
Redesign and customization possibilities			X				X	X		
Flexible and multi-purpose use				X	X	X	X	X		

Table 1 looks at 3D printed urban furniture according to sustainability approaches;

The use of recycled materials shows that recycled materials are widely used in urban furniture. This approach reduces environmental impacts while at the same time extending the life cycle of materials. The use of recycled materials makes a significant contribution to reducing waste in the production process and preserving natural resources. This can be considered as an effective strategy that contributes to the sustainability of cities.

The use of biodegradable and environmentally friendly materials contributes to the sustainability of urban furniture. However, the number of furniture with this approach is more limited. Therefore, it should be emphasized that the use of environmentally friendly materials should increase and the importance of applying these materials in a wider range should be emphasized.

Material reuse, this approach provides both environmental and economic benefits. It is demonstrated that waste can be reduced and resource efficiency increased through the reuse of materials in furniture design. This has great potential as part of sustainable design practices.

Reducing energy consumption in the production process is an important factor in the sustainability of urban furniture. The energy efficiency of 3D printing technology ensures that energy consumption is minimized in the production process. This approach is critical in terms of reducing energy costs and reducing environmental pollution and impacts.

The use of renewable energy sources is less common in the production of urban furniture. The importance of increasing practices in this area and the integration of renewable energy sources will be beneficial to society and the environment in terms of sustainability. It can be concluded that more focus should be placed on this approach for future designs.

The use of energy efficient production technologies has been observed that designers/companies that pay attention to adopting an ecological and sustainable approach prefer energy efficient production tools. Energy efficiency reduces the environmental impact of production processes and lowers costs.

Minimizing waste in the production process, effectively managing and reducing waste in the production process can demonstrate that environmental impacts are minimized. This approach is successfully realized through the integration of recycled materials and innovative production techniques.

Post-production waste management and recycling are important issues in sustainable furniture design. However, practices in this area can be limited. More efforts are needed to effectively manage waste and improve recycling processes. Improving recycling processes will also contribute to reducing environmental impacts.

Applications of smart devices to monitor and optimize energy and resource use are not yet widely used in urban furniture design. The potential benefits of these technologies and their role in achieving sustainability goals should be highlighted. Integration of smart technology device solutions can help manage energy and resource use more effectively.

Evaluating the possibilities of recycling or reuse at the end of the design's life cycle increases material efficiency and reduces waste generation.

Redesign and customization opportunities may be limited in the sustainability of urban furniture. In order to increase the number of applications in this field and to better respond to user needs, such opportunities should be utilized more.

Flexible and multipurpose use increases the ability to adapt to the changing needs of users and enables furniture to be used in different areas. Flexible designs contribute to achieving sustainability goals and extend the lifespan of furniture.

The use of recycled materials, the integration of biodegradable and environmentally friendly materials, the reduction of energy consumption and the use of renewable energy sources all stand out as important components of efforts to minimize environmental impacts and increase resource efficiency. In addition, innovative approaches such as improving waste management and recycling processes, the use of energy efficient production technologies and the integration of smart technologies have great potential in the design and production processes of sustainable urban furniture. In this context, it emphasizes the opportunities offered by 3D printing technology in the field of sustainable urban furniture and the need for a wider application of this technology. As a result, the adoption and dissemination of these strategies in achieving sustainability goals will make significant contributions to the environmental and economic sustainability of urban furniture as well as environmental protection.

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Author Contribution and Conflict of Interest Declaration Information

All authors contributed equally to the article. There is no conflict of interest.

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Solid Waste Landfill Rehabilitation in Urban Renewal

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1. Introduction

Environmental problems that occur as a result of human-induced pressures in cities can be diversified as wrong land use, increasing pressure on natural areas, gradual decrease in soil fertility and biodiversity, climate changes, global warming, water scarcity, destruction and fragmentation of forest areas, habitat loss and uncontrolled increases in agricultural lands. (Mac, 1998; Alberti, 2005; Bennett & Saunders, 2010). In addition, population growth, urbanization and urban growth in the world cause more consumption of food and products and an increase in the amount of waste. As the population increases, the production of all kinds of pollution and the accumulation of waste increases. As a result of this situation, wild landfills (solid waste sites, dumps, etc.) are created. Landfills cause the transformation of natural landscapes in and around cities.

Landflling is the procedure of organized disposal of biodegradable and non-biodegradable wastes in a designated terrestrial burial site or landfll, which is located away from a municipality's suburban areas. Landflling has been a conventional and most lucrative waste disposal route followed in many countries (Nanda & Berruti, 2021). Wastes accumulated in the environment without any precautions and the amount of which increases day by day create significant environmental problems with physical, biological and visual pollution in cities and rural areas. These wild storage (irregular storage) areas, known as dumpsites, where garbage is collected randomly, not only create visual and odor pollution, but also have a negative impact on the environment, groundwater and soil. It is necessary to reshape the land of the landfills, to create suitable slopes and to carry out landscape restoration works.

Landscape restoration is a must in terms of urban aesthetics in irregular landfills. These areas should be connected to the open green space system as they contribute to urban health, urban ecosystem and provide a place for urban recreation demands (Dilek, 2006). It is known that when an ecologically damaged area used as a landfill is left to its own devices, it will take many years for it to regain its ecological balance, repair itself and return to its pre-use state. Shortening this process is possible through some interventions in nature. The main way to improve landfills, which are a problem in urban spaces, and to eliminate the negativities caused by these areas is "vegetation cover" works and the transformation of these areas into public spaces that can be used by the city people with new functions after planting. (Erdoğan & Uzun, 2007).

More than two billion tons of garbage are produced worldwide every year, enough to fill 800,000 Olympic-sized swimming pools (URL-1). Wild landfills cause many environmental problems such as underground and surface water pollution, soil pollution, explosion and fire hazard, visual pollution, dust and bad odor emission by dumping solid wastes randomly. (Gökçe et al., 2015). In addition, if solid waste cannot be disposed of under certain technological and hygienic conditions, smelly odour, pathogenic microbes, release of ammonia and sulfur compounds, dirtinessmethane leakage, visual pollution, contagious diseases carried by mice, birds, flies, mosquitoes, water, air and soil pollution may occur. (Beyazlı & Aydemir, 2007; Şahin & Serin, 2008). Especially in open landfills, rainwater forms leachate in the waste pile and this polluting leachate is transported to surface and groundwater. Fossil gases, especially methane gas, produced due to biological decomposition in the garbage mass cause air pollution, cause small and large fires on the garbage, and the accumulated gases pose the risk of explosion of the garbage mass (Ertürk & Görgün, 2011).

In order to meet the new needs arising from socio-economic and technological developments in cities, regeneration projects are carried out for different purposes and in different dimensions. Regeneration projects, which are considered as solutions in urban areas where social, economic and physical problems are experienced for various reasons, can help to create quality landscapes and provide a sustainable and sufficient environment for individuals. (Güneroğlu & Bekar, 2019). Regeneration projects to be designed in urban settlements should be planned with a holistic planning and design approach to create spatial continuity, offer alternative accessibility and various recreational opportunities, and protect wildlife (Oğuztürk & Pulatkan, 2023). In order to reveal the opportunities offered by idle areas with rich potential, the process should be executed by architects, urban planners and landscape architects and blended with a participatory structure. In this regard, these areas, which also have a negative impact on the integrity of the city, can be reintroduced to urban life by giving them certain functions, with the multidisciplinary work of the mentioned professional disciplines and a correct approach to the issue by prioritizing public interests. (Trancik, 1986).

2. The Landfill Rehabilitation Project Examples

In this section, projects to rehabilitate unregulated solid waste areas, which have been used as landfills for many years, and transform them into public open spaces are explained through examples implemented in some countries.

2.1. Freshkills Park – New York

Once one of the largest landfills in the world, Fresh Kills was a landfill established in New York City in 1948 on 3,000 acres of salt marsh on Staten Island to meet New York City's growing solid waste disposal needs. Although not originally intended to be a long-term solid waste solution for NYC, the 2200-acre site stored 150 million tons of garbage between 1947 and 2001, becoming the largest landfill in the world in 1955. In the mid-1980s, it received 26,300 metric tons of garbage per day (Figure 1). Responding to growing public pressure on environmental, health and aesthetic concerns, Fresh Kills stopped taking garbage in 2001. At that point, the landfill contained approximately 136 million metric tons of solid waste and was spread over 931 hectares (URL 2).

Figure 1. An aerial view of the landfill site from 1943s and 1990s (URL 3)

Recognizing the potential for the Fresh Kills site to have an impact on the landscape and community, an international design competition and community support process was launched in 2001. Freshkills Park's award-winning Master Plan was developed by James Corner Field Operations in 2001. In 2006, the NYC Department of Parks and Recreation assumed responsibility for implementing the project, using this plan as a conceptual guide. (Klenosky et al., 2017) (Figure 2).

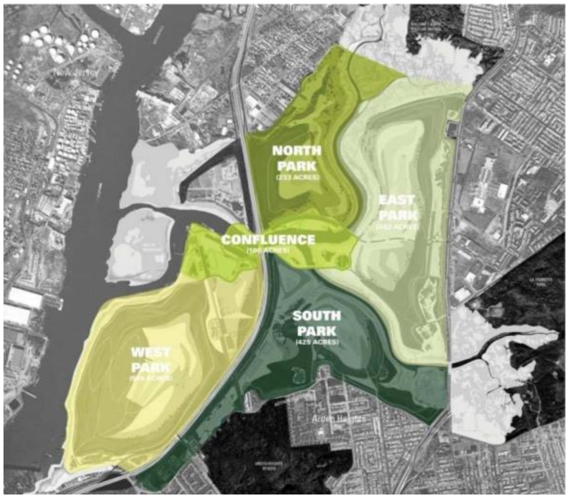

Figure 2. The Freshkills Park draft master plan (URL 4)

The design of the park emphasizes engineering, ecological restoration and environmental sustainability. The park is designed for five main sections that accommodate a range of uses, including cultural, athletic and educational programs. Each section has a variety of public spaces and facilities for social, cultural and physical activities, learning and play, and includes activities such as hiking, bird watching, cycling, jogging and canoe tours, research, arts, education and entertainment. These activities are also provided with wider access and habitat improvements (URL 5) (Figure 3). Freshkills Park is large enough to support many activities and programs. The 2,200-acre Freshkills park, which is being built in phases, is projected to be almost 3 times larger than Central Park when completed in 2036 (URL 2).

Figure 3. Overviews from the Freshkills Park (URL 2; URL 6; URL 7; URL 8)

2.2. Mount Trashmore Park – Virginia

Mount Trashmore Park is a city park located in Virginia Beach, built on a hill formed by the storage of solid waste for many years. Mount Trashmore became an abandoned garbage mountain in the late 60s and early 70s with 640,000 tons of garbage (Figure 4). In 1974, it was converted into a park and became a successful example of landfill reuse (URL 9).

Figure 4. Mount Trashmore landfill (URL 10; URL 11)

The park covers 165 acres (67 hectares) with hills more than 60 feet (18 m) high and 800 feet (240 m) long (URL 12) (Figure 5).

Figure 5. Mount Trashmore Park (URL 13)

Mount Trashmore was created by compacting layers of solid waste and clean soil. Recognized for its environmental success, this former landfill has a water-based garden with arid landscaping that requires minimal water (URL 14). In the park, activity areas such as walking areas, picnic shelters, children's playgrounds, skateboard park, basketball court, volleyball area are designed. The area also includes a parking lot, vending machines and restrooms (URL 15) (Figure 6).

Figure 6. Mount Trashmore Park activity areas (URL 16; URL 17; URL 18; URL 19)

2.3. Ariel Sharon Park - Tel Aviv

Mount Hiriya was a garbage mountain that formed on a flat area. It was raised over a period of 46 years between 1952 and 1998 and peaked at 60 meters above its surroundings and 80 meters above sea level. Known as Israel's largest landfill, Hiriya accumulated nearly 16 million tons of waste until its closure in August 1998 (URL 20). Built on the banks of the Ayalon River, the landfill grew without proper treatment for nearly fifty years until it covered 111 acres. It soon became a huge, unsightly eyesore in the heart of the country and one of Israel's biggest environmental, infrastructural and social hazards. Afterwards, the hill and its surroundings were restored and the huge dump was transformed into a green metropolitan area known as Ariel Sharon Park (Limor-Sagiv & Lissovsky, 2023).

Rehabilitation of Hiriya started in 2004 (Figure 7). An international competition was organized for ideas on how to rehabilitate and transform the garbage mountain. German landscape architect and urban planner Peter Latz and his team were selected for the design of the park and its improvement project. As part of his work, Peter Latz also headed a technical development, working with a team of planners, artists, photographers, engineers and architects. The park received The Green Good Design 2010 Award in der Kategorie Urban Planning Landscape Architecture and The International Architecture Award in 2016 (URL 21).

Figure 7. The Hiriya Mountain rehabilitation stages (URL 22; URL 23)

The restored hill has an interactive center, family picnic areas, an ecological lake, viewing points and information points providing information about the restoration of the hill and guided tours (URL 24) (Figure 8).

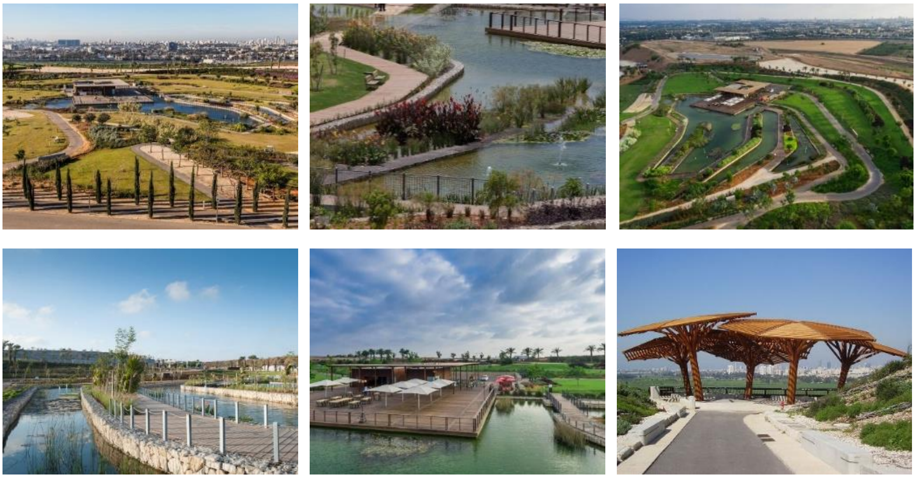

Figure 8: Overviews from The Ariel Sharon Park (URL 23; URL 25)

Formerly known as one of the largest landfills in the Middle East, Hiriya is now the Ariel Sharon Environmental Park. It is a successful example of how a holistic approach to landfill remediation can benefit multiple partners.

2.4. Qian’an Sanlihe Greenway - Qian’an

Located in China's Hebei Province, The Luan River and its surroundings, which were previously discharged with garbage and sewage water, have been recycled and recreated for recreational use and social revitalization. In the 1970s, during a period of rapid industrial development and urban growth, the Luan River and its surroundings became a dumping ground for urban waste and sewage (Figure 9). The Sanlihe River became subsequently dried up and its channel was blocked by solid waste (URL 26).

Figure 9: The Luan River and its surroundings in 1970s (URL 27)

In 2006, Turenscape landscape office was commissioned for sewage water management, ecological restoration and the design of the riverside greenway. Sewage management was planned by redesigning the sewage pipes that previously discharged directly into the river. Ecological restoration and urban design along the Greenway were realized. Over the course of two years of design and construction, the project transformed this severely contaminated land into a natural urban ecological corridor, a scenic place where "reeds grow, trees shade and birds live" (URL 26). The simple and functional wooden walkways and waterfront platforms have made this green corridor a part of people's daily use (Figure 10).

Figure 10: Waterfront platforms Luan River (URL 27)

Stormwater ditches, which absorb water like a sponge and provide habitat for wildlife, are being built along the river road for flood control. Plants in the stormwater ditches clean the water. Thus, the transformation to a clean river and green road begins (URL 27) (Figure 11).

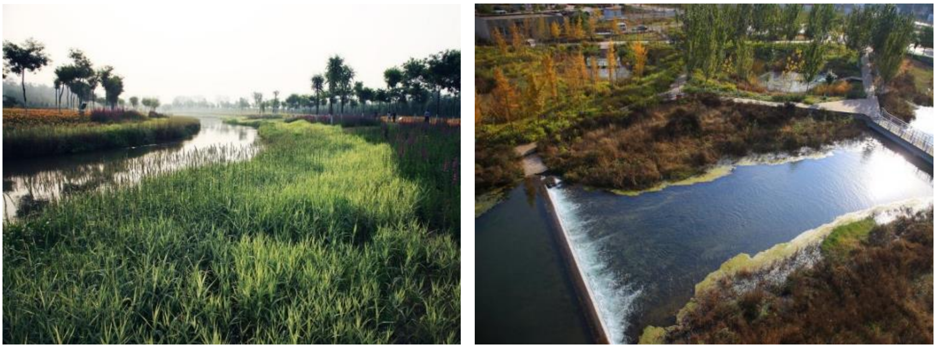

Figure 11: Stormwater ditches in Luan River (URL 27)

The 800-meter long red structure public art work, which zigzags along with the willow trees by the river, forming shade, seating and tables in different parts, draws attention with its continuity, color and functions (Figure 12).

Figure 12: The long red structure art work (URL 27)

Existing trees in the area were saved and the riverbanks were transformed into a series of tree islands connected by boardwalks. The project uses low-maintenance native vegetation, lush wetland grasses, self-propagating wildflowers, lush water grasses and wildflowers (URL 27) (Figure 13).

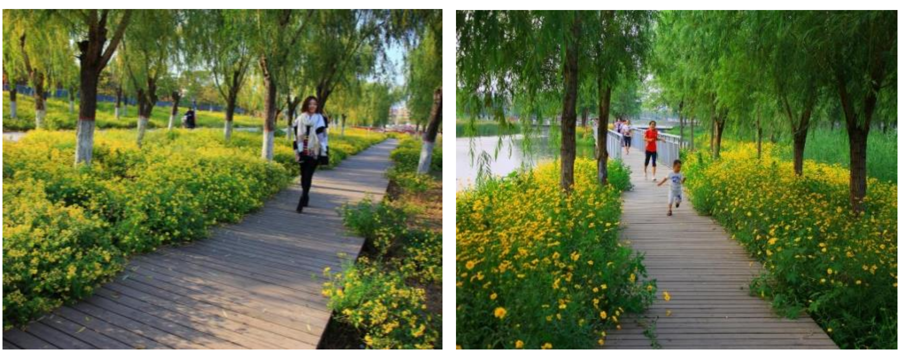

Figure 13: Waterfront walkways with existing plants and wildflowers in Sanlihe Greenway (URL 27)

3. Conclusion and Suggestions

The lands of landfills that have completed their useful life need to be restructured and landscape restoration studies need to be conducted. A landscape rehabilitation project shuld be consider improvements to the site to made it suitable for future end uses such as a public park. Reclamation is important in the case of landfill landscape rehabilitation, to transform it into a public park and to enable the development of a public park. At the beginning of the process, it is very important for a sustainable environment to plan for the future by taking into account the growth of cities and living spaces while considering the location of wild landfills. After the landfill function of such areas is completed, it is necessary to determine the rehabilitation stage and the purposes for which they will be used afterwards. Landfills should be made compatible with nature again, new functions should be given to these areas with appropriate uses, and landscape planning should be realized together with solid waste management.

With the implementation of landfill rehabilitation projects, the damage to the environment in terms of soil, air and water quality will be eliminated. It will also contribute significantly to environmental and urban health. While the projects will eliminate major environmental problems and improve the environment and quality of life, they will also serve the use of people with recreational activities in the designs.

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Urban Design Project Competitions: An Evaluation on Design Approaches and Sustainable Solutions

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1. Introduction

Today, with the increasing population and human needs, it is known that the majority of the population lives in urban areas due to job, education, social and cultural opportunities. In parallel with this, cities are in a constant process of change with intense human pressure. This process of change affects cities and people living in cities with their natural and cultural values. Therefore, in interventions to be made in urban areas where human needs, change and development are inevitable, the city must be considered as a whole and different professional disciplines must decide together. From this perspective, cities should be considered starting from planning to design and implementation. When we consider the subject from a design perspective, the concept of "designing the city" or "urban design" comes to the fore. Urban design studies, which are an interdisciplinary concept, can be carried out by private or public institutions, or the same institutions can organize competitions related to urban areas. Sustainable design approaches are expected in project proposals in these competitions.

The main purpose of the principle of sustainability in urban areas is to ensure that the urban landscape is transferred to future generations as a whole within a certain system. While doing this, it should reduce resource consumption to the maximum limit, protect ecosystems and human health, design healthy and livable urban environments or spaces that will serve users, provide comfortable and equal access to resources, spaces and services, protect cultural and social diversity and respond to the different needs of all this diversity in a holistic way (Acar, Gülpınar Sekban & Acar, 2017). Urban design studies should also be carried out from this perspective.

When looking at the relevant resources that include the evaluation of urban design project competitions and thoughts on this subject, it is seen that there are studies that generally include the theoretical framework of urban design and its reflection on competitions (Coza, 2024; Tuğcu & Vural Arslan, 2019), the status of competitions in the historical process (Eraydın & Yoncacı Arslan, 2021; Lipstadt, 2003), and the analysis of projects in terms of spatial, transportation, etc. through one or more competition projects (Çilli, 2024; Akçay, 2021).

This research focuses on examining urban design project competitions with an analytical approach to producing solutions for space in urban areas. The aims of the study are; to identify the problems in the competition areas and to determine the strategies and design approaches expected from the competitors for these problems in terms of landscape design. In this context, urban design project competitions that have been opened and concluded at the national level in our country in recent years have been evaluated. In the research, the contents of the competitions were examined, and the problems in urban areas and expected solutions were listed in line with the purposes of this research. Accordingly, it has been determined which design strategies and concepts are at the forefront in landscape design studies. In the light of these concepts and contents, evaluations were made on sustainable solutions. Thus, the study aims to provide a resource for the relevant disciplines on the design strategies used in recent urban design projects.

1.1. Urban Design and Competitions

Urban design, which encompasses a broad field, is not within the boundaries of a single discipline. Urban design is at the intersection of architecture, landscape architecture and urban planning. There are three general acceptances about urban design: urban design is a creative process, a collaborative and interdisciplinary process and a place-making process (Wall & Waterman, 2010). According to Lynch (1981), urban design is a discipline that covers a wide range of topics at different spatial scales (Özyılmaz Küçükyağcı & Yıldız, 2019). This situation, which requires diverse professional expertise, offers substantial benefits in terms of the exchange of ideas, the formation of idea pools, and the collective evaluation process leading to the identification of the most suitable solution for the field (Ünal, 2016). The concept of "Urban Design," which first entered the literature in the 1950s as a new urban approach in the United States, began to be used conceptually and operationally in Turkey starting from the 1970s. It spread within academic circles and was debated across various platforms in the early 1980s (Ayataç & Ketboğa, 2016).

Urban design project competitions are design processes that can be utilized as a project development tool; when holistically structured and effectively managed, they can produce the most appropriate spatial decisions for urban areas (Özyılmaz Küçükyağcı & Yıldız, 2019) and serve the public interest (White, 2014). Competitions are a method to obtain projects, and urban design is a tool to realize this method (Girginer, 2006). As in all project studies, there are project area boundaries in urban design competitions, but the proposed projects are expected to provide spatial solutions not only within these limits but also at higher scales and to offer ideas for more complex spatial problems. In urban design competitions, there are problems related to the functioning/living of an urban space. Therefore, we are faced with a whole range of spatial problems, each of which has different problems, at different scales, but which are interrelated. Moreover, in most urban design competitions, in addition to the project area definition, a larger impact area boundary that includes the immediate surroundings of the project is given, and solution proposals are expected within this framework (Erten, Çimen & Burat, 2005). In this context, the goal in urban design competitions is to produce solutions with a team to provide the functions expected from the project. The teams should primarily include landscape architecture, urban planning and architecture disciplines, and when necessary, disciplines with different expertise should be included depending on the subject of the project. The solutions presented are expected to be original, with up-to-date and innovative approaches that are suitable for current and future projections.

The competition environment also aims to reach the best with a competitive approach. This is a dynamic process where options are created with different perspectives and designs that meet expectations are selected and highlighted among the options. Producing spaces and having a say through competitions; as it enables interdisciplinary work, it develops the culture of working together, supports the development of original ideas, contributes to the recognition of designers by creating an environment where they can express themselves and demonstrate their talents, the resulting and shared products contribute to the education process of landscape architecture, architecture, urban planning and other related professions with their exemplary features, and the participatory process is also supported by competitions that allow the sharing of the resulting products with the user and the public to be given the right to choose from these options.

Common goals in competitions, mostly organized by municipalities, can be listed as creating the city image, revealing the city identity, ensuring the production of imaginative and symbolic values, providing economic, social and cultural benefits to the city, finding applicable solutions that will comply with historical architectural values with contemporary technology and artistic understanding, and encouraging fine arts (Girginer, 2006).

It is known that design competitions, which have existed for more than 2,500 years (Barallas & Budthimedhee, 2022), have been held since ancient times to select the designers of important public buildings and public spaces (Eraydın & Yoncacı Arslan, 2021). In Turkiye, the concept of competition first entered the field of architecture in 1930 with the “Bursa Municipality Market Hall Competition” (Ay, 2010). Later, since the early years of the Republic, it has been seen that competitions have played an important role in the spatial development of many cities (Eraydın & Yoncacı, 2021) and have been used as a tool in the transformation of public spaces that form the building block of urban identity (Toprakoğlu & Durak, 2020). Urban design competitions in our country have been on the agenda since the 1960s. Until the 1980s, competitions were held under names such as "environmental planning" and "building vicinity design" (Erten, 2016). The first competition in Turkiye to be officially titled "urban design" was the "Eskişehir Fair and Recreation, Entertainment, and Cultural Areas Urban Design Competition," organized by the General Directorate of İller Bank in 1981

(Eraydın & Yoncacı, 2021). Since then, the concept of "urban design" has begun to gain legitimacy through the institution of competitions (Erten, 2016). Until 1990, urban design project competitions of various scales were held in Turkiye, and the concept of urban design maintained its significance through these competitions from the 1980s into the 1990s. Between 1990 and 2000, the design of city squares and their surroundings became the main subject of urban design competition projects. The period from 2000 to the present has been marked by both an increase in the number of competitions and greater acceptance of these competitions as an interdisciplinary platform by a wider range of professional disciplines (Ayataç & Ketboğa, 2016). It is possible to come across important examples in world examples where competitions have shaped perspectives on the field of design and institutionalized urban design. The most well-known of these is the Parc de la Villette competition in Paris, which Bernard Tschumi won in 1983 (Erten, 2016).

A-Yeon (2022) analyzed the award-winning projects of 96 urban park design competitions in terms of design concept types and created a theoretical framework for landscape design concepts. Through literature review, five types of landscape design concepts were categorized into value and vision, analysis and interpretation, form and structure, program and element, and process and operation.

Girginer (2006) examined the urban design project competitions in our country between 1995 and 2005 and stated that urban design in the competitions was grouped in 4 dimensions (Table 1).

Table 1. Grouping urban design dimensions through competitions (Girginer, 2006).

Social Dimension	. Cultural . Historical	. Semantic . Psycho-social	. Symbolic/Imaginary . Urban identity
Physical Dimension	. Functional . Site Selection . Aesthetics/Image		. Infrastructural . Spatial Structure
Economic Dimension	. Reconstruction .Tourism development .Industrial development		. Regional development . National development
Environmental Dimension	. Ecological . Natural environment protection		. Recreation

Özer (2016) outlines the fundamental principles that urban design projects should adhere to in determining strategies for shaping urban spaces under three main headings. These are;

Creation of Spatial Identity: This refers to the way in which urban design projects generate a sense of belonging and spatial identity in the urban environment through the assembly of structures and groups of structures created according to common design principles/language.

Creation of Spatial Patterns: This refers to the process by which urban design projects integrate buildings, streets, green spaces, and public areas into a cohesive and meaningful whole.

Controlling the Formation of Space: Urban design projects and guides are important tools for managing the change of urban space with a design control for structures and groups of structures created with common design principles/language. It states that livable and identity-oriented spaces cannot be created with planning or design alone.

2. Material and Method

The primary material for the research consists of urban design projects that were announced and completed in the professional category nationally between 2000 and 2024, in accordance with the defined objectives. The competition projects were compiled from the internet platform containing announcements of urban design competitions in Turkiye (Arkitera, 2024a). In this context, 73 competitions were examined. Information about the examined competitions was compiled from the competition briefs published by the organizing institutions, jury reports regarding the competition results, and projects, reports, and visuals published by the participants. The competitions were analyzed based on the year (according to project submission dates), the subject area of the competition, issues related to the project area, and the solutions/strategies/design approaches/innovative practices expected from the participating teams. Additionally, the projects that received the first prize and the corresponding jury reports were examined to assess the project's concepts, landscape design strategies/concepts, and sustainable/innovative solutions. However, information related to these aspects was not available for some competitions.

3. Findings and Discussion

Within the scope of the research, 73 competition projects were examined according to the established criteria. The project areas of the competitions, as well as their content and functions, were categorized under seven headings (Table 2). In some cases, the name and scope of a competition indicated that it could fit multiple headings. In such instances, the competition was included under the group mentioned first in its name.

The Kadıköy Square – Haydarpaşa – Harem Surroundings Urban Design Project Competition was announced in December 2000, and the submission date was stated as April 2001. Therefore, no competition with a content suitable for the competitions within the scope of the research was encountered in 2000. When we look at the 73 competitions evaluated, the majority expect solutions at the design scale, while some expect a perspective from the planning scale to the design.

Table 2. Examined urban design project competitions

Year	Competition title (Competition subject heading)	Urban square / Street	Urban park and its surroundings/National park	Building's immediate surroundings/Courtyard	Waterfront/Water source immediate surroundings	Recreation area/Common living area/Neighborhood	Commemorative Space/Monument and Its Surroundings	University campus
2024	Balavca Stream and Its Surroundings as a Multi-Layered Natural and Cultural Living Corridor Concept Project Competition				■			
2022	Küçükçekmece Lagoon Basin Conceptual Design Competition				■			
	Istanbul Land Walls Topkapi Kaleici Square Urban Design Competition	■						
	5 Ocak Park and Surrounding Area Urban Design Competition		■					
2021	Şanlıurfa Kızılay Square and Urban Design Concept Competition	■						

	Antakya Köprübaşı Urban Square and Surrounding Area Urban Design Competition	■						
	Talas Nation's Garden and Cultural Center Urban Design Competition		■					
	Design Competition for a Memorial Space for Pandemics and Health Workers						■	
	Monument and Environmental Planning Project Competition for the Commemoration of Our Heroes on the 100th Anniversary of the Liberation of Gaziantep						■	
	Büyükada Fayton Square Urban Design Competition	■						
	Karaduvar Neighborhood Urban Design Competition					■		
	Design Competition for a Memorial and Appreciation Space for Healthcare Workers						■	
	Cumhuriyet Square and Atatürk Avenue Çamlıbel Urban Design Competition	■						
2020	Kayseri Talas Mevlana Neighborhood Square National Concept Competition	■						
	Kadıköy Square Urban Design Competition	■						
	Salacak Urban Design Competition				■			
	Bakırköy Republic (Freedom) Square and Surrounding Area Urban Design Competition	■						
	Uşak Municipality Pedestrianized Streets Architecture Urban Design Concept Project Competition	■						
	Taksim Urban Design Competition	■						
	Elbistan Municipality City Square and Surrounding Area, Pınarbaşı Recreation Area Urban Design Concept Competition	■						
	Meles Stream as an Urban and Ecological Spine National Urban Design Concept Project Competition				■			
	Istanbul is Yours Haliç Shores Design Competition				■			
	Olivelo – Ecological Shared Living Space Concept Project Competition on the Urban Periphery of İzmir					■		
2019	Akhisar Old Town Square and Surroundings National Architecture and Urban Design Idea Competition Through Traces of Urban Memory	■						
2017	Lüleburgaz Municipality Tosbağa Stream Recreation Area Concept Project Competition				■			

	7 Climates 7 Regions – Neighborhood National Architecture and Urban Design Concept Competition					■		
	Izmir Karabağlar Municipality Public Open Space and City Square Urban Design Project Competition	■						
	Elazığ Municipality City Square Urban Design and Architecture Project Competition	■						
	Bandırma Onyedi Eylül University Central Campus Urban Design Competition							■
	Bursa Osmangazi Municipality Çekirge Square Architectural, Urban Design, and Landscape Design Project Competition	■						
	May 19 Urban Design Competition						■	
2016	Adana – Seyhan Sucuzade Neighborhood Urban Transformation Area City Square and Surroundings Urban Design and Architecture Project Competition	■						
	Sivas Kızılırmak and Surroundings Concept Project Competition				■			
2015	Antalya Kepez Municipality Focus Building Architectural and Environmental Design Concept Competition			■				
	Gaziemir Aktepe and Emrez Neighborhoods Urban Transformation Area Urban Design and Architectural Concept Project Competition					■		
	Tekirdağ Metropolitan Municipality Service Building, Square, and Surroundings Arrangement Architectural and Urban Design Project Competition			■				
	Düzce University Konuralp Campus Development Plan Urban Design Competition							■
2013	Çanakkale Municipality City Square and Surroundings Arrangement "Green" Urban Design Project Competition	■						
	Kurbağalıdere Valley Concept Project Competition				■			
	Cumhuriyet Neighborhood Sports Complex and Recreation Area Project Competition					■		
2012	Uşak Municipality İsmetpaşa Street and Surroundings National Architecture Urban Design Concept Project Competition	■						
	Ödemiş Municipality City Center and Surroundings National Architecture and Urban Design Concept Project Competition	■						

	Bursa Metropolitan Municipality Orhangazi Square and Surroundings Urban Design Project Competition	■						
2011	Afyonkarahisar Cumhuriyet Square and Surroundings National Architecture and Urban Design Concept Project Competition	■						
2010	İzmit Shoreline Landscape and Urban Design Project Competition				■			
	Zonguldak Lavuar Protection Area and Surroundings Protection, Planning, Urban Design, and Landscape Arrangement Project Competition			■				
	Edirne Municipality Selimiye Mosque and Surroundings National Urban Design Project Competition			■				
2009	Denizli Government Building Architectural Project and Surrounding Urban Design Project Competition			■				
2008	Adana Metropolitan Municipality Ziyapaşa Neighborhood Mimar Sinan Park Section Urban Design National Project Competition		■					
	Uludağ National Park Development Areas I and II Landscape Planning, Urban Design, and Architectural Project Competition		■					
	Küçükçekmece District City Center National Urban Design Project Competition	■						
	Adana Metropolitan Municipality City Square and Surroundings Urban Design Project Competition	■						
2007	Antalya Metropolitan Municipality Konyaaltı Nature and Culture Park Area Architectural and Environmental Arrangement Project Competition		■					
	Başakşehir City Center Phase II National Urban Design Project Competition	■						
	Dicle Valley Landscape Planning, Urban Design, and Architectural Project Competition		■					
2006	Bursa Kızyakup City Park Urban Design and Architectural Project Competition		■					
	Ünye Cumhuriyet Square – Yunus Emre Park Urban Design Project Competition		■					
	Izmir Konak Municipality Uzundere Recreation Valley Project Competition					■		
	Beylikdüzü Cumhuriyet Avenue and Surroundings Urban Design Project Competition	■						
2005	Bursa Yıldırım Municipality Kaplıkaya Recreation Valley Urban Design and Architectural Project Competition					■		

	Gebze Historical City Center Urban Design Concept Project Competition	■						
	Architects Chamber 50th Anniversary Park Project Competition		■					
	Konyaaltı Municipality City Square Urban Design Concept Project Competition	■						
	Van – Beşyol Square, Hastane Street, Milli Egemenlik Street, and Surroundings Urban Design Project Competition	■						
2004	Gaziosmanpaşa Municipality Service Area Architectural and Urban Design Project Competition			■				
	Old Başiskele Bridge Junction Transportation System and Environmental Arrangement Concept Project Competition	■						
	Pananos Beach Urban Design and Landscape Project Competition				■			
2002	50th Anniversary Park and Martyrs' Monument Complex Urban Design, Landscape Architecture, and Fine Arts Architecture Project Competition		■					
	Antalya Historical Karaalioğlu Park Municipal Building and Surroundings Urban Design and Conservation Project Competition			■				
	Ankara Kuğulu Park and Surroundings Project Competition		■					
2001	Ankara Gölbaşı Special Environmental Protection Area Regional Park and Surroundings Urban Design and Landscape Project Competition		■					
	Bursa Culture Park and Surroundings Planning and Design Competition		■					

According to the number of competitions, the first 3 categories are urban square/street (29), urban park and its surroundings/national park (14) and waterfront/water source immediate surroundings (10). When the distribution of the number of competitions by year is examined, it is seen that the most competitions were opened in 2020 (10). There were 9 competitions in 2021 and 7 in 2017. The number of competitions in other years is given in table 2.

3.1. Problems and Expectations in Urban Areas

When it comes to a project in an open space, either no work has been done in this area before or there is an existing application but some problems have been encountered over time. It is expected that these problems will be solved with the project to be done. At this point, in order to achieve the expected goals with the project, it is necessary to first analyze and know the area very well in every aspect, to identify and understand the current problems. As expressed by Erkan Kaya & Serim (2016), “Physical and intellectual production activities on urban space will only be possible if the person makes sense of the city.” In the research conducted, the primary focus was on the competition briefs, specifically the issues related to the project areas and the expectations from the teams, thereby considering the objectives of the competitions. When these issues and the anticipated solutions are evaluated collectively, they also highlight the problems faced by urban open spaces with different functions today. It is possible to produce solutions to these problems with urban design studies. At the same time, it is also possible to take precautions and develop perspectives with possible scenarios before problems arise in future studies. Therefore, this research also aims to draw attention to the considerations that need to be addressed at the very beginning of the design process for spaces with varying functions. Each project area and its specific functions within the scope of urban design carry unique expectations. Additionally, within the context of the competition, similar project areas may present considerations that need to be addressed during the design process, thereby outlining the expectations from the project. In this context, when examining the briefs of the competition projects, the objectives, issues, and expectations from the projects, categorized under seven main themes, can generally be summarized under the following headings:

Urban Square / Street: The problems identified in these competition areas include:

• Insufficient utilization of the area's existing potential

• Loss of the area's identity

• Disconnection within the green space system

Within this context, the objectives of the competitions include:

• Revealing the historical identity of areas that, either independently or through the structures they contain, hold national and international protection status but have diverged from their original functions and are now used for different purposes, while also enhancing their public utility.

• Preserving and sustaining all tangible and intangible values.

• Uncovering the existing potential of the competition area.

The expectations from the competitors have been outlined under the following headings:

- Increasing the use of open spaces
- Considering multi-layered relationships
- Establishing a strong identity for the square
- Developing scenarios that will carry the memory of the space into the future
- Preserving cultural landscape values

- Establishing relationships across different scales
- Designing transportation systems for vehicles, pedestrians, and bicycles
- Balancing the use of structural and natural elements
- Creating readable designs that highlight and enhance the area's identity by evaluating its existing potential
- Respecting the silhouette value of the area
- Creating connections between the proposed open and green spaces within the competition area and those in the surrounding areas
- Developing proposals that support positive social transformation through scenarios generated within the project area
- Establishing connections with existing and proposed uses in terms of transportation, functions, etc.
- Transforming the square into a focal point, supported by cultural and social activities
- Making the area vibrant throughout the day and year by integrating cultural, social, and commercial functions
- Addressing social life, spatial memory, transportation, and the natural and built environment
- Designs are expected to consider the following design criteria;
  - Continuity of spatial perception
  - Spatial comfort and safety
  - Diversity for different user groups
  - Legibility
  - Aesthetics
  - Flexible use
  - Public space strategy and functional proposals
  - Planting, water management, lighting, transportation strategies, and energy efficiency
  - Adoption of sustainable and innovative approaches
  - Resilience
  - Accessible
  - Feasible and cost-effective solutions
  - Support for biodiversity

- Accessible/universal and inclusive design strategy
- Square usage strategy and operation/event management

Urban park and its surroundings/National park: Generally, based on the issue of the competition area having lost its identity over time, the objectives for competitions in this category are expressed as follows:

- Creating high-quality, site-specific, and contemporary open public spaces
- Establishing a cultural hub within the city's public life
- Enhancing urban quality of life
- Creating a high-quality social environment
- Formulating design principles aimed at improving the national park area in terms of ecology, aesthetics, functionality, and economics while maintaining a balance between conservation and utilization.

In this context, the expectations from the competitors are listed as follows:

- Establish connections with the use of open spaces in the surrounding area
- Develop site-specific spatial scenarios
- Propose recreational potential that facilitates healthy living activities
- Offer a variety of activities that reflect the cultural identity of the city
- Develop transportation scenarios
- Design a legible, well-defined, and planned relationship between pedestrian, vehicular, and green spaces, integrated with the city.

Building's immediate surroundings/Courtyard: The objectives of competitions in this category are as follows:

- Designing a focal structure or group of structures and their surrounding areas in a way that strengthens the city’s identity, leaves a lasting impression, and contributes to the quality of urban life, while also meeting the recreational needs of the city's residents.

• Ensuring the preservation of structures and their surrounding areas recognized as industrial heritage or similar, and enabling their transmission to future generations through conservation, planning, urban design, architectural, and landscape design efforts.

• Creating spaces that positively contribute to the city's image, enhancing its visual and physical quality.

The expectations from the competitors in this context are as follows;

• Contributing to the city’s identity

• Enhancing natural and cultural values

• Developing solutions that adhere to sustainable design principles

• Approaching the project area and its surroundings with a holistic perspective

• Creating solutions to regulate transportation

• Integrating the architectural program with the activity program of the surrounding area

• Proposing solutions to connect the surrounding structures and historical environment, and addressing any inconsistencies

• Designing according to universal/inclusive design and accessibility principles

• Developing original proposals related to social and cultural amenities

• Establishing relationships between public and private spaces

• Generating solutions for registered buildings and their surroundings that reference the city's history, culture, and social life

• Enriching the city’s social and cultural activities

• Enhancing the spatial and visual quality of the city and contributing to its image

• Considering the competition area in its entirety, including its surroundings

• Preserving the city’s natural and cultural heritage

• Creating scenarios that are safe, comfortable, offer a variety of activities, and are suitable for use at different times

• Undertaking conservation, improvement, repair, restitution, and restoration works related to the competition topic.

Waterfront/Water source immediate surroundings: The problems related to the competition areas under this heading are;

• The water source involved in the competition has lost its connection with the city, as well as its naturalness and visibility.

• The water source faces infrastructural, environmental, and spatial problems.

• Parts of the water source are covered, obstructing its flow.

• The water source is not integrated into urban life.

• Objectives of the Competitions:

• Ensuring the sustainability of the water source at various scales

• Developing ideas to integrate different regions of the city socially and spatially

• Designing the water source as a living corridor and habitat

• Combining ecological restoration, rehabilitation, and improvement methods with design

• Addressing the multi-layered nature of the competition area while maintaining ecosystem integrity and diversity in all its components

Expectations from competitors:

- Addressing the topic from historical, cultural, spatial, ecological, and social perspectives
- Strengthening the historical continuity of the water source
- Interpreting the vital value of the water system within the urban context
- Repairing and ensuring the sustainability of the water source in light of climate change
- Improving the relationship of flora, fauna, the city, and users with the water source
- Developing daily life scenarios that consider the water source as a living space
- Producing solutions that contribute to and enhance the value of the water source and its surroundings
- Reimagining the relationship between the city and water and soil
- Developing a holistic system that reveals the natural, cultural, and, if applicable, archaeological landscape values of the water source
- Integrating the water source and its surroundings within the ecosystem's integrity
- Resolving pedestrian, vehicular, and bicycle transportation systems

Recreation area/Common living area/Neighborhood: The objectives of these competitions can generally be grouped under two headings;

- Developing uses that reflect the character of the neighborhood in light of historical and urban developments through sustainable methods
- Producing solutions that account for the use by all social layers
- Expectations from competitors;

• Development of high-quality, feasible, original, sustainable, flexible, and nature-respecting solutions

• Establishing connections across different scales

• Improving transportation options

• Revitalizing interaction spaces

Commemorative Space/Monument and Its Surroundings: The purpose of these competitions can be expressed as "developing artistic and design proposals to narrate historical heritage and stories, and to keep social memory alive by honoring the dedication and heroism demonstrated."

Expectations from competitors;

• Developing a comprehensive narrative for the competition area in terms of urban scale and context, focusing on memory and space

• Enhancing and strengthening public space relationships and their continuity, and considering spatial relationships

• Expressing and developing scenarios related to commemoration practices and their connections with the urban context and public life

• Incorporating ecological systems, flora and fauna, and climate crisis conditions into the developed scenarios

• Ensuring adherence to universal design criteria

University Campus: The objectives of the competitions and the expectations from competitors in this context are as follows;

• The campus planning and design should be shaped with a visionary approach to the university's institutional development.

• The Campus Development Plan should address the entire campus, including undeveloped areas and forested zones, propose an open space structure, develop an architectural language for new buildings, and encompass various scales of open/closed/semi-enclosed activity areas.

- The area, which serves as a significant habitat for vegetation and wildlife, should be considered for its potential to support recreational activities during leisure times.
- The balance between conservation and use must be maintained, with expectations that the campus will serve its users and provide opportunities for students in terms of science and education.
- The 'Campus Development Plan' should aim to create interconnected social learning environments that influence one another.
- The physical conditions of the area should be considered to meet the needs of all users, not just for research and education.
- The campus should also be considered for its potential as a social, cultural, and recreational focal point for the city.
- Connections with the surrounding area for pedestrians, cyclists, and vehicles should be planned.
- The needs of disadvantaged groups should be taken into account.
- The resulting Master Plan should reflect the university's future goals and address future projections.
- The design should also consider the relationships between the campus, its immediate surroundings, and the city.
- Concepts of city, education, and campus should be considered from perspectives that are accessible, innovative, sustainable, youth-friendly, and sensitive to disadvantaged groups.

- The design should incorporate approaches such as the use of renewable energy, smart buildings, smart transportation systems, and principles of accessible, flexible, and modular campus design.
- Alternatives should be discussed in terms of the holistic design of the campus, innovative educational approaches, formal-informal-lifelong learning interactions, synergy among university internal and external stakeholders, transportation-circulation, building-public space relationships, and functional harmony at the urban design scale.

According to the competition specifications, when examining the stated objectives, problems, and requirements for competitors, it can be argued that certain criteria should be considered independently of the competition topic during the planning and design processes. In other words, some criteria can be regarded as essential for every project. For example, "Considering the competition area as a whole in relation to its surroundings" and "Providing high-quality, feasible, original, sustainable, flexible, and nature-respecting solutions," among others. The aim of this research is to ensure that these criteria are considered from the very beginning of the process, beyond the scope of the competitions.

3.2. Approaches and Proposed Solutions of The Award-Winning Projects

In the study, alongside the specifications of the competition projects, the projects that received awards were also examined. In this context, it is observed that awards are distributed as 1st, 2nd, and 3rd Prizes or equivalent awards, 1st, 2nd, and 3rd Honorable Mentions (or more) or equivalent mentions, and purchase awards. This research focuses on the most recent competitions in the categories determined according to the competition topics, specifically the 1st Prize-winning projects and the jury reports. These projects have achieved the expected goals of the competition with the most desired and innovative ideas. The positive aspects noted in the reports are significant for indicating the expectations.

Urban Square / Street: In the 2022 "Istanbul Land Walls Topkapi Kaleici Square Urban Design Competition," the project that won the 1st prize approached the urban space through the concept of "Palimpsest" (Şekil 1) (Arkitera, 2024b).

Figure 1. Images of the Istanbul Land Walls Topkapi Kaleiçi Square Urban Design Competition 1st prize project (Arkitera, 2024b).

The high-level strategic objectives proposed are as follows;

- Incorporation of the square into a transportation system focused on pedestrians, bicycles, and public transit
- Integration of natural water routes, green spaces, and green corridors
- Ensuring the continuity of pedestrian-focused squares and integrating them with open green areas and amenities
- Facilitating the role of the square and its surrounding area within the blue-green system necessary for urban and district-scale planning
- Achieving climatic comfort through planting, enhancing ecological diversity, contributing to sustainable water management, and improving urban resilience

- Establishing connections between tree-lined streets and other public green spaces to ensure continuity of the green system
- Energy-efficient landscape design
- Water management
- Development of a phone-compatible digital application/Topkapi: A next-generation urban experience

In the project, five focal points and four routes have been established.

- The focal points are: Intangible Heritage (Traditional Food/Gastronomy Focus), Historical Commemoration/Remembrance, Revitalization of Production Culture, Art/Education, and Culinary Culture/Daily Life.
- The routes are: Monumental Architecture Route, Monumental Grave/Tomb/Mausoleum Route, Fountain Route, and Cultural Route.

Urban agriculture is among the proposed solutions in the project for enhancing the city's resilience against ecological crises within sustainable urban policies. Additionally, it is considered significant for increasing the city's resilience to ecological crises by reducing the carbon footprint due to the shortening of the distance between urban residents and their food supply.

Urban park and its surroundings/National park: In the 2022 "5 Ocak Park and Surrounding Area Urban Design Competition," the concept of the project that won the first prize was designated as "Orange" (Figure 2) (Arkitera, 2024c).

Figure 2. Images of the 5 Ocak Park and Surrounding Area Urban Design Competition 1st prize project (Arkitera, 2024c).

The aim of the project proposal's approach to the space is to reverse the planned urban development of this region of Adana, which is characterized by quality buildings and vehicle accessibility but is not pedestrian or nature-friendly. The goal is to create a contemporary, pluralistic, diverse, inclusive, disability-friendly, democratic, resilient, nature-friendly, and high-quality urban space by integrating it with a public space that offers equal opportunities for all segments of the city.

The higher-scale strategies in the project are addressed under the following headings: Transportation, Disaster and Emergency strategies, Climatic comfort, Risks and strategies for pedestrian comfort in the competition area, Integrated landscape management (Ecological resilience, Social resilience), Park program, and Landscape characteristics. The planting design considers species suitable for valley ecology and aims to treat the study area as an ecological corridor. The proposed trees in open spaces are intended to reduce rainfall velocity and surface runoff, and prevent erosion caused by slopes. Additionally, it aids in reducing the urban heat island effect through evapotranspiration. Ecological landscape strategies for rainwater management have been developed. In this context, a more robust pedestrian environment is created through environmentally sensitive landscape strategies such as permeable paving, rain gardens, and the use of local species. To prevent flooding during heavy rainfall, a system consisting of rain gardens is proposed to direct surface runoff to collection areas, allowing as much of the accumulated rainwater as possible to infiltrate the soil and flow into the stream. Additionally, a digital application, "Turuncu App: Adana’s Digital Interface," compatible with contemporary technological advancements, has been proposed.

Building's immediate surroundings/Courtyard: In the "Antalya Kepez Municipality Focus Building Architectural and Environmental Design Concept Competition" completed in 2015, the proposed "focus building" in the first-place winning project presents a "new urban image" at one of the city's most prominent locations. (Figure 3) (Arkitera, 2024d). The building symbolically represents the open form of a crown. It is described as "a crown adorned with nature and the city." The proposed design gains significance in terms of respecting natural formations, considering environmental data, sustainability, and harmony with nature.

Figure 3. Images of the Antalya Kepez Municipality Focus Building Architectural and Environmental Design Concept Competition 1st prize project (Arkitera, 2024d).

Land use decisions are addressed under four headings: Urban Interface (City Park), Spine (Main Backbone), Flexible Use (Festival Meadow), and Natural Area (Creating a Context for the Focus Building). Structural decisions concerning urban image and impact are considered within the contexts of the Immediate Surroundings, Park Scale, and City Scale.

Waterfront/Water source immediate surroundings: In the "Balavca Stream and Its Surroundings as a Multi-Layered Natural and Cultural Living Corridor Concept Project Competition" completed in 2024, the first prize-winning project (Figure 4) proposed solutions according to the following headings (Arkitera, 2024e);

• Continuity of water from capillary to Stream

• Transformation of the limited stream within the concrete channel into a public spine

• Pedestrianized stream edge – Recreational axis

• Stream and its extensions – Integration of the shoreline and the city

• Differentiated shoreline uses

• Shoreline components – Varied interaction forms with the stream

Figure 4. Images of the Balavca Stream and Its Surroundings as a Multi-Layered Natural and Cultural Living Corridor Concept Project Competition 1st prize project (Arkitera, 2024e).

In the awarded projects of the competition, the jury recognized the following aspects as successful: socio-economic sensitivity considering different user groups, flexible and holistic spatial configurations, shoreline typologies, stream ecosystems and biological diversity, support for production through agricultural approaches, public use proposals integrating with the stream, green infrastructure strategies, disaster/climate change sensitivity and corresponding projections, hydrological analyses, and water management approaches.

<u>*Recreation area/Common living area/Neighborhood*</u>: The concept of the first prize-winning project in the "Karaduvar Neighborhood Urban Design Project Competition" completed in 2021, was designated as "Trace-Karaduvar" (Arkitera, 2024f). The project proposal includes a modular system for residential and commercial areas, referencing the existing fabric by tracing traces across different urban layers in the spatial design. (Figure 5).

Figure 5. Images of the Karaduvar Neighborhood Urban Design Project Competition 1st prize project (Arkitera, 2024f).

The project envisions five focal points: the Karaduvar welcome center, the Karaduvar community center, Prestige avenue and Gastronomy axis, the Karaduvar agriculture and Aquaculture institute, and the Karaduvar bazaar. These focal areas propose uses related to production, tourism, and socio-cultural activities, all of which are based on existing traces. Additionally, solutions have been developed in the areas of sports and recreation, transportation and accessibility, and energy. The sustainable solutions considered in the project are listed below;

- Regulate traffic to prioritize pedestrian and bicycle access on existing vehicular routes
- Considered the use of materials, fixtures, and technologies in public spaces to promote energy conservation
- Ensured that the transportation system and building layouts are designed to maximize energy efficiency
- Incorporation of solar panels in buildings and urban furniture
- Rainwater collection, storage, and utilization
- Recycling stations
- Composting facilities and networks
- Biogas energy institution

Commemorative Space/Monument and Its Surroundings: In the 2021 "Design Competition for a Memorial Space for Pandemics and Health Workers" the project awarded first place was themed "Goodness." The project’s awareness was defined under the titles "Being in harmony with nature" and "Gratitude to the unsung heroes of the pandemic, the healthcare workers" (Figure 6) (Arkitera, 2024g).

Figure 6. Images of the Design Competition for a Memorial Space for Pandemics and Health Workers 1st prize project (Arkitera, 2024g).

Given that the competition is centered on a memorial space, the project's conceptual dimension was considered more prominent. The main circulation axis of the project, the "Memorial Route," was designed inspired by the wave patterns of epidemic graphs. Additionally, the project emphasizes three fundamental criteria for the structural landscape: sustainability, permeability, and resilience. The design is structured to support coexistence with all forms of life.

University Campus: In the 2017 "Bandırma Onyedi Eylül University Central Campus Urban Design Competition" the first-prize winning project aimed to plan the university's departments within a cohesive system and develop a flexible design framework that would reflect the traces of its future development (Figure 7) (Arkitera, 2024h).

Figure 7. Images of the Bandırma Onyedi Eylül University Central Campus Urban Design Competition 1st prize project (Arkitera, 2024h).

The design decisions led to the development of a campus design scenario that is holistic, balanced, and incorporates the values of its geographical context, encompassing ecological, social, and cultural infrastructure. The relationship between the city and the campus has been considered. According to the fundamental approach of the design, site data and land conditions were assessed, and a pedestrian-focused campus concept was adopted.

The spatial organization has been considered under the following headings: Main spine (Pedestrian promenade), Plaza/Sub-Plaza hierarchy, Expansion axes: Culture-Science-Sports, Focus areas (Living spaces-Social infrastructure), University units, and Courtyard-Interior garden open space systematics.

The ecological infrastructure has been addressed under the following headings: Passive & Active green space relationship, Aquatic areas: Stream rehabilitation and Pond formation-Pools, and Energy: Rainwater harvesting, Wind turbine-Solar panel field.

4. Conclusion and Suggestions

The development of new open space proposals in urban areas, the functional transformation of existing uses, or the creation of new solutions and ideas for places that have lost their identity and urban space quality over time due to various factors, is inevitable. In this context, competitions serve as significant tools, especially in public spaces, for generating options that are innovative, original, ecologically sustainable, economically viable, and prepared for future scenarios while adhering to the design approach for all.

In our country, many project sites have been opened to competitions within this scope for many years. Competition projects not only provide solutions for the specific area but also serve as a valuable resource for professionals working in the field and for the educational process of related professions. This research aims to evaluate national urban design project competitions in our country from this perspective.

Each project site should be evaluated based on its unique natural and cultural potential, the meaning and value it contributes to the city, its connections due to its location, and its place-specific culture and identity. However, every previous project has the potential to serve as an example. This is because within the design process, it is essential for the designer(s) to thoroughly analyze theoretical and/or practical studies related to the subject. At this point, it is believed that the evaluations made based on the competition project specifications examined in this research will serve as an important resource for future work.

Competitions should not only address the use of public space for today but also consider strategies for its future use. In this context, the concept of "design guidelines" becomes crucial. While the specific requirements in design guidelines may vary depending on the competition, the common objective is to develop life scenarios for the area in question. When the topic involves shaping the city and urban space through design, creating these scenarios is possible by conceptualizing through an understanding and interpretation of the city's physical, social, and cultural components (Erkan Kaya & Serim, 2016).

Based on the evaluations of the awarded projects, it is possible to identify key themes that should be addressed in urban design projects. The following topics emerge as significant in the design process;

- Context and identity/Memory in relation to the project site and theme,
- Design concept/Conceptual approach,
- Design principles and strategies,
- Public space usage scenarios and strategies,
- Integrated landscape management perspective, including resilience approaches, climate comfort aligned with future scenarios, disaster resilience, and water management,
- Supporting biodiversity with a focus on flora and fauna,
- Efficient use of natural resources, balancing conservation and use, with sustainable and ecological solution proposals,
- Solutions supporting production and commercial uses for public benefit,
- Digital usage proposals compatible with modern technologies.

These aspects can be categorized under three main headings: semantic, syntactic, and pragmatic. Each of these topics can be included in the design process and applied with original details from concept to implementation.

Due to the large number of urban design competition projects considered in this study, the evaluation was conducted primarily on selected award-winning projects. This may be regarded as a limitation of the research. Future studies could focus on evaluating each competition category and its results independently. Similarly, the content, approaches, and innovative solutions of award-winning projects within specific categories could be analyzed in detail using tables and graphs. These proposed studies would serve as valuable resources for both theoretical and practical urban design projects and related research.

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Integration of Cultural Landscape Values and Preservation of Industrial Heritage

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1. Introduction

Urban culture, which is the accumulation of material or intangible values carried by urban dwellers from past to present, is the sum of what history and nature have contributed to the city. Industrial structures that have witnessed significant parts of history reflect the traces of their respective eras through their architectural style, spatial design, and environmental relationships. Often located in city centers, industrial buildings stand out with their large interior spaces, structural characteristics, and flexible design potentials. Erdem et al. (2022) describe these areas as encompassing manufacturing facilities, factories, transportation networks such as railways and bridges, stations, and power source operations, which are social and technological products produced with new technology. The reuse of industrial buildings that have completed their functional lifespan or those with unique character but limited development potential within the cultural landscape is defined by the concept of "industrial heritage buildings." This concept is based on the principle of reusing these structures without destroying the traces of their initial function and creating new identities for them. Consequently, projects are being developed worldwide using new methods that are widely accepted, and special design decisions are being made for the adaptation of new identities to the region. As they are regarded as a significant element of cultural heritage, they are often transformed globally to serve cultural and artistic activities. In addition, they are refunctionalized through various commercial or tourism-oriented activities.

At this point, the adaptive reuse of cultural heritage comes into play. In this way, it can contribute to sustainable development and the circular economy, extend the life of heritage sites, and prevent waste production and resource depletion. According to ICOMOS, adaptive reuse is an accepted strategy for protecting cultural heritage. "Adaptive reuse" refers to the process that extends the useful life of heritage by providing it with (new) use, thereby preserving it. It is a multidisciplinary, multi-stakeholder process that can contribute to sustainable development and circular cities (Pintossi, 2023).

1.1.The Concept of Industrial Heritage

In the mid-twentieth century, with the decline and transformation of traditional industry, Western European countries entered a post-industrial era and began taking steps to preserve their industrial heritage (Zhang et al., 2020). During this period, both technological advancements that affected industrial processes and the devastating impact of World War II rendered many industrial sites non-functional and abandoned. People perceived these industrial areas as opportunity spaces for new developments. Consequently, after the war, many industrial regions in Europe underwent rapid redevelopment. These areas were, in fact, considered heritage. The awareness of industrial heritage was first introduced in the 1950s in England, the birthplace of the Industrial Revolution (Aydın et al., 2022). The preservation of old industrial structures and the recognition of the international significance of industrial monuments and sites brought the concept of 'industrial heritage' to the forefront (Andrade et al., 2024; Gürcanlı et al., 2024). Particularly after the 1960s and 70s, the remaining heritage values of industrial society and culture began to be evaluated from different perspectives, raising awareness of industrial heritage values (Saraylı & Reyhan, 2022). Transforming an old industrial facility into a tourist attraction is one of the most effective ways to preserve heritage (Naramski et al., 2022). Industrial heritage buildings have gained increasing popularity worldwide as adaptive reuse for residential, commercial, or public purposes has become a viable and fashionable option. Such redevelopment projects often require a complete structural assessment and building survey to identify the conditions and heritage values that will form the basis for subsequent design phases and conservation management plans (Haupt, 2023).

The number of examples of conservation and adaptive reuse in industrial heritage began to increase after the 1970s. One of the most important organizations interested in this issue is ICOMOS, the International Council on Monuments and Sites, established in 1965. Today, ICOMOS has national committees established in many countries. Its purpose is to develop principles and policies for the conservation and evaluation of historical monuments and sites. According to ICOMOS (2013), the concept of industrial heritage is defined as “buildings where industrial production processes took place and/or structures produced with the technology of the industrial revolution. Industrial heritage consists of disused buildings, production equipment, building components, and settlements along with the natural and urban landscapes in which they are located” (Erdem et al., 2022). Another significant international organization created for the purpose of researching, documenting, and conserving these areas is TICCIH, The International Committee for the Conservation of Industrial Heritage. Another important institution in this field is the European Route of Industrial Heritage (ERIH), a European network aiming to promote industrial heritage by establishing routes and networks among sites that exemplify industrial heritage in Europe (Saner, 2012). For an industrial site to be included in the ERIH route, it must meet several criteria, such as having significant weight in Europe's industrial history, possessing unique testimonial value as industrial heritage, having high historical value, showing development potential, being a place where adults and children can gain historical knowledge, having competent staff to inform visitors, offering a good experience for the whole family, and having a qualified tourism infrastructure in its vicinity (Köksal, 2005).

In the literature, it is suggested that industrial heritage undergoes changes and potential renewal in three stages: territorialization, deterritorialization, and reterritorialization. At the beginning of territorialization, industrial sites are identified as significant heritage resources and preserved as manifestations of local history. Territorialization thus transforms historical experiences and post-industrial images into urban redevelopment areas, converting them into consumption strategies. Deterritorialization refers to the stage where tourism forces inject new meanings and values into urban transformation. It is a concept that includes the process of changing and diminishing the traditional meanings and roles of space and boundaries. The final stage, reterritorialization, indicates the emergence of the redesign of industrial landscapes for the use of creative industries (Xie, 2015). In summary, reterritorialization refers to the process of a region or place gaining new meaning, identity, and function after the deterritorialization process.

Cimino (2009) suggested that industrial landscapes should be valued and protected as much as any other category of heritage, that conservation should be a generative act, that they should reveal the layers of their history, and that they should be managed in a way that attends to their dynamic nature. Szromek et al. (2021) define industrial heritage as a unique type of heritage related to the industrial past of a region. They state that many modern cities still house remnants of old industrial functions like factories and mines, permanently altering the urban landscape. They argue that these structures are traces of human history documenting technological and technical progress, naturally arousing tourists' curiosity and serving as a source for their cognitive needs.

Industrial heritage sites are highly complex structures that are an important part of our social, spatial, cultural, and technological history. A significant feature of industrial heritage sites is their complexity, which complicates the conservation process and sustainable revitalization (Ifko, 2016). An example of this can be seen in the area established by Norsk Hydro for the production of synthetic nitrogen fertilizer. In 2015, the Rjukan-Notodden Industrial Heritage Site was declared a UNESCO World Heritage Site to protect the industrial landscape. In this region, which has structures in very different functions and architectural styles, some hydroelectric power plants are still operational, and almost all industrial buildings are still in use (Haupt, 2023). Choosing a new function for industrial buildings is quite challenging. Stereotypical adaptive reuse practices can sometimes result in the complete loss of the buildings' identities. Current conservation approaches emphasize that the conservation action should primarily form the physical, economic, and social foundation, arguing that these structures are valuable only when preserved along with their historical values and identities, not just structurally and/or physically (Güngör & Gökçen, 2022).

1.2. Concept of Industrial Tourism

Industrial heritage areas, which have evolved into tourism destinations, are defined by various terms, such as post-industrial tourism, industrial tourism, industrial objects, cultural tourism, and industrial heritage tourism. However, the most commonly used term is "industrial tourism." Some researchers propose to separately address industrial tourism and post-industrial tourism. According to this approach, industrial tourism refers to touristic activities conducted in active production facilities for educational and cognitive reasons, while post-industrial tourism involves travels to decommissioned facilities and former industrial areas (Szromek et al., 2021).

The transformation process of a former industrial facility into a tourist attraction is complex and varies from region to region, as each case is unique in its own way. In a study by Naramski et al. (2022), a general classification was proposed, distinguishing three main types of industrial heritage tourism initiatives and their subtypes:

1. Post-Production Tourism Organizations: These refer to former industrial facilities that have ceased production before opening to tourists and currently serve only as tourist attractions. Subtypes include:

- **Post-Production Tourism Organizations with Changing Tourism Functions**: These organizations once overlapped production and tourism functions before becoming solely tourist attractions without any pause between the two functions.

2. **Production and Tourism Enterprises**: This type includes facilities that continue their primary production function but also offer historical production tours where visitors can experience traditional crafts.

- **Production and Tourism Enterprises with Dominant Tourist Function**: These enterprises mainly function as tourist attractions while still maintaining some level of production.
- **Production and Tourism Enterprises with Resumed Productive Function**: These enterprises have restarted their production functions to meet tourist demand while maintaining their historical significance.

3. **Tourist Thematic Organizations**: These are tourist sites that were never production facilities but were created for tourism purposes from the beginning. They might include exhibits or collections related to industry in non-industrial buildings.

- **Tourist Thematic Organizations with Emergent Productive Function**: These sites, created in places without a production history, have developed a production function in response to tourist demand, similar to production and tourism enterprises but without a historical production background (Naramski et al., 2022).

The diverse forms and functions of industrial tourism reflect its adaptability and potential to preserve and repurpose industrial heritage while engaging visitors in the historical, cultural, and technological narratives of these sites (Naramski et all., 2022).

1.3. Effects of Industrial Buildings and the Restructuring Process

The transformation of industrial structures through the restructuring process, when evaluated from a cultural perspective, is a multifaceted process with significant impacts and dimensions. This transformation profoundly affects the socio-cultural fabric of cities and communities. As Gürcanlı et al. (2024) have stated, industrial heritage renewal and restoration projects can have important social, cultural, and spatial impacts by revitalizing communities, preserving cultural identity, and promoting sustainable development.

1.3.1.Preservation of Historical and Cultural Heritage

Projects for the adaptive reuse of industrial structures not only involve the transformation of old industrial buildings into functional spaces but also demonstrate a model for sustainable economic development while preserving historical elements (Xie, 2015). Industrial structures reflect the architectural, technological, economic, and social fabric of their respective periods. The primary preservation and adaptive reuse of these buildings help maintain connections to the past and facilitate their transmission to future generations, thereby strengthening communities' historical consciousness.

It has been proven that effectively salvaging industrial structures preserves not only their physical forms but also the associated intangible values. This integration positions industrial tourism as part of a broader category known as cultural tourism. A study conducted in Korea indicates that innovative advancements can be applied in cultural tourism, and further knowledge can be gained regarding product development through the creation and proper utilization of opportunities. This situation can also be observed in the transformation process from an active or inactive production facility to a tourist attraction (Naramski et al., 2022).

1.3.2. Identity and Social Memory

Industrial heritage has long been transformed into sites of memory. It has increasingly become an area of planning practices to construct new social identities and establish creative industries (Xie, 2015). Industrial structures are, in fact, a part of a society's collective memory. While gaining insight into the region's history, visitors will experience a different landscape. These structures represent the working-class culture, production processes, and economic history of the area. With structural change, there are various viewing points that allow visitors to the industrial sites to observe from different vistas. The preservation of these structures contributes to the maintenance of social identity and local culture. Creating interactive environments for those involved in industrial use will facilitate visitors' journeys through time and help them understand those periods.

Industrial heritage tourism, a subset of cultural tourism, refers to "the development of tourism activities and industries on man-made areas, buildings, and landscapes arising from previous industrial processes." Industrial remnants represent spatial symbols of emotional and collective memory in contemporary society. By transforming such sites into tourist attractions, a valuable tool emerges for educating tourists about the economic production histories. Most importantly, these industrial resources embody a distinct sense of place that shapes the character of former industrial centers while simultaneously creating a source of pride for post-industrial communities (Xie, 2015).

1.3.3. Urban Aesthetics and Architectural Value

Structures and lives with an industrial past are, in fact, symbols of the region's industrial heritage. The adaptive reuse of industrial buildings plays a significant role in urban transformation projects. Transformed through art, culture, and creativity, these structures become some of the most striking industrial monuments in the city. Preserving the aesthetic and architectural values of these buildings while adapting them to modern needs enriches the visual landscape of cities and enhances architectural diversity. The Sümerbank Textile Factory, one of the first industrial establishments of the Republican era, began serving as Abdullah Gül University (AGU) in 2013 after restoration work that reflected the traces of history. This example is seen as a successful transformation story that contributes architectural and aesthetic value to the city while continuing to design and produce with a new understanding and new materials and technologies.

1.3.4. Artistic and Cultural Achievements

The transformation of old industrial buildings into art galleries, museums, theaters, concert halls, and other cultural venues promotes the revitalization of cultural life. This allows individuals to experience an ongoing dialogue between the past and the present, thereby strengthening the public's perception of contemporary art. Such conversions provide new spaces for cultural activities that intertwine moments in time, offering creative spaces for artists.

1.3.5. Economic and Social Life

The transformation of industrial buildings enhances economic and social vitality. This process creates new job opportunities, promotes tourism, and contributes to the local economy. Additionally, these areas becoming social interaction points strengthens inter-community bonds. A study highlighted the importance of preserving industrial heritage from an economic perspective. The significance of industrial heritage is crucial when revitalizing cities. Industrial areas that can be adapted for tourism can serve as tools for a region's economic development and restructuring (Szromek et al., 2021). The revitalization process is also found to be beneficial for sustainable development (Naramski et al., 2022).

1.3.6. Education and Awareness

The repurposing of industrial buildings for artistic, technological, or cultural purposes creates potential for educational and awareness activities. These structures offer opportunities to learn about industrial history and culture, helping younger generations understand the past. A recent example is the impressive project at Samsun University's Ballıca Campus, where old tobacco warehouses, despite not being under protection, were treated as though they were and transformed. The project focused on preserving the memory of the place, creating faculties with stories, reusing all materials that had not outlived their usefulness, and utilizing rainwater and solar energy. Changes were made to the interiors with these principles. The 60,000 m² area, originally established as a production and storage center, has been transformed into a center of knowledge production, where industry, craft, and art converge, maintaining the continuity of the site's memory. It now houses the Özdemir Bayraktar Faculty of Aviation and Space Sciences, the Faculty of Engineering, the Faculty of Architecture and Design, the School of Civil Aviation, and the Technical Sciences Vocational School. Located near the Kızılırmak Delta, it serves as a pioneering example of integrating industrial heritage with modern architecture.

The repurposing of industrial buildings is a multifaceted process with many positive cultural impacts. This transformation raises awareness in various areas such as the preservation of historical and cultural heritage, the maintenance of social identity, and the enrichment of artistic and cultural life. Xie (2015) notes that industrial heritage sites, while bearing witness to the past, consist of multi-layered spatiality within a continuous cycle of redevelopment.

1.4. Industrial Heritage and Cultural Landscape Value

A cultural landscape is a unique structure created in harmony with and influenced by its environment. Cultural landscapes result from human interactions with the environment and are studied to understand how people use and modify nature, as well as the spatial differences between human achievements and cultures (Zhou et al., 2024). The transformation and adaptive reuse of industrial buildings significantly impact the value of cultural landscapes, reshaping the cultural identity and heritage of cities and regions. Cultural landscapes, which represent a combination of natural and human-made environments, benefit from the reuse of industrial buildings by enhancing the landscape value of an area. Integrating industrial structures into the cultural landscape promotes cultural tourism and stimulates economic revitalization. These buildings can become tourist attractions and contribute to the local economy.

Industrial heritage preserves the historical layers of a region and enriches its cultural landscape. These structures provide opportunities to learn about and understand past industrial activities and cultural values. They offer environments where people can partially experience and comprehend the industrial history through hands-on activities. These buildings represent the economic and social structures of their respective periods and carry these traces into the present day.

Moreover, industrial buildings are part of the spatial memory and identity of communities. Their transformation and adaptive reuse with new functions keep local identity and community memory alive while strengthening the connection between new generations and these spaces. The adaptive reuse of industrial buildings significantly contributes to the aesthetic value and cultural landscape of cities.

Combining remnants of a building's past with modern steel, brick, and wood to create a contemporary industrial area results in unique and captivating spaces. These structures, reproduced with modern architectural and creative design principles, add artistic richness to urban areas. This process allows for the aesthetic re-evaluation of industrial heritage. Repurposed industrial buildings provide new venues for social and cultural activities, thereby revitalizing social life. These spaces can be used for various purposes, including museums, art galleries, performance venues, libraries, exhibitions, workshops, festivals, and corporate events, thus enhancing the vibrancy and diversity of the cultural landscape.

Additionally, industrial heritage sites are often at the forefront of sustainable development and ecological balance preservation goals. Gürcanlı et al. (2024) suggest that the adaptive reuse of existing structures has the potential to contribute to environmental sustainability. This is evidenced by projects like the repurposing of the gas holder frames at King's Cross in London as a public park, which promotes green spaces in the city and reduces the environmental impact of construction. Moreover, gas holders can be adapted to store renewable energy sources, such as biogas or hydrogen, as exemplified by the Olympia Gasometer in London, which has been converted into a green technology center showcasing sustainable energy solutions. These transformation projects often include eco-friendly and energy-efficient solutions, preserving the ecological dimension of the cultural landscape.

Traditions and customs born in relation to industrial areas are integral, intangible parts of this heritage, just like the behaviors and ethical values prevalent during that period. These elements still constitute a significant part of regional identity and have become increasingly popular among tourists since the transformation from heavy industry to tourism began in Europe in the early 1990s. Additionally, more of these sites have been included in the UNESCO World Heritage List (Szromek et al., 2021).

In summary, the transformation of industrial buildings holds great potential for preserving and enriching the value of cultural landscapes. This process is essential not only for the preservation of physical structures but also for the maintenance and development of the historical, cultural, and social fabric of communities. As Xie (2015) states, adaptive reuse and skillful reinterpretation have opened up new spaces for cities and provided a stimulating foundation for the growth of the creative economy.

1.5. The Adaptive Reuse of Industrial Heritage Buildings as Cultural Spaces: Global Case Studies

Pintossi, Kaya, and Roders (2023) emphasize that adaptive reuse is a category of intervention in the existing built environment that not only preserves cultural heritage but also provides cultural, economic, environmental, and social benefits. Current practices regarding the transformation of industrial structures and cultural landscape values are evidenced by numerous successful examples worldwide. These examples clearly demonstrate how the preservation and adaptive reuse of industrial heritage can enrich cultural landscapes.

One example of a restored industrial landmark is the Gasometer Oberhausen in Germany, which serves as an exhibition space hosting art installations and events. Gasholder Park in London is utilized as a space that reflects community needs by involving residents in its design and programming. The Vienna Gasometers in Austria have been transformed into a multifunctional complex comprising residential units, offices, a cinema, and a theater. This vibrant area serves as a social center for communities (Gürcanlı et al., 2024). Below are some noteworthy recent examples in this context.

1.5.1. Tate Modern (London, England)

Tate Modern, located in London, began its service as a contemporary art museum following the transformation of the former Bankside Power Station (Figure 1). This transformation is a significant example of the intersection between an industrial structure and modern art. Tate Modern is not only an art gallery but also an essential element of London's cultural landscape.

Figure 1. The transformation of an abandoned power station into a state-of-the-art gallery, Tate Modern (Arkitektuel, 2024).

1.5.2. Zeche Zollverein (Essen, Germany)

Zeche Zollverein is an old coal mining complex located in Essen, Germany (Figure 2). Designated as a UNESCO World Heritage Site in 2001, this site has been transformed into a hub for cultural and creative industries. With its art galleries, museums, design workshops, and event spaces, Zollverein has become a significant component of the cultural landscape. Once a place for workers, Zollverein now offers opportunities for art, concerts, festivals, and sports, showcasing industrial culture at its best. It symbolizes a unique structural transformation in the Ruhr region. Former miners guide visitors through the site, taking them back to bygone times with lived stories as they pass by the machinery. Known as a successful transformation story, it is actively used year-round, featuring a swimming pool in summer, an ice rink in winter, an open-air cinema, and gourmet festivals.

Figure 2. Zollverein Coal Mine Industrial Complex, offering art, concerts, festivals, and sports opportunities (NRW, 2024).

1.5.3. Mill City Museum (Minneapolis, ABD)

The Mill City Museum was established in Minneapolis by transforming a former flour mill (Figure 3). This museum is part of the historic industrial area along the Mississippi River and serves as a cultural space showcasing the region's industrial past. To create a contemporary industrial space, the museum preserves the building's historical integrity by combining remnants of the mill's past with modern steel, brick, and wood. This transformation contributes to the preservation and revitalization of the local cultural landscape.

The museum offers various programs and exhibits that help visitors understand the history of milling. It hosts media shows like the Flour Tower, interactive exhibits, and walking tours. Among the programs are a baking lab where visitors can grind wheat, bake bread, conduct experiments, and package food NPS, (2024).

Figure 3. The transformation of a former flour mill into the Mill City Museum, (Venuereport, 2024).

1.5.4. Westergasfabriek (Amsterdam, Holland)

Westergasfabriek, a former gas factory transformed into a cultural and social hub in Amsterdam, now features parks, cafes, restaurants, cinemas, and event spaces, playing a significant role in Amsterdam's cultural landscape. This area has become a popular venue for artistic and cultural events. It serves as an industrial landscape space for various social activities such as weddings, celebrations, product launches, corporate meetings, workshops, and dinners.

Figure 4. The Gas Factory, reopened as "Westergasfabriek Cultural Park" in 2003 (Agilecity, 2024).

There are many other significant examples of the preservation and adaptive reuse of industrial heritage. These include:

- "798 Art District" (Beijing, China): Once an industrial area, this extraordinary cultural destination has undergone a captivating transformation to become a dynamic space where art, innovation, and cultural expression harmoniously converge (Whitestone, 2024).
- "Silo City" (Buffalo, USA): Former grain silos have been converted into a venue for cultural and artistic events, serving as a crucial element of the cultural landscape with concerts, theater performances, art exhibitions, and other activities.
- "Matadero Madrid" (Madrid, Spain): A former slaughterhouse complex transformed into a cultural and artistic center, it now hosts contemporary art exhibitions, theater performances, film festivals, and other cultural events.

All these examples demonstrate the profound and positive impacts that the transformation of industrial buildings can have on cities and cultural landscapes. Such transformations are vital as they bring numerous benefits, including the preservation of historical and cultural heritage, enrichment of the cultural life of communities, and economic revitalization.

Especially the Historic Urban Landscape approach, integrating new global approaches for sustainable cities, is being successfully implemented in various cities around the world (Andrade et al., 2024). At this point, as Xie

(2015) indicated, defining the adaptive reuse of cultural heritage as "sustainable landscape reclamation" not only offers a significant cultural objective but also inherently promotes a sustainable practice by encouraging the preservation and positive reuse of industrial buildings. Industrial heritage tourism, as an extension of these ongoing processes, represents a new form of economic livelihood.

1.6. Adaptive Reuse of Industrial Heritage Buildings as Cultural Spaces: Examples from Turkey

The integration of abandoned industrial structures into urban planning has become an integral component of urban growth and transformation (Gürcanlı et al., 2024). Buildings that once served specific industrial functions are now repurposed as spaces for artistic production and tourist consumption. This renewal has created a new form of heritage where tourism and culture are inseparable, fostering a new regional identity (Xie, 2015). Recently, there have been successful examples in Turkey of transforming industrial heritage buildings and integrating them with the cultural landscape. Some prominent projects in Istanbul in this regard include:

Santralistanbul: This cultural and arts center was created by transforming the former Silahtarağa Power Plant. It serves as a prime example of industrial heritage being repurposed into a cultural space, offering facilities for various artistic and cultural activities.

Bomontiada: This project converted the historic Bomonti Beer Factory into a cultural and living center. The restoration of the historic brewery building into a modern living space exemplifies the successful transformation of industrial heritage into a cultural venue.

Müze Gazhane: The historic Hasanpaşa Gasworks in Istanbul's Kadıköy district has been restored and repurposed as a cultural and social center under the name Müze Gazhane. This project highlights the integration of industrial heritage into contemporary cultural landscapes.

Rahmi M. Koç Museum: Located on the shores of the Golden Horn, this museum was established by restoring an old shipyard and industrial complex. It significantly contributes to Istanbul's cultural landscape by preserving and showcasing the city's industrial past.

In İzmir:

Historical Gasworks Factory: Situated in the Alsancak district, this factory has been restored and transformed into a center for cultural and social activities, including concerts, exhibitions, and workshops.

Kemeraltı Bazaar: This historic market area has been revitalized by repurposing old trade and industrial buildings into a cultural and tourist center.

In Antalya:

Kaleiçi: The historic Kaleiçi district features old industrial buildings and warehouses that have been restored and repurposed as boutique hotels, art galleries, cafes, and restaurants. This transformation preserves the historical fabric of the area while creating modern usage spaces, making Kaleiçi one of Antalya's key tourist and cultural centers.

In Kayseri:

Former Tekel Tobacco Factory: This historic building has been restored and is now used as the Faculty of Fine Arts. The project is a prime example of repurposing an industrial structure for educational and artistic purposes, preserving its original architecture while adapting it to meet modern educational needs.

These examples demonstrate how industrial heritage buildings in Turkey can be integrated with cultural values and adapted to meet modern social and cultural needs. Such projects contribute to the enrichment of the cultural landscape and the preservation of societal values by maintaining and repurposing historical structures. These buildings serve as venues where industrial heritage meets contemporary art, creating new lives and uses for these historic structures. These examples illustrate that, as seen globally, industrial heritage buildings in Turkey can be successfully repurposed for cultural and social purposes, contributing to societal and cultural values by integrating historical structures into modern life.

2. Material and Method

Port cities are unique living environments shaped by the coexistence of different cultures due to national and international trade. This privilege and advantageous situation also support industrial activities. On the other hand, the multifaceted developments experienced can sometimes create spatial complexity in city centers. Therefore, the future of port cities must be planned and implemented through careful analysis and development processes, involving multiple institutions as part of a shared vision. However, the processes that operate effectively in developed countries may not always function as desired in our country.

The primary material of this research consists of industrial structures and transformation projects from around the world. It is known that our country, surrounded by seas on three sides, possesses a rich potential in terms of regions or structures with industrial heritage value. Focusing on our living environment, particularly Trabzon, as landscape architects is related to its status as a port city, its geographical location, and its cultural richness. Additionally, its significance stems from its function as an important commercial hub along the Silk Road. As a port city, Trabzon will be examined concerning the presence or absence of industrial structures in its port area and its surrounding environment, emphasizing its pioneering role in the Black Sea region.

2.1. Evaluation of Trabzon's Industrial Heritage

A significant portion of the industrial structures in Trabzon is concentrated in the coastal area, where population, settlement, and economic activities have become dense (Güner et al., 2001). In the 19th century, Trabzon not only hosted trade concentrated in the port but also housed many industrial buildings active in agriculture and industry. Notable examples among these include the Tobacco Processing and Cigarette Factory, cement factory, tea factory, fish oil factory, soap factory, flour mill, hazelnut factory, and various workshop structures. One of the city's important landmarks, the old cement factory (Figure 8), was privatized after 50 years and was demolished following its relocation to a new site in Değirmendere (Haber61, 2024). The Old Tekel Building had secured a place in the urban memory with its approximately 50 years of existence. The building was repurposed and continues to be used as a shopping and living center (Figure 8).

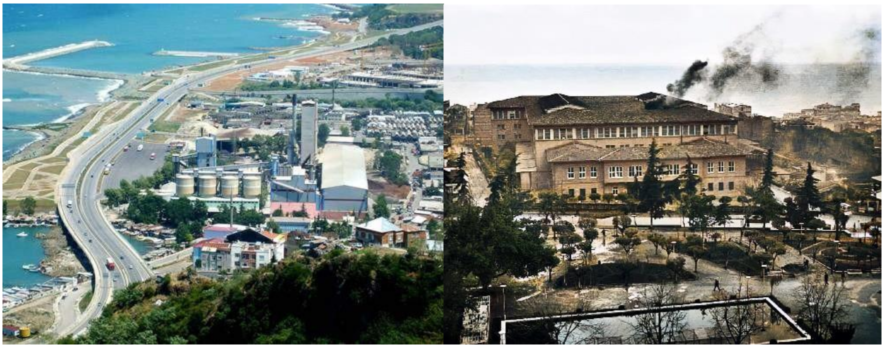

Figure 8. A) Cement factory (Haber 61, 2024) B) Tekel building (Personalpage, 2024).

Although the topic of industrial heritage has been widely studied and interest in the adaptive reuse of industrial buildings has significantly increased, there have been few academic studies focused on industrial heritage related to port activities and its reuse. In fact, these historical buildings are often not perceived as cultural assets because they are part of infrastructure, such as ports. As a result, when they lose their utility or are considered a health threat, they are no longer seen as valuable, which poses a risk of decline due to the lack of support for port industrial heritage. Indeed, this is how the process has unfolded in Trabzon. Following the relocation of the Cement Factory, located in the Değirmendere neighborhood of Trabzon’s Ortahisar district, to a new site in Akoluk, production at the old factory completely ceased, and demolition processes were partially completed. While the factory needed to be relocated for public health reasons, its demolition is seen as a significant loss for the city. Today, it is still possible to encounter old industrial buildings that are out of use in many port cities. In this context, as emphasized by Andrade et al. (2024), the reuse of industrial structures transforms port heritage from a "cost" to an "investment" for society. They argue that interventions requiring low-cost investments in existing areas and buildings can provide local solutions to urban planning challenges with realistic expectations.

As part of urban transformation practices, the adaptive reuse of the old cement factory within the scope of port area and coastal strip development could have turned this region into a significant attraction center. The socio-cultural area associated with the city’s port, which is open to cruise tourism, would also economically revitalize the city (Bekci, 2022). It could have been a success story incorporating recreational and cultural activities, artistic events, and solutions that facilitate access to water for people, alongside cafes or restaurants. The loss of such an important memory space for the city is not something to be taken lightly; decisions should be made through a master plan accepted by various stakeholders in such projects (Cengiz et all., 2012). Yavuz (2024) suggests that Trabzon should be planned in conjunction with the area covered by the cement factory, potentially expanding it further to include the industrial district, to support the renewal or development of the port.

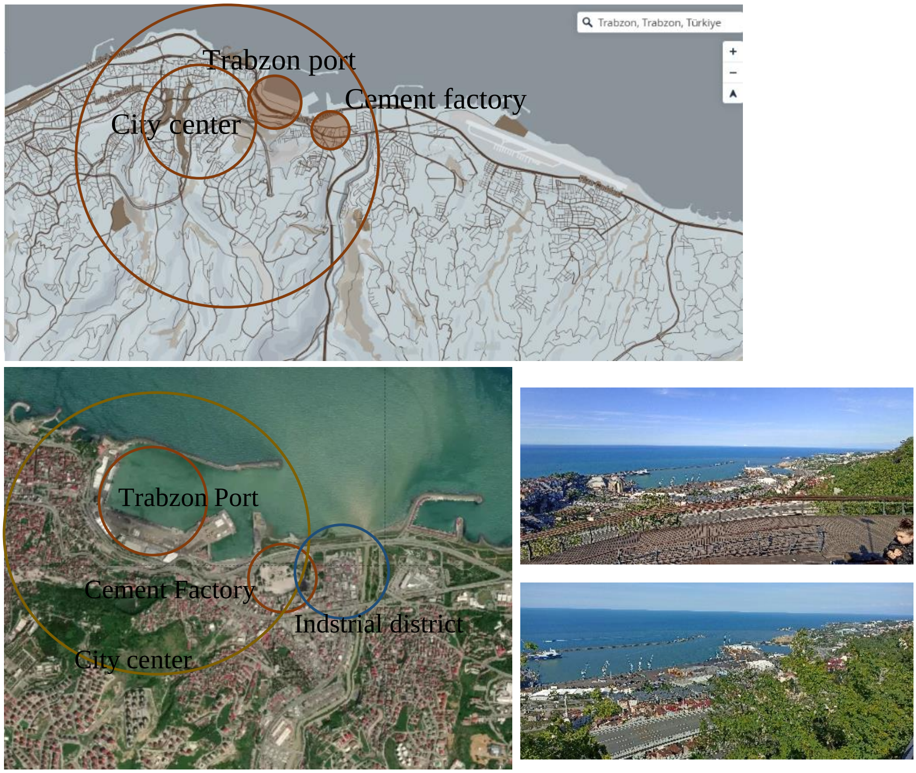

Figure 9. Trabzon port and industrial area

The relationship between Trabzon's port and the city has historically been dynamic and characterized by change. Throughout this process, it is necessary to note the absence of a more progressive and long-term planning approach that respects historical values and promotes responsible cultural and social transformation.

In this context, the lack of principles such as adaptability, flexibility, and openness to change in industrial buildings poses a significant issue. The unexamined demolition of the port's industrial heritage represents a regrettable loss. However, with spaces to be rediscovered, spatial planning, public space, and architectural design processes will become increasingly dynamic.

This study, which calls for a critical perspective on the renewal of the coastal strip from an industrial heritage standpoint, contributes to the existing literature.

3. Findings and Discussion

3.1. Landscape Strategies for Integrating Industrial Heritage Structures with Cultural Values

The landscape strategies for integrating industrial heritage structures with cultural values primarily focus on preserving their historical fabric and identity while creating meaningful and functional spaces for communities. Combining architectural details from the past with contemporary innovative approaches will transform these structures into captivating artistic venues through the renewal of their original architectural details, materials, and structural elements.

1. Creation of Multipurpose Cultural Spaces

- Establish multifunctional spaces such as museums, galleries, theaters, and concert halls to create cultural and artistic venues that cater to a variety of community needs.
- Design social spaces for workshops, educational activities, libraries, and public events that encourage local community participation.

2. Ecological Landscaping

- Develop green areas around industrial structures to create a restorative and environmentally friendly landscape, promoting ecological balance through the use of natural vegetation and water elements.

- Implement energy-efficient solutions and renewable energy sources to enhance the sustainability of these landscapes.

3. Historical Pathways and Cultural Routes

- Create walking paths that evoke historical associations between industrial buildings, offering visitors a cultural and historical route that connects various sites.
- Enhance these pathways with artistic elements and sculptures to increase the cultural value of the area.

4. Regular Cultural Programming

- Maintain the vibrancy of the area through regularly scheduled cultural and artistic programs, including concerts, exhibitions, and festivals that engage the community and attract visitors.
- Ensure the integration of industrial heritage sites with public transportation networks to facilitate visitor access.

5. Inclusive Design

- Develop accessible designs and infrastructure to accommodate all visitors, ensuring that industrial heritage sites are welcoming and inclusive.

These strategies aim to integrate industrial heritage structures with modern social and cultural needs, thereby enhancing their cultural landscape value and ensuring their sustainable preservation. The significant outputs of these industrial areas can be summarized as follows: teaching the industrial history of the region, becoming memory spaces, providing a foundation for scientific discoveries, facilitating the transfer process of technology, and showcasing the sociological changes and transformations that businesses historically offered to their users and local communities (Aydın et al., 2022). Cimino (2009) emphasizes that the preservation of historical industrial areas requires an approach that considers multilayered values and diverse societal expectations. Effectively negotiating these values can help prevent indifference toward the landscapes that need preservation.

4. Conclusion and Suggestions

The preservation, conservation, and sustainable use of urban industrial heritage continues to be a globally significant theme. UNESCO is actively engaged in serious studies regarding the examination of resources for sustainable urban development and will continue to do so.

This research reflects the industrial landscape approach and underscores the necessity of considering the complex layering of various aspects that constitute the landscape. It also analyzes contemporary practices related to attitudes and implementations concerning the preservation of cultural landscape values and industrial heritage sites, offering pathways to understand conservation methods for these areas. Using case studies of industrial structures and areas located in the city center of Trabzon, the study examines the evolution of existing conservation approaches through global industrial heritage practices. It argues that, alongside traditional conservation practices, broader management strategies are necessary to interpret the complexities of these historic sites and that various conservation measures must be considered for the preservation of historical industrial landscapes. Additionally, the study aims to propose landscape strategies for integrating the cultural values of the region's industrial heritage structures.

Today, researching and preserving industrial heritage has become more comprehensive, integrated, extensive, and interdisciplinary, as reuse strategies have diversified. Different strategies are being developed for each city. Industrial buildings embedded in the urban fabric are being redirected for local activities, thereby ensuring that local urban activities are preserved in living memory (Andrade et al., 2024). There is a need for in-depth studies on the investigation and preservation of industrial heritage, with a focus on diversifying reuse scenarios and conducting extensive studies that reflect decades of history.

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Approaches to Ecosystem Service Assessment

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Introduction

Ecosystems, are also known as ecological systems, are shaped by the interactions between living organisms & their abiotic environments within a specific geographical area. These interactions are interconnected through cycles of energy and materials (Kumar & Mina, 2018). According to Odum (1969), an ecosystem forms a biological organizational unit where all organisms within a specific area (community) interact with the physical environment. Natural ecosystems, described as open systems, exhibit broad tolerance ranges, are subject to the influence of living organisms, and undergo constant transformation (Dindaroğlu, 2021). According to Çepel (1976), ecosystems possess a dynamic structure subject to continuous changes through events such as birth, growth, death, and decomposition, in addition to the constant flow of matter and energy. Furthermore, they exhibit a flow of energy and matter resulting from the biomass of living organisms, including processes like water and nutrient transfer, leaf fall, and the exchange of organic and inorganic materials. Additionally, ecosystems range from local ecosystems like coral reefs to vast ocean ecosystems.

Ecosystems encompass both biotic (producers, consumers, decomposers) and abiotic (soil, temperature, climate) components. Producers or autotrophs synthesize their own food and regulate atmospheric gases, including plants, certain bacteria, archaea, and protists. Consumers or heterotrophs acquire nutrients from their surroundings, including animals, fungi, some protists, and bacteria. Abiotic factors in ecosystems include energy sources, temperature, climate, soil composition, minerals, and water availability, all of which influence species diversity and distribution. Ecosystems are categorized into four classes: Terrestrial Ecosystems, Freshwater Ecosystems, Marine Ecosystems, and Artificial Ecosystems (Biology Online 2021).

The concept of ecosystem services was first introduced in 1953 by ecologist Eugene P. Odum in his article "Fundamentals of Ecology." Odum (1953) defined the concept of ecosystem services and emphasized the idea that ecosystems provide various services or benefits to human societies. The concept of ecosystem services gained more recognition as researchers began to explore and classify the different types of services provided by ecosystems. For example, Westman (1977) addressed the topics of ecosystem services and their assessment in his article "How Much Are Nature’s Services Worth?" discussing how ecosystems contribute to human well-being. In 1981, Paul and Anne Ehrlich highlighted the importance of ecosystems in providing essential services for human survival in their book "Extinction: The Causes and Consequences of the Disappearance of Species" (Ehrlich & Ehrlich, 1981).

The Millennium Ecosystem Assessment (MEA), conducted from 2001 to 2005, aimed to examine the impact of ecosystems on human well-being and their sustainable use. Its purpose was to provide a scientific basis for conserving ecosystems and enhancing their contributions to human well-being by analyzing the benefits people derive from ecosystems, particularly focusing on "ecosystem services" (MEA, 2005). Ecosystem services, classified as regulatory, supporting, provisioning, and cultural services, encompass the benefits people obtain from ecosystems. In 2007, a study on the economic value of biodiversity and the cost of its loss was initiated at a meeting in Potsdam, Germany, leading to the preparation of The Economics of Ecosystems and Biodiversity (TEEB) report. Based on the MEA approach, the Common International Classification of Ecosystem Services (CICES) was developed to provide a classification for measuring, accounting, and assessing ecosystem services (Haines-Young & Potschin, 2017). It aims to create a classification that explains the purposes or uses of different ecosystem services and relates them to specific ecosystem characteristics or supporting behaviors.

While the MEA provides a comprehensive assessment of ecosystem functions and their impact on human well-being, TEEB focuses on the economic valuation of ecosystem services to facilitate their integration into decision-making processes. In contrast, CICES aims to offer a standardized classification system for ecosystem services, prioritizing it over comprehensive assessments or economic valuations (Table 1).

The assessment of ecosystem services is typically a complex process requiring the integration of various methodologies. Establishing a modeling framework is essential for effective measurement of ecosystem services (Kasparinskis et al., 2018). A framework developed in the context of ecosystem assessment serves as a structured methodology or a set of guiding principles, helping researchers, resource managers, and decision-makers align their efforts and promote a shared perspective and understanding across different backgrounds and expertise (Potschin & Haines-Young, 2016).

Table 1. Comparison of MEA, TEEB, and CICES reports

		Scope	Aim	Methodology
MEA		It is a global assessment of the state of ecosystems worldwide, their contributions to human well-being, and the impact of ecosystem changes on human development goals.	t aims to evaluate the consequences of ecosystem changes on human well-being and to provide decision-makers with tools to better manage ecosystems sustainably.	A multidisciplinary approach that integrates natural and social sciences has been used. It categorizes ecosystem services into provisioning, regulating, supporting, and cultural services.
TEEB		It is an international initiative focused on making the values of nature visible. It was launched in response to the understanding that the economic invisibility of ecosystem services often leads to their neglect in decision-making processes.	It aims to provide decision-makers with tools to understand the economic value of ecosystem services, to promote their inclusion in policy and business decisions, and ultimately to integrate the values of nature into national and international accounting systems.	t applies economic principles to assess the economic value of ecosystem services, including both market and non-market values. It categorizes ecosystem services into provisioning, supporting, cultural and comfort, and habitat services.
CICES		It aims to provide a common language and classification system to identify ecosystem services across different disciplines and scales.	It aims to improve the consistency and comparability of ecosystem service assessments by providing a standardized classification system.	It divides ecosystem services into three main groups: provisioning, regulating and maintaining, and cultural ecosystem services. Each group is further subdivided into categories for classifying and defining various ecosystem services.

According to the IPBES Methodological Assessment Report on the Diverse Values of Nature and Its Assessment, there are various methods for assessing ecosystem services, encompassing biophysical, economic, and social evaluations (IPBES, 2022). Kasparinskis et al. (2018) describe existing methodologies for mapping and assessing ecosystem services in three main approaches:

1. **Biophysical Methods:** These methods measure ecosystem services in biophysical units using indicators, representative models, and biophysical models, evaluating both supply and demand, and providing information about ecosystem structure and function.
2. **Socio-cultural Methods:** These approaches assess values, perceptions, knowledge, and demand for ecosystem services through traditional socio-cultural data collection techniques such as rankings, surveys, and preference assessments.
3. **Economic Methods:** Economic methodologies measure the welfare derived from ecosystem services in monetary terms and allow for the evaluation of spatial variations in economic values through mapping approaches. The highlighted economic methods include cost-effectiveness analysis, cost-benefit analysis, and multi-criteria analysis.

The 2030 European Union (EU) Biodiversity Strategy aims to develop a standardized methodology across the EU, primarily utilizing the System of Environmental-Economic Accounting - Ecosystem Accounting (SEEA EA) (Vallecillo et al., 2022). SEEA EA is a globally recognized spatially-based framework adopted by the United Nations as a statistical standard (United Nations et al., 2021). This methodology consists of five core accounts (Vallecillo et al., 2022):

1. **Ecosystem Extent Accounts:** These accounts track changes over time in the total area of each ecosystem within a specific region.
2. **Ecosystem Condition Accounts:** These accounts evaluate the health and quality of ecosystem assets at specific points in time.
3. **Ecosystem Services Flow Accounts (Physical and Monetary):** These accounts measure the provision of ecosystem services by ecosystem assets and their use by economic actors.
4. **Monetary Ecosystem Asset Accounts:** These accounts provide information on the stocks and changes in stocks of ecosystem assets, including aspects of degradation and improvement.

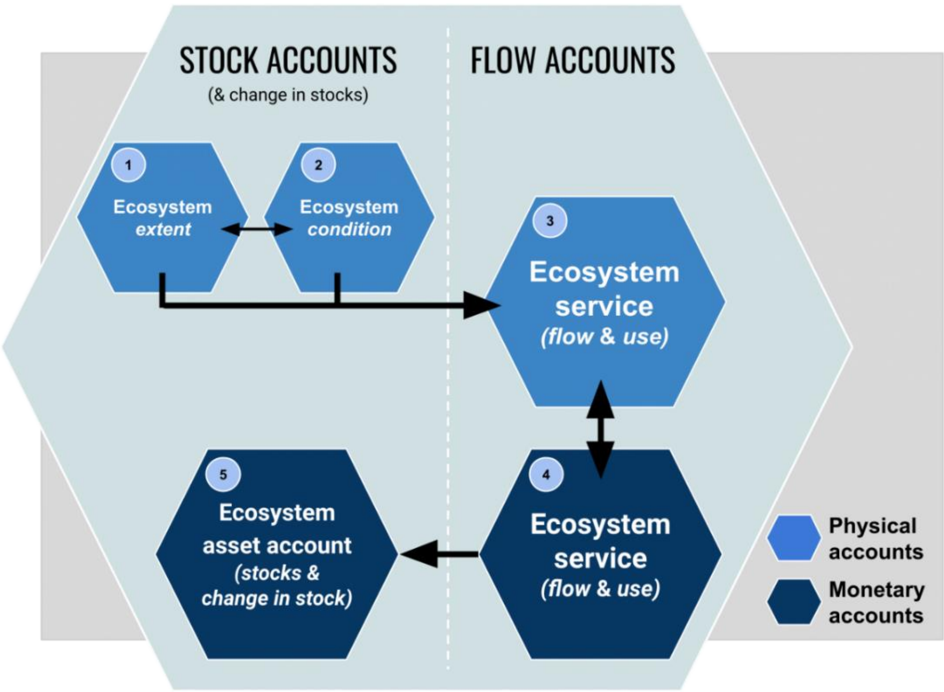

Figure 1. Ecosystem accounts and how they relate to each other (United Nations et al., 2021)

National Ecosystem Assessments (NEA) are country-focused initiatives designed to provide comprehensive syntheses of biodiversity and ecosystem service information tailored to specific policy questions and national needs (UNEP-WCMC, 2021). The NEA process typically involves four stages (Anonymous, 2024):

1. **Scope Definition:** Identifying the scope, objectives, and key questions of the assessment. This stage involves engaging stakeholders to ensure relevance and comprehensiveness.
2. **Data Collection and Analysis:** Gathering data on ecosystem conditions, biodiversity, and ecosystem services. This data is usually obtained from scientific research, remote sensing, and local knowledge.
3. **Modeling and Scenario Development:** Using models to predict future changes in ecosystems and services under different scenarios, such as climate change, land use change, and policy interventions.
4. **Reporting and Dissemination:** Producing reports and other materials to communicate findings to policymakers, stakeholders, and the general public. This includes providing action recommendations.
5. **Review and Update:** Regularly updating the assessment to reflect new data, scientific developments, and changing environmental conditions.

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) was established in 2012 to improve the science-policy interface on biodiversity and ecosystem services. Modeled after the IPCC and MA, IPBES conducts international and national assessments, accelerates knowledge production, develops policy tools, and supports capacity building (Borie & Hulme, 2015).

IPBES assesses ecosystem services by gathering contributions from governments, experts, and partners, evaluating them in terms of their contributions to human well-being. It conducts various assessments at sub-regional, regional, and global scales and supports local and national assessments. The determination of ecosystem service values by IPBES involves a comprehensive, multidisciplinary approach that includes both quantitative and qualitative methods. The steps in the IPBES assessment process are as follows (IPBES, 2018):

1. **Definition of Ecosystem Services:** Categorizing ecosystem services (provisioning, regulating, cultural, supporting) and identifying specific services relevant to the assessment.
2. **Data Collection:** Collecting ecological data on ecosystems and biodiversity through remote sensing, field surveys, and databases, and socio-economic data on the human benefits derived from ecosystem services.
3. **Modeling and Assessment:** Predicting the supply of ecosystem services based on biophysical models and estimating their monetary value using economic valuation methods such as market pricing, cost-benefit analysis, willingness to pay, and replacement costs.
4. **Integrated Valuation:** Analyzing non-monetary values (cultural, spiritual, recreational) and contributions to human health and well-

being using interdisciplinary approaches, and assessing trade-offs between different ecosystem services and land uses.

5. **Stakeholder Engagement:** Involving local communities, indigenous peoples, policymakers, and other stakeholders to gather diverse perspectives and collaborate.
6. **Synthesis and Reporting:** Combining data and model outputs to provide a comprehensive assessment of ecosystem service values. Using maps, charts, and visual tools to clearly present findings.

In addition to IPBES, the EU Joint Research Centre (JRC) Policy Science Report provides a comprehensive ecosystem assessment covering all EU terrestrial and marine regions. Initiated after the third Joint MAES INCA meeting in 2018, this assessment aims to enhance the understanding of European ecosystems, identify key pressures and impacts, and provide insights for ecosystem restoration and management policy (Maes et al., 2020). The operational framework for this assessment is developed through collaboration between the MAES Working Group, policymakers, and researchers. A general methodological approach for conducting ecosystem assessments is outlined below (Maes et al., 2020):

1. **Scope Definition:** Identifying key issues related to ecosystem status, pressures, and trends.
2. **Design:** Transforming the assessment into thematic and intersecting evaluations, integrating them for policy development.
3. **Operational Framework:** Establishing a common framework and typologies for indicator selection for status and service assessments.

4. **Practical Application:** Overseeing the coordination team, lead authors, and data collection process. Ensuring public access to indicator data, stakeholder consultations, and comprehensive review.
5. **Geographic Coverage and Ecosystem Types:** Evaluating various ecosystem types using CORINE land cover data.
6. **Data Utilization:** Using CORINE Land Cover for coverage and trend analysis, aligning with 'Article 17' habitat data for biodiversity assessments, and maintaining consistency with the 'State of Nature' report.
7. **Common Mapping and Assessment Approach:** Using a unified approach for mapping and assessing ecosystem changes. Applying a consistent typology for indicators to define ecosystem status and pressures.
8. **Indicator Classification:** Classifying indicators based on environmental quality and ecosystem characteristics according to established frameworks. Focusing on key structural and functional indicators, including species diversity and conservation status.
9. **Trend Assessment:** Evaluating short-term and long-term trends by integrating reference years from CORINE Land Cover datasets.
10. **Baseline and Trend Calculation Methodology:** Calculating baselines using current data or linear interpolation. Expressing trends as decadal changes, emphasizing statistical significance.
11. **Confidence Assessment:** Qualitatively assessing indicator confidence based on expected annual change dynamics as low, medium, or high.

12. **Mapping:** Creating new maps by comparing data from different time points to identify improvements, degradations, or changes per spatial unit. Basing decision-making on EU-wide trend assessment rules or statistical tests.

Burkhard et al. (2012) proposes a non-monetary assessment plan focusing on indicators categorized and mapped according to relative supply/demand scales. Ecosystem service matrices facilitate the integration of ecological and socio-economic data to support decision-making in land management, spatial planning, and ecosystem conservation. Typically, the matrix consists of rows representing various ecosystem services and columns representing different land use types or coverage categories. Each cell in the matrix represents the potential or actual provision of a specific ecosystem service by a particular land use type. Cell values indicate the capacity or contribution of each land use type to each ecosystem service, either qualitatively or quantitatively.

The comparison of the objectives, scope, and process parameters of the System of Environmental-Economic Accounting – Ecosystem Accounting (SEEA EA), National Ecosystem Assessments (NEA), the International Platform on Biodiversity and Ecosystem Services (IPBES), and the Mapping and Assessment of Ecosystems and their Services (MAES) methodologies is presented in Table 2.

Table 2. Comparison of SEEA EA, NEA, IPBES, and MAES Report

Feature	**SEEA EA (System of Environmental-Economic Accounting-Ecosystem Accounting)**	**NEA (National Ecosystem Assessments)**	**IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services)**	**MAES (Mapping and Assessment of Ecosystems and Ecosystem Services)**
Purpose	To measure the economic value of ecosystem services and integrate it into accounting systems.	To provide comprehensive national-level information on ecosystems and biodiversity for specific policy questions.	To strengthen the science-policy interface on biodiversity and ecosystem services, conduct assessments, and develop policy tools.	To provide a comprehensive understanding of European ecosystems, identify key pressures and impacts, and offer insights for policy-making.
Scope	Global scale, spatially-based, and adheres to international standards.	Country-specific, focused on policy questions and national needs.	International, regional, and local scales, encompassing a multidisciplinary and comprehensive approach.	Comprehensive assessment for both terrestrial and marine ecosystems across Europe.
Process	5 main types of accounts: ecosystem extent, condition, service flows, monetary values, and changes.	4 stages: defining scope, data collection and analysis, modeling and scenario development, reporting and updating.	6 steps: defining services, data collection, modeling, integrated valuation, stakeholder engagement, and synthesis.	12 steps: defining scope, design, operational framework, practical implementation, geographic coverage, data usage, mapping and assessment.
Methods	Uses biophysical, economic, and social methods to evaluate ecosystem services.	Scientific research, remote sensing, local knowledge, and modeling are utilized.	Uses biophysical models, economic valuation methods, and integrated valuation approaches.	Uses CORINE land cover data, 'Article 17' habitat data, 'State of Nature' reports, and other compatible data sources.
Data Sources	Standardized data and calculations as defined by the United Nations.	Scientific data, field research, and remote sensing.	Remote sensing, field research, databases, and socio-economic data collection.	CORINE data, 'Article 17' habitat data, 'State of Nature' reports, and other aligned data.
Modeling and Scenarios	Modeling and mapping the supply and economic values of ecosystem services.	Predicts future changes in ecosystems and services under various scenarios.	Models based on ecosystem functions and processes and predicts monetary values using methods like market pricing, cost-benefit analysis, and willingness-to-pay.	Evaluates short- and long-term trends and uses trend calculation methodologies.

NEA stands out for its significant contribution to the development of national policies and conservation strategies by providing valuable information. However, it also involves challenges such as resource-intensive data collection processes and data gaps. Moreover, integrating local knowledge into NEA assessments can be complex, presenting additional hurdles. IPBES has notable strengths, including extensive international collaboration and the capacity to conduct comprehensive assessments at various scales. Nonetheless, ensuring complex coordination among different stakeholders and maintaining consistency across different geographical scales and regions remains a challenge. SEEA EA provides a globally accepted standard framework that facilitates the seamless integration of ecosystem services into national accounts. However, the detailed and precise data requirements pose a significant challenge to its widespread application. MAES significantly supports EU biodiversity and sustainability policies by offering a common methodology for EU Member States. However, variation in data and methodologies among different countries poses a challenge to seamless cooperation and comparison across regions.

In summary, while all the mentioned methodologies aim to assess ecosystems, they differ in scope, approach, and methods, reflecting the diversity of perspectives and priorities in ecosystem assessment.

2. Findings and Discussion

Although human-centered approaches stemming from technological advancements are thought to yield positive outcomes, the degradation of ecosystems over time has had detrimental effects on both the environment and human well-being. It is crucial for people to recognize the interconnectedness among all living beings in nature and ecosystems. Understanding and assessing the state of ecosystems is essential for creating sustainable development and livable environments.

Various methodologies for assessing ecosystem services have been developed by different organizations and researchers. These methodologies differ in scale, scope, approach, and methods. However, these differences reflect the diversity of perspectives and priorities in ecosystem assessment. The integration of biophysical, socio-cultural, economic, and expert-based methods allows for a holistic assessment of ecosystem services, supporting informed decision-making and sustainable natural resource management.

Given the complexity and interdependence of ecosystems, ongoing research is important to comprehensively understand ecosystem dynamics and the services they provide. Collaborative efforts among multidisciplinary teams and stakeholders are essential to integrate different perspectives, expertise, and data sources to enhance the robustness and accuracy of assessments. Prioritizing continuous research and collaboration can contribute to informed decision-making for the global conservation and sustainable management of ecosystems. Combining solutions to environmental issues such as conservation efforts and sustainable resource management can support the resilience and longevity of ecosystems, promoting a healthier and more sustainable future.

Author Contribution and Conflict of Interest Declaration Information

All authors contributed equally to the article. There is no conflict of interest

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Visual Quality on Streets in the Context of Seasonal Differences

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1. Introduction

Visual quality is an important factor affecting the attractiveness of public spaces and refers to a perceptual value representing the visual experience resulting from street views (Qi et al., 2023).

It is stated in the literature that visual quality is an important element of urban design. In particular, it is emphasized that the design elements on the streets and their effects on visual quality should be measured quantitatively. This evaluation should be made in order to contribute to making effective urban design decisions and creating high-quality street areas (Ye et al., 2019).

However, visual quality is an abstract concept and is usually associated with physical features. However, it is not possible to fully understand people's general perception only through physical features. Therefore, it is necessary to take into account people's perceptual experiences when evaluating the physical elements of the space.

Lothian (1999) suggests a mixed approach where both objective and subjective paradigms are used together to evaluate the visual quality of the natural and built environment.

In order to develop and improve the visual quality of the streets, it is first necessary to determine the elements that affect the visual quality of the streets (Tekel, 2021). Research shows that determining these elements has a significant impact on people's perception and use of the urban environment.

In the literature, it is stated that comparative studies on visual quality through street images are limited according to different seasons (Palang et al., 2007; Stobbelaar and Hendriks, 2007; Junge et al., 2015). In this study, a detailed literature review was conducted with the keyword "seasonal differences". The total number of sources reached in the WoS (Web of Science) database is 131. The shortcomings in these studies limit our full understanding of how human perception and aesthetic preferences are affected by different seasons. However, it is stated that comparative studies conducted according to different seasons provide important information on how people's perceptions and aesthetic preferences are affected (Zhao et al., 2017; Kuper, 2020).

In addition, there are studies in the literature examining the relationship between seasonal differences and crime rates (Bhatia and Jason, 2022). In another study, the relationship between time and space was examined in terms of the effects of daily and seasonal differences on individuals' behavior (Muğan, 2018). Seasonal change in green areas on streets and avenues is suggested as an important component of landscape perception and aesthetic evaluation in studies on visual quality (Junge et al., 2015). Such studies can help us understand the effects of seasonal differences on visual quality more deeply.

2. Material and Method

This study is based on answering the question of how seasonal differences in streets affect visual quality. The main material of the study is visual quality and seasonal differences. In this context, first of all, a literature review was conducted on the concept of visual quality and seasonal differences. In addition, measurable design qualities and measurement methods that determine visual quality were defined in the literature.

3. Findings and Discussion

3.1. Visual Quality and Visual Quality Assessment

In general, quality refers to the degree of perfection of something and can be applied to the concept of street areas due to the relationship between environmental conditions and service level (Tang and Long, 2019).

The measure of visual quality is visual elements such as form, line, color, live liness, harmony, and integrity. The arrangement, positioning, proportions, and physical structures of these elements are the basic elements that determine visual quality (Tüfekçioğlu, 2008).

Visual quality depends on four basic physical variables. These are organizing variables, psychophysical variables, ecological/satisfaction variables, and spatial variables. While organizing variables include elements such as complexity, surprise, and uncertainty, psychophysical variables include factors such as size, brightness, color, and contrast. While ecological/satisfaction variables include naturalness, architectural style, and environmental effects, spatial variables include features such as openness and mystery (Atabek, 2002; Tüfekçioğlu, 2008).

In the studies in the literature, street photographs are frequently used in the evaluation of visual quality on the streets.

Subjective and objective visual quality is determined by evaluating measurable design qualities through street photographs.

Street photographs have defined street areas characterized by human perspective on a large scale. Street photographs provide indicators that allow spatial quality to be measured from a human-scale perspective (Jiang et al., 2022). Research has shown that emotional and aesthetic responses to environments and visual stimuli help us understand human interaction with the natural environment (Ibarra et al., 2017).

Measuring the quality of urban street images facilitates the definition of street renewal. Street-level images enable the development of new techniques for observing, perceiving, and comprehending the street environment.

Streets are an integral part of urban space and are increasingly gaining attention in terms of human perception. Visual quality is an important factor affecting the attractiveness of urban spaces (Qi et al., 2023). Human perception and physical elements in street space are important parts of evaluating spatial quality. Related studies show that spatial features are related to physical elements such as buildings, sky, and landscape in the streetscape. Previous studies have indicated that greening, open space layout, and spatial features directly affect pedestrians' behavior and mood. In this context, urban design features such as density of green areas, openness, closure, long sight lines, and pedestrian space have been found to have an impact on spatial quality (Meng et al., 2023).

The physical features in the street environment can objectively reflect the street’s spatial quality; however, people's overall perception cannot be obtained from these features. Previous studies have confirmed that there is a close relationship between perception and quality. It has been suggested to understand streetscapes based on visual perception. This is an important factor determining the quality of urban life and user experience (Meng et al., 2023).

Literature suggests that urban design features play an important role in urban quality of life. Many of these features have the potential to affect spatial diversity, visual aesthetics (Nasar, 1994), sense of comfort and security, and physical activity level (Hamidi et al., 2020).

In addition to the various social and economic effects of urban design features, some researchers suggest that these features can act as psychologically stimulating or deterrent forces in terms of individuals' behaviors towards the urban environment (Hamidi et al., 2020).

As a result of the literature review, the design features affecting visual quality in urban spaces are summarized in Table 1.

Table 1. Design qualities affecting visual quality in urban spaces

Source	***Design Features Affecting Visual Quality in Urban Spaces***				
(Smith, 1977; Kalavı, 2021)	Light and Shadow	Rhythm	Contrast	Harmony	Complexity
	Texture	Unity	Intensity	Balance	Pattern
(Ewing et al., 2006)	Viewability	Human Scale	Transparency	Complexity	Consistency
	Legibility	Closeness	Connection		
(Ewing and Handy, 2009)	Balance	Originality	Complexity	Diversity/complexity	Rhythm
	Closeness	Contrast	Openness	Sense	Naturalness
	Balance	Texture	Viability	Ornament	Unity
	Protection	Continuity	Being Meaningful	Spaciousness	Transparency
	Unity	Consistency	Tidy	Intensity	Remarkable

	Visibility	Order	Directionality	Comfort	
(Tang and Ying, 2019)	Presence of Green Areas	Openness	Closeness	Street Wall Continuity	Section Ratio

There are many variables and design qualities that affect the visual quality of the built environment. Some of these qualities are measurable, while others are not. Below are listed the measurable qualities that affect the visual quality of streets and avenues, and these qualities are widely used in the literature.

1. Green Area Density
2. Openness Ratio
3. Closedness Ratio
4. Facade Density
5. Light/Shadow Effect

<u>Green area density</u>

The restorative potential of nature has been theoretically and empirically associated with a strong affinity and aesthetic preference for natural environments (Ibarra et al., 2017). Landscaping aims to actively raise awareness of the distribution of vegetation on streets by including green landscape elements such as grass, trees, vegetation, and green belts (Ma et al., 2021).

Studies indicate that trees can help improve the physical urban environment and improve the psychological health of urban residents (Morakinyo et al., 2017).

Most studies on the measurement of street trees focus on the “amount of greenery,” such as tree cover, tree density, and biomass. However, due to the lack of quantitative assessment methods, the aesthetic value of street trees is often neglected (Hu et al., 2022).

Studies indicate that landscape density affects people's stress and tree cover increases the feeling of closure (Tang and Long, 2019).

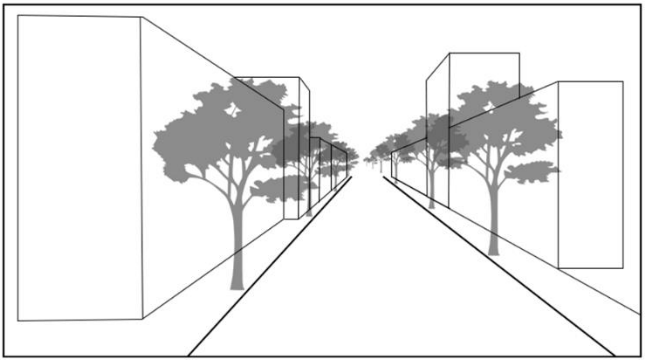

Figure 1. Green Area Density (Original, 2024)

<u>Openness</u>

Openness is the degree of visibility of the sky. It represents the portion of the sky that can be seen from a point on a horizontal surface such as the ground. The height and alignment details of building facades have a direct impact on openness (for example, a wide, set-back building facilitates the creation of a wide horizon), and dense clusters of tall buildings tend to divide the sky into narrow visual areas (Figure 2). The evaluation of openness includes increasing the attractiveness of the streetscape and enhancing the comfort of public activities (Tang and Long, 2019). The representation of visual openness is defined as the ratio between the area of visible sky and the area surrounded by buildings or trees within a street canyon.

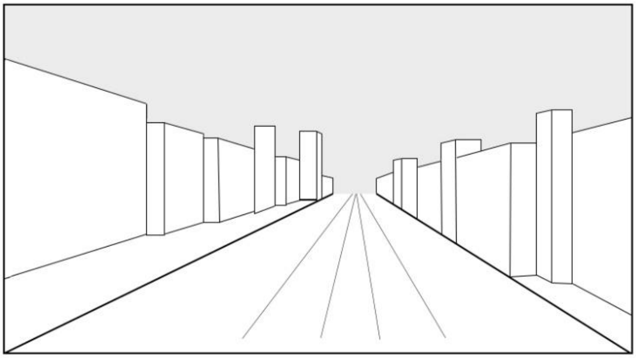

Figure 2. Openness (adapted from Ma et al., 2021)

The openness and closure on the street exhibit a closely related increase and decrease trend as the road width changes. Therefore, in order to well handle the proportion between the openness of the sky and the closure of the street surroundings, the view factors related to the sky, trees, and buildings in the outdoor environment should be designed in advance and taken into account in the same way (Ma et al., 2021).

<u>Closedness</u>

Enclosure creates space; it represents the dimension of the human scale. The built environment expresses how pedestrians are contained through the positioning and shape of the structures surrounding pedestrian areas. A well-enclosed street tends to create a higher impression of safety for users and therefore offers more opportunities for physical activities. For this reason, enclosure is highlighted as a priority feature in designs that enhance street life and is widely used as a measure of comfort. Continuity can be defined as the ratio of street edges intersecting with buildings (Tang and Long, 2019).

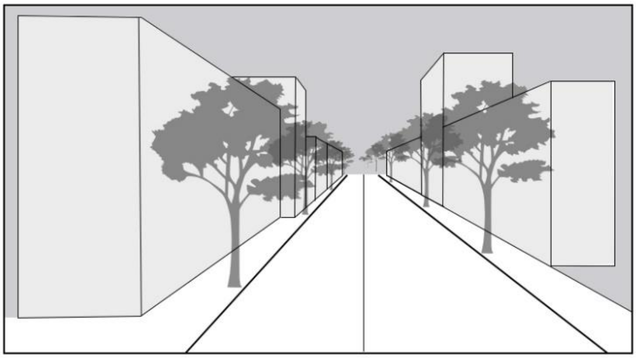

Figure 3. Closedness (Original, 2024)

Facade Density

Studies on street photographs show that measurable design criteria such as the occupancy and vacancy rates on the facade and the presence of landscape elements, which affect the visual quality of the street, can affect people's preferences and play an important role in these preferences.

The occupancy and vacancy rates of the streets constitute important elements that determine the characteristics of the space and the continuity of the street wall (Akbaba, 2022). In the study of Kalavı (2021), it was stated that as the height of the buildings in street images increases, the building façade ratio and the level of closure increase, while the decrease in the height of the buildings provides a more open view.

A complete and continuous building façade creates a regular and lively streetscape within the provided closed area (Figure 4). As the closure rate of the street increases, it creates a high impression of security, and provides more opportunities to encourage physical activities and social contact among residents. Therefore, closed area is considered a basic design feature that improves street life and is widely used to measure walkability, comfort, and accessibility in urban health-related neighborhoods (Tang and Long, 2019).

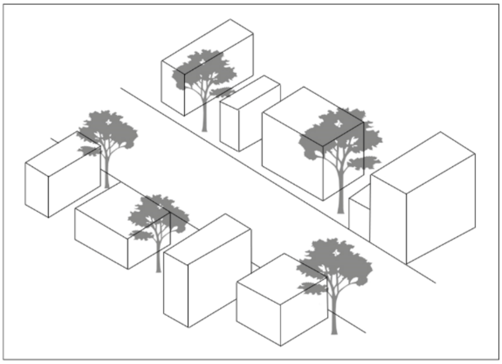

Figure 4. Facade Density (Original, 2024)

Light/shadow effect

Streetscapes include the light and shadow effects of the landscape and structures, as well as the elements that determine visual quality. Lighting and shading are important factors that deeply affect the perceived beauty of streetscapes. Properly arranged landscape elements and structures, when used in harmony with natural light sources, can increase the aesthetic value of the landscape. Similarly, the correct use of shadows can increase the visual appeal of the landscape by increasing the perception of depth and size. Therefore, the visual quality of streetscapes can be increased by the correct planning of structures and landscapes and the balanced use of light-shadow effects.

Although shadows in cities often seem like an accidental presence, they can often leave a significant impression on the individual. For example, the tree shadows of a campus, together with the soft light filtering through the leaves, can create awareness by drawing attention to the gentleness of nature's change. These and many other beautiful shadows and images can be among the sights that can be observed by people living in the city. However, it is a fact that there are few cities with beautiful shadows in our modern urban centers (Kawasaki, 1994).

When the right elements come together, shadows and light can deepen a space and transform the atmosphere of a place. Such shadows should be re-evaluated for their potential role in the transformation of the urban landscape (Kawasaki, 1994).

They argued that street greenery significantly affects thermal comfort due to tree shading and people's aesthetic preferences and advocated the creation of pleasant and attractive urban environments (Yan et al., 2023).

In the study of Kalavı (2021), it is stated that the effect of light and shadow (contrast) in street images is related to the amount of detail in the image, and the presence of various elements and details in street images reduces the contrast and increases the visual quality of the streets.

Figure 5. Light/Shadow Effect (Original, 2024)

3.2. Quantitative Methods Used to Measure Visual Quality

In the studies in the literature, street photographs are frequently used in the evaluation of visual quality on streets. Subjective and objective visual quality is determined by evaluating measurable design qualities through street photographs.

Street photographs have defined street areas characterized by human perspective on a large scale. Street photographs provide indicators that allow spatial quality to be measured from a human-scale perspective (Jiang et al., 2022). Studies have shown that emotional and aesthetic responses to environments and visual stimuli help us understand human interaction with the natural environment (Ibarra et al., 2017).

Measuring the quality of urban street images facilitates the definition of street renewal. Street-level images allow the development of new techniques to observe, perceive, and comprehend the street environment. Street View Imagery plays an increasing role in urban research. Such studies are increasingly gaining attention due to their value in various areas of the urban environment (Ma et al., 2021).

Streets are an integral part of urban space and have increasingly attracted attention in terms of human perception. Visual quality is an important factor affecting the attractiveness of urban spaces (Qi et al., 2023). The methods used to evaluate visual quality are divided into two categories: qualitative and quantitative. Qualitative methods include surveys, interview techniques, case and behavior studies, and aesthetic preference questionnaires. Quantitative methods include approaches such as fractal geometry, visual statistical analysis, golden ratio, correlation methods, content analysis, Brunswik's lens model, entropy, artificial intelligence, spatial index, and fuzzy logic theory (Tekel, 2021).

3.3. Seasonal Difference

It is stated in the literature that comparative studies conducted according to different seasons provide important information on how they affect people's perceptions and aesthetic preferences (Zhao et al., 2017; Kuper, 2020). Seasonal change of green areas on streets and avenues is an important component of landscape perception and aesthetic evaluation in studies on visual quality (Junge et al., 2015). However, in studies on visual quality through street and street images, comparative studies according to different seasons are limited (Palang et al., 2007; Stobbelaar and Hendriks, 2007; Junge et al., 2015) Revealing the effect of seasonal differences on visual quality and aesthetic perception with such studies will contribute to the literature in this respect. In this context, this section includes literature on street trees and seasonal differences in the evaluation of visual quality in urban environments. It is suggested that seasonal changes in landscape are an important component of landscape perception and aesthetic evaluation (Junge et al., 2015). There are also planners and architects who emphasize the importance of seasonal characteristics in urban planning (Palang et al., 2005). Landscape physiognomy can vary greatly depending on seasonal changes, which can affect people's perceptions and preferences. However, few studies have considered seasonal dynamics (Palang et al., 2007; Stobbelaar and Hendriks, 2007; Junge et al., 2015) Season can significantly affect landscape preference for two important reasons. As seen in Figure 6, the biological characteristics of plants cause changes in the appearance of the plant community with seasonal changes. Ecological characteristics such as color, shape, density, and biodiversity change, which affects visual perception and psychological response (Kothencz et al., 2017; Półrolniczak et al., 2019).

Figure 6. Landscape areas according to different seasons (Kuper, 2020)

The monitoring of scientific research and the examination of different perspectives can be carried out with the bibliometric analysis method. This method evaluates trends and relationships in scientific literature using the numerical data of published articles and citations. In this context, databases such as Scopus and Web of Science are some of the most frequently preferred sources for such analyses (Akpınar, 2023).

In this study, a detailed literature review was conducted with the keyword "seasonal differences". However, this review was limited only to the "Urban Studies", "Regional Urban Planning" and "Architecture" Web of Science category filters. The total number of sources reached in the WoS database is 131.

The distribution of a total of 131 studies on the concept of seasonal differences by publication type is as follows: 109 articles, 2 book chapters, 18 papers, and 2 early access publications. These studies cover research conducted in various publication types on the subject of seasonal differences.

Seasonal differences are included in studies belonging to various categories in the WOS atabase, such as urban studies, environmental studies, city and regional planning, ecology, and geography.

Table 2. Categories of publications in WOS on seasonal variation

WOS Category	***Number of publications***
Urban studies	82
Environmental Studies	67
Urban and Regional Planning	52
Ecology	40
Geography	32
Environmental Sciences	24
Forestry	24
Plant Sciences	24
Physical geography	21
Architectural	18
Conservation of biodiversity	18
Other	51

There are 82 studies in the urban studies category, 67 studies in the environmental studies category, 52 studies in the city and regional planning studies category, 40 studies in the ecology category, and 32 studies in the geography category.

3.3.1. The topic “seasonal variation” and the keyword “visual quality”

In the search, the keyword "seasonal differences" was selected and the keyword "Visual Quality" was included under the filter of the Web of

Science category "Urban Studies", "Regional Urban Planning", and "Architecture", and a total of 2 sources were found in the WOS database.

The studies conducted by Clay and Daniel (2020) and Yılmaz (2022) are summarized below.

There are many studies that prove that photographs have representative validity in the assessment of landscape qualities. The study conducted by Clay and Daniel (2000) also supports these findings. The study includes fieldwork and photo-based perceptual assessment along a road corridor in southern Utah. This corridor is located in a region that is a first-class tourism and recreation area and has heavy visitor traffic. The aim of the study was to determine how observers' perceptions of landscape beauty change along the corridor. The research is based on fieldwork conducted over four years between 1994 and 1997.

The study results evaluate the factors affecting the observers' preferences and show that the proportion of meadow has the strongest effect on preference. In addition, the study focuses on seasonal differences. The study states that flowering plants provide the variety of colors seen on the ground during most of the summer season. It was observed that management policies and field conditions also affect preferences. In particular, it was determined that banning animal grazing in park areas caused an increase in flowers and increased preference for these areas. These findings make a significant contribution to understanding landscape preferences.

In the study conducted by Yılmaz (2022), the effect of stress on visual landscape perception was examined with a survey based on photographs. The photographs used in the survey included images of natural, artificial, and cultural areas that affect landscape design and also included photographs from different seasons. The survey was applied in two periods: when the students were under high stress before an important exam and when they were at a low stress level one month after the exam. The participants provided information about their daily activities, study habits, and emotions before the exam and rated the effects of various environmental factors on their study abilities and academic achievement.

In the main perceptual survey, emotional responses to 22 landscape photographs were measured by rating six emotions associated with each scene (excitement, relaxation, happiness, stress, discomfort, and fear). Emotional ratings during high-stress and low-stress periods were analyzed using SPSS 17.00 with multiple comparisons and Pearson correlation methods. Higher stress levels were confirmed in the first survey, and perception ratings showed significant differences among landscape scenes. The results showed that stressful conditions affect perception and that these conditions result in higher emotionality. In both cases, students gave the highest scores for comfort and the lowest scores for fearful scenes. Under stress, students perceived the photographs superficially, while under no stress, they examined them in more detail. Urban space designs, especially on university campuses, should be examined in more detail in order to reduce stress and increase emotional comfort. It is recommended that landscape architects consider water surfaces, colorful plants, and open green spaces in their designs.

3.3.2. The topic “seasonal variation” and the keyword “visual aesthetic quality”

In the search, the keyword "seasonal differences" was selected, and the keyword "Visual Aesthetic Quality" was also included under the filter of the Web of Science category "Urban Studies", "Regional Urban Planning" and "Architecture", and a total of 1 source was found in the WOS database. In the study conducted by Zhao et al. (2017), the effects of seasonal changes in trees on people's aesthetic preferences were examined. The study focused on the appearance of deciduous trees in different seasons. Considering that the appearance of trees, especially deciduous trees, is affected by seasonal changes, deciduous trees were preferred in the study. The photographs were taken at eye level and when the weather was clear or slightly cloudy in four different seasons, each in spring, summer, autumn, and winter. All photographs were taken in the same location. The study found that the aesthetic quality of trees in spring was not significantly related to that in winter, but the aesthetic quality in autumn or summer was closely related to the aesthetic quality in the other three seasons (Figure 7).

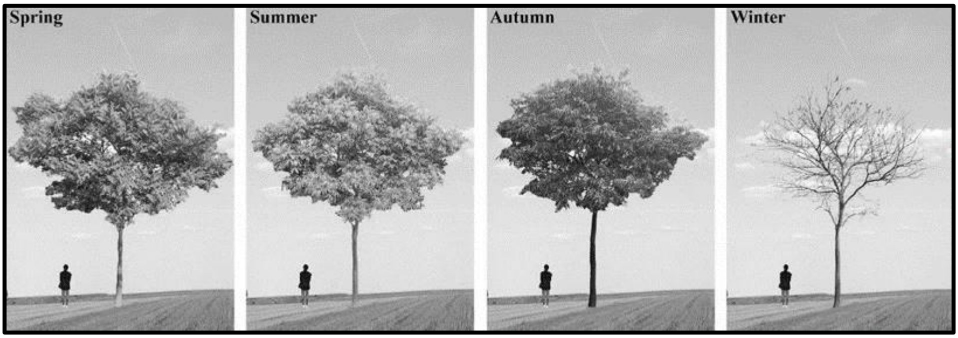

Figure 7. Images of a tree in different seasons (Zhao et al., 2017)

3.3.3. The topic “seasonal difference” and the keyword “street”

In the search, the keyword "seasonal differences" was selected and the keyword "Street" was included under the filter of the Web of Science category "Urban Studies", "Regional Urban Planning" and "Architecture", and a total of 4 sources were found in the WOS database.

Two sources found to be suitable within the scope of this study are summarized below.

In the study conducted by Bhatia and Jason (2023), the relationship between greenery levels and crime rates in Chicago was examined. In the study, greenery levels were measured using the remotely sensed normalized difference vegetation index (NDVI), and seasonal changes were taken into account. This study supports Jane Jacobs' theory. The main idea of Jacobs' theory is that neighborhood residents should watch the streets in order to prevent crime (Jacobs, 1961). The idea that "the more eyes on the street, the less likely crime will occur" emphasizes that streets are natural surveillance providers and is consistent with this study (Jacobs, 1961). In addition, the eyes on the street theory is supported by indicating the potential for interaction between greenery levels and social cohesion and guardianship in the neighborhood (Bhatia & Jason, 2023).

The findings show that greenery levels are inversely related to overall crime rates. This means that increasing green areas can reduce crime rates and increase the sense of safety in neighborhoods. The study also observes the effects of seasonal changes on crime, finding that greenness measured by NDVI is highest in summer and lowest in winter for each year. It was observed that seasonal crime rates tend to be highest in summer and lowest in winter across all crime classifications (total, violent, and non-violent).

A study conducted by Muğan (2018) examined the complex relationship between time and space in a study conducted with urban youth in Ankara. The study was conducted in an area designated for pedestrians for about 40 years, such as Sakarya Street. Data were obtained through observations and face-to-face interviews with 82 youth. The effect of the interaction of time and space on youth's perception and experience of uncivil behavior was examined within the framework of different times of the day and seasonal differences.

The qualitative assessment of the study, supported by statistical analyses, showed that the physical and social environments of the street context affect the behavior of young people and affect their perception and experience of uncivilized behavior. It was observed that young people attributed different meanings to Sakarya Street and the use of time and space. For example, Sakarya was perceived as a safe entertainment place for some young people, while it was perceived as a dangerous place for others.

The findings show that young people used the streets more when they perceived Sakarya as a problematic and unsafe place. The effect of daily and seasonal differences was examined, and it was determined that Sakarya was perceived as more dangerous and unsafe, especially in the evening and at night. However, although the effect of seasonal differences is not definite, it was observed that it affected some uncivilized behavior experiences.

As a result, it was seen that time and space variability had an effect on young people's perception and experience of uncivilized behavior. It was stated that the changes occurring at different times of the day had the greatest effect on young people's perceptions and experiences. However, the effect of seasonal differences was generally ignored.

4. Conclusion and Suggestions

The visual quality of streets is an important factor that determines the attractiveness of public spaces. Studies emphasize that the visual quality of streets and avenues forms the basis of street activities (Lynch, 1984; Gehl and Svarre, 2013; Gehl, 2013). Recently, studies that address street and street quality from a more detailed perspective have been proposed (Yang et al., 2018). These studies emphasize that the presence of green areas on streets and avenues is an important element that increases visual quality (Cooper et al., 2013). At the scales of urban design and architecture, design decisions related to the green system are evaluated at the scales of parks, squares, pedestrian paths, streets, avenues, gardens, parcels, and buildings. Integrating these decisions with urban plans and urban design projects will increase the efficiency of applications (Gedikli, 2022). Therefore, it is stated that the aesthetic evaluation of green areas on streets and avenues is important not only theoretically but also practically. The physical characteristics of streets and avenues can objectively reflect their spatial quality, but people's aesthetic perception cannot be obtained from physical characteristics alone. Research suggests a mixed approach to assessing the visual quality of natural and built environments. It has been determined that seasonal changes in street trees may affect individuals' visual quality assessment processes and may lead to differences between measurable design attributes that shape perceptual differences.

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Landscape Design Process in Historical Environments: The Case of Hacı Bektaş Veli Shrine

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1. Introduction

With globalization, cities are turning into a collection of buildings that are increasingly ordinary and similar to each other, losing their unique identities. Historical environments bearing the traces of different periods and cultures are important urban spaces in the formation and strengthening of urban identity. In other words, historical urban spaces are a narrative of an idealized past that keeps urban culture and history on the agenda (Lynch, 1972).

Historical cities are settlement textures that have gained identity with their architectural, cultural, archaeological, and monumental values and sometimes have cultural richness and diversity with their traditional texture characteristics (Temizel & Erdoğan, 2019). Historical environments, which reflect unique tangible and intangible values, were formed as a result of the life philosophy and accumulation of various civilizations (Norberg-Schulz, 1979). Therefore, in a world where living conditions, traditions, and construction techniques are changing rapidly, historical urban spaces are open-air museums that show what kind of environment they lived in in the past (Ahunbay, 2004). However, historical environments that give clues to traditional lifestyles, building styles, and artistic sensibilities cannot keep up with the pace of globalization, rapid consumption, and technological development and disappear over time (Binan, 1999).

The buildings in the historical environment define the architectural identity of the region with their architectural styles and space designs. It is important to see the buildings and their elements, which are the components of the city, in their original location in order to understand the

integrity of the historical environment and to create environmental awareness (Ahunbay, 2007). In this context, the main purpose of conservation and renovation of historical environments is to ensure historical and cultural continuity, to re-function historical environments in line with contemporary living conditions by preserving their identity, and to protect the urban landscape and traditional settlement model (Çelik & Yazgan, 2007).

Historical heritage conservation at the city scale starts with the structure and its garden. When historic buildings are preserved together with their surroundings, traditional architecture can maintain its distinctiveness and continuity (Çelik, 2004; Ponting, 2000). At this point, landscape design stands out in historical environments. Özdemir (2007) stated that while urban landscape design provides the formation of the physical and social character of the city, it emerges as an effective process in the context of the protection, survival, and development of historical textures.

Design is a process in which solution alternatives for a given problem start in the mind, are produced through analysis and synthesis processes, and the best one among these alternative products is transformed into a design product (Karaşah & Özdemir Durak, 2022). One of the main purposes of design is to create a harmonious whole by combining different parts (Pile, 1997; Alpak et al., 2018). Landscape design in historical environments is an important tool in the protection and highlighting of historical buildings and historical urban textures, which are among the determining elements of urban identity, and in the development of holistic design approaches at the urban scale (Temizel & Erdoğan, 2019). Therefore, with the landscape design works carried out in historical environments, historical environments are transformed into an area integrated with the existing urban texture, and their sustainability is ensured.

In this study, the landscape designs and processes produced for the transformation of Hacı Bektaş Veli Shrine and its surroundings, which is an important cultural heritage site located in Nevşehir and included in the UNESCO temporary heritage list, into an integrated area with the city, were evaluated.

2. Material and Method

The main material of the study is Hacı Bektaş Veli Shrine and its immediate surroundings in Nevşehir/Hacıbektaş district of Central Anatolia (Figure 1). Founded in the 14th century, the shrine is a faith tourism destination and is on the UNESCO tentative cultural heritage list (April 13, 2012). The shrine has a total area of 30.000m^2 and is 45 km from the center of Nevşehir. The study area is a landmark on Atatürk Boulevard. Some landscaping was made in the study area, but there are visual, aesthetic, and functional deficiencies. The shrine, known as the 2nd most visited museum in Turkey, is visited by an average of 600.000 tourists, both local and foreign, throughout the year. The maximum slope in the area is 8%, and the area also has a semi-arid continental climate.

Figure 1. Study Area

Landscape design is a disciplined process consisting of different design stages. The first stage of this design process is site analysis. In the second stage, the functional diagram is completed, where design decisions are made for the main uses and the uses are correctly associated in the most appropriate locations. In the third stage, draft projects were prepared in line with the stain study. In the third stage, design alternatives were prepared in line with the functional diagram and design decisions, and the process was completed with hardscape design, planting design, section views, construction details, dimensioning, and 3D modeling projects.

Within the scope of the Nevşehir Hacı Bektaş Veli University Department of Landscape Architecture education program, in studio classes, landscape design studies are carried out on different subjects and scales, such as single housing, mass housing, urban parts (such as squares, historical environments, urban parks, educational campuses, etc.), and coastal areas (river, hotel). In the Project III lesson of the 2022–2023 fall semester, a city part with the theme of historical environment was studied.

3. Findings and Discussion

In the design-oriented landscape architecture department, project courses are carried out in groups. This study focuses on the products that represent the best examples of landscape design processes among the project layouts produced by 20 students working under the responsibility of two different lecturers.

3.1. Findings Related To The Survey-Analysis Process

In this process, where the current situation of the study area is revealed in detail, data such as natural, cultural, and perceptual factors related to the area are collected and personal observations are made. In the survey-analysis process, which forms the basis of the landscape design, the data obtained after the assessment of the situation is handled according to the landscape design and planning principles. Therefore, in this process, if the student does not correctly inventory the study area and analyze the data they obtain correctly, the basis of the design starts wrong.

In the survey-analysis process, all data are interrelated. During this process, students were asked to analyze data such as location analysis, far-near environment, slope, mass void, vegetation, soil, climate, land use, and transportation analysis. Students were asked to design this data on a 70x100 layout using different presentation techniques in line with the criticisms given by their group lecturers (Figure 2).

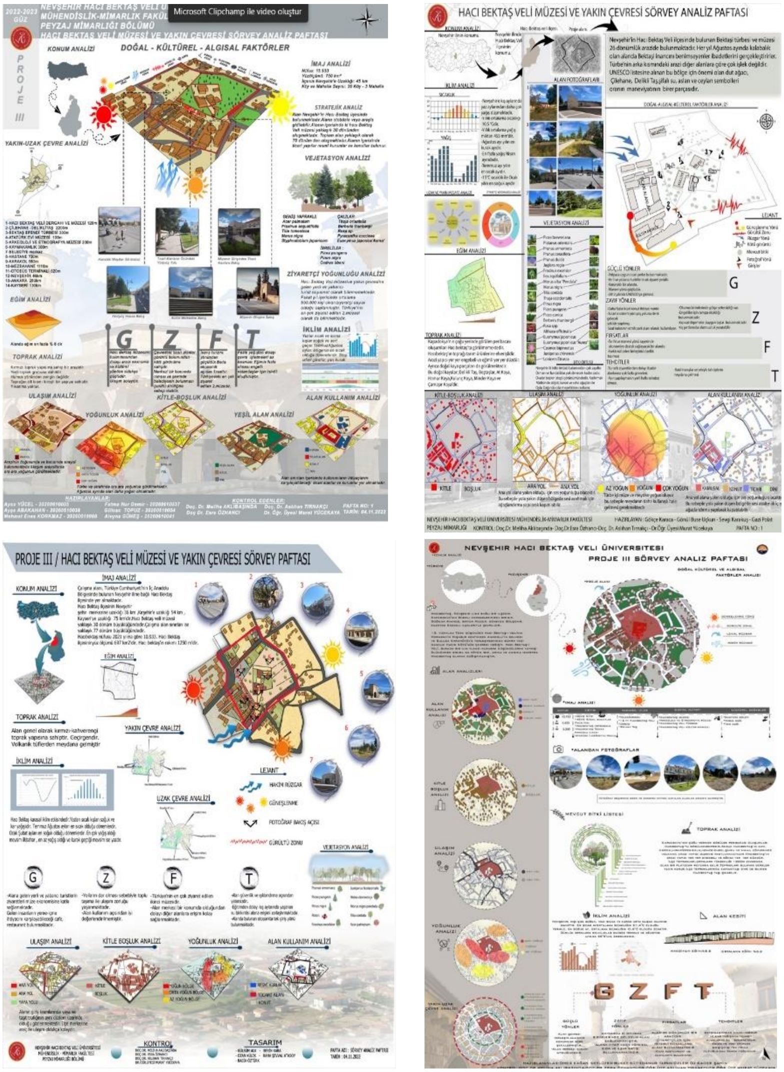

Figure 2. Survey-Analysis Sheets of Students

3.2. Findings Related To The Functional Diagrams and Design Desicions

In order to achieve success in outdoor design and meet user needs, it is extremely important to establish a good need-activity-space relationship (Sarı, 2019). In this process, students were asked to prepare a list of needs in line with the data they obtained in the study area, taking into account the user profile, wishes, and needs. Due to the cultural and historical values of the study area, the main spaces of use identified by the students, where the basic requirements of the project subject were put forward, were such as the CEM square, culture street, water surfaces, seating areas, food court spaces, exhibition areas, and ceremony area.

The function diagram is the first functional diagram made on paper, and the aim is to create an idea plan based on function. At this point, they were asked to focus on the usage areas, their relations with each other, and circulation without considering the scale. Afterwards, the students were asked to design the most ideal function diagram and design decision sheets that they determined by trying different alternatives in line with the criticism they received from their lecturers.

3.3. Findings Related to the Final Projects and Planting Design Sheets

- Historical environments are primarily sensitive areas that need to be protected and developed in urban areas. Each student produced original designs in line with the targets set for the protection and development of the study area. These targets are:
- Emphasize buildings of historical, cultural, and architectural importance.
- Removal of functions that are incompatible with the study area, designing the surrounding buildings in a way to ensure integrity with the area (building facade designs),
- Creating a pedestrian-dominated circulation system in the area, designing the city square, pedestrian roads, and pedestrian zones,

- Design sufficient car parking spaces for the use of local residents and visitors.
- Design of spaces for tourism and traditional production and sales units,
- Designing and using the educational and directional signage for the study area,
- Creating microclimatic spaces with the use of plants and water in open areas,
- Designing recreational areas suitable for the traditional structure of the local residents and for all age groups.

In general, the students took Hacı Bektaş Veli Shrine as the landmark in the designs and made it possible to enter the study area from every point. A sufficient number of parking areas have been designed for the use of tourists arriving throughout the year. As it is a faith tourism center, it has created spaces supported by different activities where traditional and cultural product sales units are located. In projects with a pedestrian-dominated circulation system, the climate of the area and its surroundings have been improved with designed water surfaces and green areas, and recreation areas suitable for all age groups, such as exhibition areas, ceremony areas, and cultural streets, have been designed. Because people who interact with nature perceive their surroundings as more efficient and comfortable (Taşçıoğlu et al., 2019).

Plants are the most important living materials used for aesthetic and functional purposes in landscape design. In addition, the ecosystem services provided by plants are remarkable in urban areas (Sarı et al., 2020; Tülek et al. 2024). While planting designs are made in the historical environment, the species to be used should be carefully selected, and different approaches should be presented in plant compositions. Students are expected to do so when planting design, especially in historical environments; they were asked not to disturb the silhouette of the existing historical texture, to give dimension to the spaces they designed, to guide the users, to define the spaces, to enrich the spaces in terms of form, color, and texture, to ensure the mass-void balance in the design, to determine the boundaries, and to pay attention to the seasonal sustainability of the design.

All students designed in accordance with the desired design approach in their plant design projects and took care to prefer native plant species. Especially around the historical texture, evergreen and coniferous species were selected, and multi-colored plants were not preferred. Students have supported and focused on the historical buildings with plants, shaded the squares and pedestrian roads with plants, and provided a balance of mass and space in the area. The boundaries of the study area are defined by the layering plants they have created. They also provided the color effect in the area with ground cover plants, which are complementary elements of the planting design (Figure 3).

Figure 3. Planting Design Sheets of Students

3.4. Findings Related to Section- Views, Construction Details, Dimensioning, 3D Views, and Presentation Sheets

After the planting design process, students were asked to take cross-sections from different points of the study area in a way to show their relationship with the environment. Afterwards, they were asked to prepare a sheet containing the details of the hardscape materials and urban furniture they used in their designs. Finally, they prepared a dimensioning sheet, which is an important output in the landscape design process, to be used in the implementation of the project in the area. They also prepared a sheet containing 3D details of different points in the area using different programs, such as SketchUp and Lumion. Finally, they were asked to prepare a presentation sheet in which they explained the whole project process using different presentation techniques in a layout. This is a sheet in which students organize the content of their project in the best way to describe their project and the project briefly and in short (Figure 4).

Figure 4. Presentation and Cross-Section Sheets of Students

4. Conclusion and Suggestions

Historical environments, which are nodes in the urban landscape, are sensitive zones that need to be protected and developed with priority. In this context, landscape design is important in preserving the traditional texture of historical environments, revealing the historical identity, and creating livable urban areas.

In landscape design education, studio courses in which different study subjects such as residential housing (Yaşar & Düzgüneş, 2013), mass housing (Karaşah, 2023a), courtyard (Karaşah, 2023b), and waterfront (Acar & Bekar, 2017) are handled at different scales consist of a process that requires disciplined and meticulous work. In this study, it is aimed to teach how the general approach should be in landscape design in historical environments with unique character with their historical, architectural, monumental, and cultural values in the city and how the balance of conservation and utilization can be achieved. In line with this purpose, the products of the designs that emerged in the process of landscape design in historical environments were evaluated.

Historical environments, which are a determining part of the physical character of the city, are a type of cultural landscape that establishes a connection between the past and the present. In the study, it is aimed at designing spaces where the historical texture is emphasized and preserved within the urban texture, where urban residents and tourists can socialize and meet their needs. In this context, students have supported urban memory by creating spaces that emphasize the identity of the study area and meet the needs of the users, provided that they are not too different from the historical identity of the area and the spatial use of the residents.

Extensive open-green areas to be created with the right landscape planning decisions to be taken in historical environments support the protection of the historical building and its surroundings (Tırnakçı & Aklıbaşında, 2018). It has been seen that the students produced designs with a protective approach to the historical structure and its surroundings with the extensive green areas they created around Hacı Bektaş Veli Shrine.

Urban historical environments are damaged and even destroyed due to reasons such as migration, population growth, urbanization, social-cultural differentiation, and economic differentiation. For this reason, historical environments should be integrated into urban design not only on the basis of buildings but also by integrating them with their surroundings and today's needs. Consequently, in line with the principle of integrated conservation, unique spaces that have an impact on urban identity should be designed in these areas. We expect this study, which explains the landscape design process in historical environments, to serve as a guide for both landscape designers and students.

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Xeriscape Landscaping and Roof Garden Design

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1. Introduction

Industrialization, technological developments, increasing urbanization and the impact of population, which have progressed without slowing down until today, have caused global warming to be felt seriously. Global warming affecting the world; It disrupts the natural balance by changing climatic values and causes great harm to water, which is one of the basic resources required for life (Appenzerler and Dimick, 2004; Karaman and Gökalp, 2010).

The decrease in water resources, which directly affects the life of living things, disrupts the sustainability of nature; It has caused many problems such as deforestation, drought, decrease in the diversity of agricultural products, increase in natural disasters and atmospheric events, aggravation of erosion and decrease in productivity (Öztürk, 2002).

The decrease in water resources because of the increasing need for water in all areas of life has brought to the fore the need to better understand the importance of water. Protecting and ensuring the continuity of water from natural resources that have no alternatives and cannot be produced is of great importance in terms of both environmental balance and transferring water to future generations (Karaman and Gökalp, 2010). In this context, managing, protecting and improving the use of water resources as a whole in terms of physical, social, economic and environmental aspects has become more important day by day (Ertop, 2009; Karaman and Gökalp, 2010; Baykan and Birişçi, 2013; Metin and Koçan, 2020).

Most of the available water in the world is used in agricultural areas. In this regard, landscape design works are one of the areas with the highest water consumption among agricultural areas. Droughts that occur because of increasing temperatures and low amounts of precipitation due to changing climate conditions today have brought to the agenda the more rational, strategic, and efficient use of water in landscaping, as they directly affect the vital activities of plants (Barış, 2007). In this context, practices such as using water-efficient landscape designs such as "Xeriscape", that is, xeriscape approach, and choosing natural plant species, especially in landscaping works in arid regions, which are gaining importance day by day, are very important in terms of water saving (Atik and Karagüzel, 2007; Çorbacı et al., 2011a).

"Xeriscape Landscaping", unlike the classical landscaping approach, comes to this day as an approach that embraces water saving such as "Less Water Use", "Rational Use of Water" and "Natural Landscape Arrangement", which are collected under the title of "Water Efficient Landscape Arrangements" (Weinstein, 1999).

Design studies carried out in line with the arid landscape understanding; It has been brought to the fore in many studies that it has a perspective that saves water, is compatible with the environment, preserves visual quality and aesthetics, reduces maintenance costs and processes, does not have adaptation problems by choosing natural species with low water needs in the area where it is applied, and can minimize chemical applications (Aklanoğlu, 2007; Güvenç and Demiroğlu, 2016).

2. Xeriscape Landscaping

When the history of landscaping is examined, gardens were previously created for aesthetic and pleasure purposes rather than for a purpose and benefit. However, later, the gradual decrease in natural resources as a result of environmental problems, increased pressure on water and water scarcity

have warned people that water should be used more rationally. Problems in places where water use is the highest, such as parks and public or private gardens, have led to the formation of new trends in landscaping on the need to use less water. For this purpose, under the subject heading "Water-Efficient Landscaping"; Apart from classical movements such as "Rational Use of Water" (Water-Wise, WaterSmart), "Low -Water" and "Natural Landscaping", new concepts have emerged. Although these concepts show some differences, they all have the same purpose. One of the first approaches developed by formulating these basic principles was "Xeriscape Landscaping" (Tülek, 2008).

The concept of xeriscape (zer-i-scape) was first developed in 1978 by the Denver Water Department and Colorado State University in the state of Colorado, USA, for the purpose of saving and protecting water in landscaping. It was created by combining the Greek words ' xeros ', meaning 'dry', and the English ' landscape ', meaning 'landscape' (Wilson and Feucht, 2007).

The value of water in the landscape and the necessity of its protection emerged as a result of the drought experienced in Western America in 1977. It was observed that approximately half of the water was consumed for uses such as lawn and landscape plants. After this situation emerged, many homeowners chose to create large areas made of materials such as plastic and stone instead of grass areas to contribute to water conservation. However, this practice resulted not as a rational use of water or as a real xeriscape, but as a practice that harms trees and shrubs (Wilson and Feucht, 2007).

The first garden was designed in the seventies in line with the principles of arid landscaping. Located in the semi-arid region of Colorado, this garden was designed as an exhibition area where vegetal areas were created using little or no water. This garden was designed within the framework of a non-classical plan, using similar but different materials and offering visitors a variety of options. Thus, it became an instructive garden on how to use water more rationally. This garden, opened in 1980, was designed with more than five thousand plants consisting of ninety different species. Most of these plants are local plants of the region they belong to. Xeriscape, also found in Colorado and containing all the features of today's xeric landscape demonstration Garden ‟ was created as a continuation of the first garden. It is an exemplary garden that demonstrates the basic principles of Xeriscape Landscaping, consists of certain irrigation zones, and contains easy-to-access and natural-looking landscape elements. It covers an area of 7041.78 m^2 and contains 64 trees, 126 shrubs, 340 seasonal flowers, many ground cover and ivy varieties, 12 grass species, 71 local plants, and 185 tons of large rocks (Çorbacı et al ., 2011a)

For the garden to be easily visited by visitors, landscaping projects are designed in a coordinated manner and the plants are listed with letters indicating their location. Information about the local name, Latin and characteristics of the plants was processed (Çorbacı et al., 2011a)

Over time, the Xeriscape Landscaping understanding has developed further and become a part of the Energy-Friendly Architecture movement, along with current issues such as "Ecological Planning", Energy-Saving Design and "Rational Use of Energy". All these ideas aim to use natural resources within the scope of sustainable development. These ideas, which have remained at the design scale for now, will apparently be examined and designs will be created in larger areas and on a larger plan scale in the future (Taner, 2010).

3. The Importance of Xeriscape Landscaping

Xeriscape Landscaping, gardens or green areas created in line with Xeriscape principles to the environment are examined under the headings,

- *Provides water savings:* Research has shown that a garden designed with xeric landscaping principles saves nearly 50% of water annually compared to other traditional gardens. This water saving rate is an important criterion regarding domestic water consumption. If these methods are carried to a regional or even national level, water consumption will decrease considerably, water saving will reach a satisfactory value, and thus water saving will no longer be evaluated as a preference but in line with need (Welsh, 2007; Taner, 2010).

- *Provides financial savings:* A garden designed in a xeric landscape reduces water consumption and a decrease in water costs is observed. In addition, these types of gardens remain self-sufficient, simple, and useful in the future, thanks to their appearance close to nature. As a result, application, maintenance, and repair are significantly reduced,

-*Saves time:* In xeric landscape areas, local plants that do not require much water are used, which reduces the time spent on planting, maintenance, repair, irrigation, and fertilization,

- *It is aesthetically pleasing:* Arid landscape areas are like simple, natural areas, far from artificiality, and are permanent. It creates a rural and comfortable environment for the person,

- *Provides ecological benefits:* In Xeriscape Landscaping areas, the use of pesticides and fertilizers is low. Local plants are used. The structure of the soil does not deteriorate, and it provides water conservation. Thus, it provides a healthy living environment for other plants, animals, and humans (Şahin, N. 2013).

4. Contributions of the Xerious Landscape to the Ecosystem

- According to Tregay (1986), ecological designs provide solutions to many problems in urban open green space ecosystems (Kavuran and Yılmaz, 2022).

-Microclimate can be created with the natural environment created and contributes to the increase of air quality,

-Insulation of the natural structure with local plant species provides urban sound control and noise absorption,

-With the wetland designs to be in the region, it creates the recovery of rainwater, which is predicted to be lost through surface runoff, to the area through the natural hydrological water cycle,

-As these areas are the determinants of possible environmental changes and threats, they play a guiding role in preventing larger ecosystem problems,

-At the same time, according to Chow and Brazel (2012), landscape studies for the efficient use of water resources; while reducing the need for water, it also reduces the urban heat island effect (Kavuran and Yılmaz, 2022).

One of the most important functions of Xeriscape Landscaping applications is to reduce maintenance costs.

5. Basic Principles of Xeriscape Plants

5.1 Project Planning

For effective planning and implementation of Xeriscape Landscaping work, each stage must be carefully designed and implemented. Because in a properly designed application, time and cost are saved. While it can be done from scratch during the planning and project phase, it can also be implemented in the existing field with various arrangements (Çorbacı et al. 2011a). During the planning and projecting phase, a survey analysis should first be created to determine the physical and environmental conditions of the area. In survey analysis, climatic data of the area to be planned should be taken into consideration. The areas covered by their functions should be created with the designs that are intended to exist in the area, when choosing the plants in the area, care should be taken that the plants to be used are local plants, grass areas should be given as little space as possible, the area should be divided into water use zones for effective planning of irrigation, water should be used for both plant roots and the growing environment. Mulching practices should be increased in order to preserve more soil in the soil (Ertop, 2009).

5.2 Soil Preparation

Soil analysis must be carried out correctly to use the soil, which is the growing medium, in the most accurate way in xeric landscaping applications where water is used effectively. With soil analysis, it becomes easier to select the plants that are expected to exist in the area and to adjust the amount of water to be given to these plants and the irrigation time. (Ayanoğlu and Demirel, 2023).

5.3 Appropriate Plant Selection

When selecting plants for xeriscaping applications, climatic factors and the existing soil structure of the area should be analyzed well to determine the growing conditions of the plants to be used in the area. During vegetative design, plants should be well-formed by zoning them according to their water needs. When selecting plants in xeric landscaping applications, plants specific to the region should be chosen, and existing plants that require less water should be used exactly to save water in the area (Hersek, 2021).

5.4 Creation of Grass Areas

Grass areas are the plant material that needs water the most due to their physical structure. For this reason, when creating grass areas in xeric landscaping applications, warm climate grass plants are generally chosen if they are suitable for the region, and grass areas are placed in entrance areas and areas where recreational activities are intensely carried out in a way that takes up less space (Çetin and Mansuroğlu, 2018).

5.5 Effective Irrigation

Three methods are included in irrigation, which is one of the most important parameters that determine the success of Xeriscape Landscaping applications. These methods are drip, sprinkler, and hand irrigation methods. To provide the most effective irrigation in the area, pressurized irrigation systems and drip irrigation systems should be used, and irrigation should be applied to control the time and amount of irrigation (Demirel, 2022).

5.6 Mulch Use

Mulch is organic and inorganic materials that reduce the plant's need for additional irrigation, maintain soil moisture, and prevent weed growth. Organic origin materials, such as leaves, pine bark, etc., can be obtained through natural means due to their structure. While it consists of materials of inorganic origin, it is applied by processing artificial elements such as rocks and gravel (Çöp and Akat, 2021).

5.7 Proper Maintenance

In xeric landscaping applications, in the planning and projecting stages, local plants are used in designs that adhere to the seven basic principles of Xeriscape Landscaping, and since less space is given to grass areas, maintenance costs can be mostly saved (Çorbacı et al., 2011a).

6. Plant Species That Can Be Used In Xeriscape Landscaping

6.1 Xeriscape Plants

- Phoenix dactylifera (Date) / Less WATER / Middle East,
- *Acacia cyanophylla* (Cypriot Acacia) / Medium WATER /Mediterranean Countries,
- *Robinia pseudoacacia* (False Acacia) / Medium WATER /Northern Anatolia, North America, Mediterranean Countries,
- *Melia azaderach* (Rosary Tree) / Medium WATER /Far East, Southern Europe, India, China,
- *Albizia julibrissin* / Medium WATER /Asia, Northeastern Anatolia, Northern Iran,
- *Celsius orientalis* (Hedgehog Tree) / Less WATER /Southern Europe, North Africa, Turkey,

- *Ceratonia siliqua* (Carob) / Less WATER /Mediterranean Countries,
- *Koelreuteria paniculata* (Guvey's Lamp) / Less WATER / Asia, China,
- *Morus platonifolia* (Plane Leaf Mulberry) / Medium WATER / China, Japan, Far East,
- *Pinus pinea* (Stone Pine) / Less WATER / Mediterranean Countries, Portugal,
- *Grevillea robusta* (Grevilya) / Less WATER / Australia,
- *Ligustrum vulgare* (Common Privet) / Medium WATER / Northern Turkey, Central Anatolia, Morocco, Europe
- *Cercis siliquastrum* (Judas tree) / Less WATER /Mediterranean Countries,
- *Lagerstroemia indica* (Lacewood Tree) / Less WATER / Southern China, South Asia *Nerium oleander* (Oleander) / Less WATER /Mediterranean Countries
- *Myrtus communis* (Mersin) / Less WATER /Mediterranean Countries, Southern Europe, North Africa, Western Syria, Cyprus, Central Asia
- *Hibiscus syriacus* (Tree Marshmallow) / Medium WATER /Pakistan, China, India
- *Laurus nobilis* (Laurel Laurel) / Medium WATER /Mediterranean Countries
- *Vitex agnus-castus* (Visitor) / Less WATER /Mediterranean Countries, Southern Europe,

- *Cotoneaster horizontalis* (Mountain Medlar) / Less WATER /China, Asia, Europe, Africa
- *Lantana camara* (Tree Mineral) / Less WATER / South America, Tropical Asia
- *Thymus vulgaris* (Thyme) / Less WATER / Europe, North Africa, Asia, Mediterranean Countries,
- *Campsis radicans* (Acemborosu) / Less WATER /USA, Florida, Texas
- *Yucca filamentosa* (yucca flower) / Less WATER / USA
- *Pyracantha coccinea* (Fire Thorn) / Less WATER /Asia, Southern Europe, Crimea
- *Cineraria maritima* (Ash Flower) / Less WATER /South Central Europe, Western Mediterranean
- *Rosmarinus officinalis* (Rosemary) / Less WATER /South Africa, Mediterranean Countries, France, Spain, USA, China, Australia
- *Magnolia grandiflora* Magnolia / Medium WATER requirement
- *Acer negundo* L. Ash-leaved maple / Medium WATER requirement
- *Vibirnum opulus* (Deciduous Viburnum) / Medium WATER /Mediterranean Countries, Southern Europe
- *Juniperus horizontalis* (Spreading Juniper) / Less WATER /North America
- *Tamarix tetranda* (Tamara) / Less water /Europe, Africa, Western Europe, Mediterranean, East Asia (Çöp, S., & Akat, H. (2021).

7. Dry Landscape Examples

7.1 Free Zone Example:

Figure 1. Xeriscape Landscaping Example (Nationality, 2021).

If a one-acre area is designed with rich plant species and grass areas, it needs to be irrigated 150 days a year using 6 liters of water per square meter per day under Izmir seasonal conditions, and this amount corresponds to an annual water consumption of 900 tons. After the Xeriscape Landscaping approach applied in the region in question, the average daily water need decreased to 3 liters and irrigation was carried out once a week, for a total of 30 days a year, and 90 tons of water were consumed annually. In this way, it was possible to save 810 tons of water per decare in green areas with xeric landscaping application (Esbaş, 2023).

7.2 Burdur Bucak District Example

Figure 2. Bucak Municipality Xeriscape Landscaping application (Milliyet, 2021).

An average of 25 thousand tons of water was saved annually in the intersections and median strips implemented by Bucak Municipality with xeric landscaping. During the application, 13 thousand plant species that consume low water, 96 tons of stone, 66 m^3 of tree bark and 6 thousand m^2 of mulching cover were used. Thanks to the application, water, electricity, maintenance and repair activities and labor costs were saved, while 50% of water and 30% of electricity were saved (Anadolu Agency, 2022).

7.3 Antalya City Center Example

Figure 3. Example of intersection application in Antalya (Milliyet, 2021). By removing the grass areas at intersections and median strips and applying mulch materials instead, 50% savings in water and electricity and 30% savings in pesticides and fertilizers were achieved (Milliyet, 2021).

8. Roof Gardens

Roof gardens are vegetative layers on structures that have existed since the earliest times of history. In the early modern era, the idea of green roofs was put forward on different continents and the first model was featured at the World Expo in Paris in 1867. Designers of modern architecture in the 20th century (Le Corbusier, Alvar Aalto and Frank Lloyd) began to implement green roofs and walls in their designs with construction (Abbas et al., 2020).

H. Koch at the end of the 20th century and was later developed technologically and used effectively in modern buildings. The innovation and development of roof technology made Germany the first country in the world to adopt the principle of green roofs, followed by several countries in Northern Europe and North America and most recently in Asia (Jim, 2017). As an ecologically new tool, roof gardens are also referred to as covering traditional conventional roofs with a real living cover consisting of plants that require minimal maintenance and irrigation, with minimal changes to the structure of existing buildings or without requiring any changes on the roof (Aras, 2019).

In other words, roof gardens are growing places where the roof or waterproofing membrane of a building is partially or completely covered with vegetation. These gardens are often places used for recreation, entertainment, and as additional outdoor living space for building occupants. In these areas, it is a tool to re-establish the relationship between humans and nature that has been lost in urban environments. In addition, roof gardens absorb rainwater, provide insulation, improve air quality and urban ecology, offer an aesthetically beautiful view, and help reduce the urban heat island effect, thus offering advantages to their users (Bizhanzad., 2021). with plants can be installed in a wide variety of buildings, from industrial facilities to private residences. Green roof systems consist of many components such as providing plants with the nutrient source they need, providing an environment for the roots to grow, and a drainage layer to drain the water required for their development and the remaining water (Abbas et al., 2020).

9. Layers that should be included in roof gardens

9.1 Separation Layer

The separation layer prevents the materials used in roof insulation (roof seal; water, temperature and vapor barrier insulation layer) and the root protection layer from damaging each other chemically. It consists of synthetic felt or similar material. On roofs where the root protection layer also has the function of waterproofing, the felt laid on the ground provides mechanical protection of the root protection layer against damage that may occur due to negative effects on the drainage system or planting layers (garden tools, vertically positioned sharp objects, rough surface below). According to Fisher (1983), while plastic mesh protection elements are generally used on flat roofs, a felt type material is generally used on sloping roofs. At the same time, by inserting pressure-resistant thermal insulation plates into or under the drainage layer, the root protection layer and similarly the layers used for roof insulation are protected (Kucukerbaş, 1991).

9.2 Root Protection Layer

Bituminous water insulation alone is not sufficient to prevent roots from penetrating the structure on roofs. The roots of some plants react aggressively and damage the roof surface to reach water. To prevent damage to the roof insulation layers by plant roots, the existing waterproofing should be reinforced with a root protection layer made of soft PVC, a synthetic or plastic material, and care should be taken to ensure that the material used is strong and bituminous. Research and trials conducted to date have shown that the resistance of the cover material to roots depends on the properties of the material it is made of and the thickness of the cover, and the joints must be strong. Techniques used in connections; bonding, welding, thermal bonding (thermal welding) and coating (Küçükerbaş, 1991).

9.3 Drainage Layer

Liesecke (1984, 1987), the function of the drainage layer is to drain the excess rain or irrigation water leaking from the vegetation and filter layer. This event is very important in obtaining the air-space volume required for the oxygen requirement of the roots. The drainage layer should be made of natural and artificial materials (volcano tuff, synthetic mats, etc.) that are lightweight, have a structure that is resistant to atmospheric conditions and water, is long-lasting, does not undergo chemical and physical decomposition, and does not undergo reactions that may be harmful to plants. Light weight swollen clay particles and gravel can also be used for this purpose if they do not pose any drawbacks in terms of structural statics. However, since this layer is placed directly on the waterproofing layer, sharp-edged materials can pierce this layer. Gravels with large particles are not used because they are heavy and abrasive (Aslanboğa, 1988).

9.4 Filter Layer

The filter layer consists of a porous material that removes excess water from the plant growing medium, while retaining aggregate. This layer, located between the drainage layer and the plant growing environment, must be made of a non-decaying material to function for a long time (Küçükerbaş, 1991).

Generally, a geotextile product or a 150 g/m^2 polyester material is used for this purpose. Polyester felts prepared in sheet and roll form are installed on the roof with a simple application. Glass wool, synthetic knitted sacks and synthetic felts are also widely used (Erdoğan and Kemaloğlu, 1991).

9.5 Thermal Insulation Layer

Thermal insulation layer should be used in all roof gardens. For example, in applications carried out on garages, the presence of a thermal insulation layer is optional. This layer is generally placed above living and permanent use spaces (Anon, 1996).

It protects waterproofing membranes from thermal damage. Thanks to this layer, waterproofing membranes protect against day and night temperatures, seasonal changes and natural events such as rain, snow and frost throughout the year the waterproofing layer of the roof. It is exposed to various mechanical effects during work. The thermal insulation layer also eliminates damage caused by mechanical damage to the waterproofing membranes (Koç and Güneş 2011).

-Thanks to the thermal insulation layer, the life of this layer can be extended by preventing damage caused by ultraviolet rays on the waterproofing membranes (Anon, 1996).

These layers are made of hard foam-like materials with nearly 100% closed pores, which do not absorb water and whose thermal insulation coefficient is constant. In practice, a filter layer is placed on top of the thermal insulation layers and materials such as gravel, tiles or concrete are placed on top of it. Thus, it prevents the wind from displacing the thermal insulation layers or the water from floating these layers (Koç and Güneş 2011).

9.6 Waterproofing Layer

Insulation of the roof, especially against water, is very important not only for roofs that will accommodate vegetation, but also for other roofs (Kucukerbas, 1991). Various methods can be applied to create this layer.

However, regardless of the method to be applied, there must be a long-lasting guarantee before additional materials are placed on the roof. Properly placed waterproof layer should ensure that the life of the structure is extended. Even a single hole in the waterproof layer due to various effects can cause leakage. Studies carried out to find the source of the leak may make it necessary to transplant the entire garden. Even if the leaks are very small, roots can enter through these holes. As a result, the roots can widen the openings and become a threat to the waterproof layer at first and, in later stages, to the roof and the structure underneath it (Osmundson, 1988).

9.7 Substrate (Plant Growing Medium)

Substrate is the layer in which plants can develop roots. Due to its physical, chemical, and biological properties, this layer creates the necessary environment for plant growth and allows the plant to use some of the rainwater and irrigation water. Heavy soils can be lightened by adding light weight clay granules. The load that the plant growing medium to be used will impose on the roof should also be taken into consideration. If possible, the use of sterile soil that does not contain living plant parts and weed seeds is recommended. The soil depth in the Cannon Bridge roof garden in England is 200 mm, and the soil depth in Kingston Hospital is 100-450 mm (Johnston and Newton, 1993).

Different opinions have come to the fore regarding the appropriate plant growing environment for various planting types in roof gardens. Soil amounts are generally determined according to profile depth. In the landscape architecture literature, the soil depths for plants in roof gardens are generalized as 150-300 mm for grass, 450 mm for ground covers, 600 mm for shrubs and 800-1300 mm for trees. According to Johnston and Newton (1993), 200-250 mm soil depth is sufficient for grass, 500-600 mm for herbaceous plants, and 800-1300 mm for trees. According to Dehmichen (1975), a 10-15 cm peat mixture for grass and other ground cover plants and annual flowers, 50% soil + 50% synthetic with a depth of 15-20 cm for annual plants and perennial plants. Material mix: For shrubs and small trees, a plant growth environment with a depth of 25-50 cm is suitable (Ürgenç 1990, Johnston and Newton 1993).

9.8 Irrigation System

Some techniques have been developed to collect rainwater in areas that receive rainfall during the vegetation period and slowly deliver it to the plants. For this reason, the roof must be insulated against water. The excess accumulated water is drained through a control mechanism (Aslanboğa, 1988).

The amount of water required to protect the plant on the roof varies with the type and size of the tree, as well as the type of root system. Other variable external factors determine the amount of water required and the frequency of irrigation. For example, a significant part of the water given to a plant in a raised container evaporates due to the drying effect of sunlight on the container. Such a problem occurs in areas where vegetation is at the same level as the roof surface every day to determine the amount of water required for various plants; It is very important to observe flowering, leaf fall times and signs of health status (Zion, 1968).

Three methods are used in irrigation. These; water accumulation layers, sprinkler irrigation and drip irrigation. In accumulation irrigation, layers consisting of substances that can store water and deliver it back to the plant via capillary method are used. In order for water to reach the plant roots via capillary route, water-storing layers and topsoil must be created with suitable materials (Aslanboğa, 1988).

For sprinkler irrigation, normal water heads or heads rising on the soil surface with pressure are used. In this way, water is stored in the root spreading area and excess water is drained. Irrigation can be done automatically by controlling the irrigation system with electronic moisture meters, or it can be given automatically at certain times and in certain amounts. The pipe network must be placed directly above the filter layer. Before laying topsoil, drainage heads should be temporarily closed and tested under pressure to detect leaks. In the sprinkler irrigation system, water losses are quite high due to reasons such as water being blown by the wind and rapid evaporation (Aslanboğa, 1988; Osmundson 1988).

In the automatic irrigation system, some problems are encountered because all plants are watered without considering the differences in their individual needs. Automatic irrigation vehicles with underground systems perform the irrigation process in a simple way. Like humans, plants also require water in different amounts. However, subsurface irrigation also makes it difficult to detect excess water. If water accumulation occurs frequently, damage to the structural system may occur. If irrigation is done on the surface, stagnant water that cannot be absorbed will be noticed immediately and this serves as a warning (Zion, 1968).

In the drip irrigation system, irrigation water is kept in the vegetative soil with storage ability. Drip irrigation pipes are laid either directly on the soil surface or just above the drainage layer. Since areas in deep shade and areas with plenty of sun will receive equal amounts of water, separate valves can be placed in places with different habitat characteristics when setting up the system. In drip irrigation, damaging the pipes by pressing them if they spread on the surface; If the pipes are buried in the ground, problems such as damage during hoeing are the drawbacks of the system. However, it is seen as the most ideal method for roof planting (Aslanboğa, 1988).

10. Conclusion

Population growth brings with it various problems such as the effects of climate change and biodiversity in terrestrial ecosystems (Bekiryazici and Acar, 2024). Changing climatic conditions have brought to the fore the temperature increases and the resulting water scarcity problems.

The efficient use of water brings to the fore the Xericscape Landscaping approach in the context of ensuring sustainability. Xericscape Landscaping is a design approach that reduces water consumption compared to traditional landscaping areas, creates aesthetic and sustainable comfort areas, and also reduces maintenance costs by half. It has been observed that in the Xericscape Landscaping approach, compared to the classical landscaping approach, 54% savings are achieved in water consumption, 36% in electricity consumption, 64% in maintenance costs and 5% in application costs (Ayanoğlu, 2023).

Landscape architecture profession designed with Xericscape Landscaping ıt would be beneficial to raise public awareness by carrying out the necessary studies on landscaping and to use these designs frequently. In landscape areas designed with this understanding, local plants should be used, considering the climate of the application area, and drought-resistant plant species that require less water should be used. Irrigation systems should be used in the designs and new methods such as reusing wastewater and collecting rainwater should be used instead of mains water.

Xericscape Landscaping practices should also be included in urban landscape areas created by municipalities, governments, and private organizations. Seasonal plants should not be used in areas such as medians and intersection roadsides, large grass areas should not be created, and in summer months, irrigation should be done with irrigation systems, not sprinklers.

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Next-Generation Urban Furniture Design: Tekno Bicycle Stand

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1. Introduction

The term "bicycle" refers to a human-powered transportation device consisting of two wheels, one at the front and one at the back, driven by a chain and pedals, and capable of carrying one or more passengers in an environmentally friendly manner (Öztaş et al., 2014). The exact inventor and history of the modern bicycle are not definitively known. From the initial design that emerged to the present day, it has been incrementally developed with new and technical designs to achieve its modern form. The work closest in technical and functional aspects to the modern bicycle was done by the German Baron Karl von Drais de Sauerbrun (Britannica, 2011) (Figure 1).

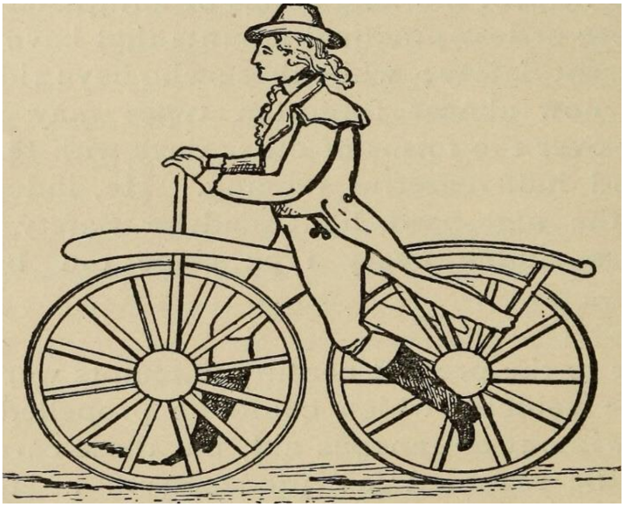

Figure 1. Comte de Sivrac's design of the Celeripede (URL 1)

Scope and Importance of Bicycles

Today, bicycles are among the most commonly used means of transportation. They are frequently preferred due to their cost-effectiveness compared to other transportation modes, the comfort they provide during riding, their positive impact on human health, their minimal environmental and ecological damage compared to internal combustion engine vehicles, their lack of contribution to traffic issues, and their status as eco-friendly, environmentally conscious vehicles (Huy, Becker, Gomolinsky, Klein & Thiel, 2008).

Given the multiple branches of cycling, the interactions between cyclists and their environment are quite significant and consistent. In the mountain biking branch, it is known that cyclists engage closely with nature and the environment, and that biking is recommended by psychologists due to its benefits for psychological and mental health. It is also recognized as an effective means for socialization. Bicycles are used for a wide range of purposes, from indoor sports facilities to Olympic Games, encompassing sports, transportation, and recreational activities (Öztaş et al., 2014).

When evaluating bicycle usage by country, it is observed that in Asian, African, and Latin American countries, physical power-based transportation is more preferred, considering economic, political, and socio-cultural factors. In contrast, in developed countries such as the United States, the United Kingdom, and France, bicycles are more commonly used as sports and recreational tools (Sigurd, G., 2003).

The use of bicycles is becoming increasingly popular both in our country and globally. The main reason for this widespread use can be attributed to the physical and psychological effects that bicycles have on their users.

Due to its positive impact on users both physically and psychologically, cycling also serves as an effective tool for enhancing social interaction among communities (İyinam & İyinam, 1999).

Despite the mentioned benefits and positive impacts, problems arising from widespread and intense use also occur. Issues such as insufficient and ineffective bicycle parking facilities create undesirable visual effects in public squares and streets. Accidents are caused by complex and congested parking areas, and the techno bicycle stand has been designed as a solution to these problems due to its aesthetic and functional features.

2. Material and Method

The bicycle stand designed to address problems associated with bicycle parking consists of several stages.

In the initial stage, areas with bicycle parking facilities, such as parks, public squares, shopping malls, schools, and public building courtyards, were examined to identify problems associated with these parking areas. Additionally, consultations were conducted with bicycle users and pedestrians regarding the issues with existing bicycle parking facilities (see Figure 2).

Figure 2. Çanakkale Municipality Bicycle Stand (URL 2)

In the second stage, the idea of the "New Generation Urban Equipment Design: Techno Bicycle Stand" was conceived as a solution to the existing problems. In this context, an extensive literature review was conducted. After reviewing the relevant literature, the idea was refined based on the results obtained.

In the third stage, the goal was to transfer the idea into a technical drawing. During this stage, technical specifications such as the size and diameter of bicycle wheels were examined. As a result of these examinations, a two-dimensional technical drawing was created using AutoCAD (see Figure 3).

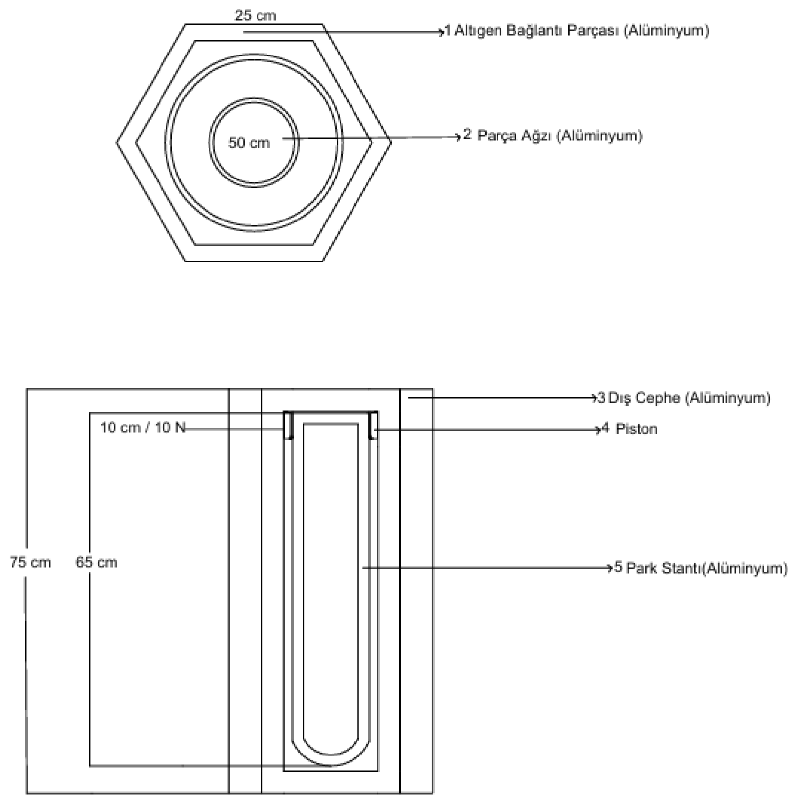

Figure 3. Techno Bicycle Stand Technical Drawing (Original, 2024)

In the fourth stage, material allocation was carried out. Aluminum was chosen due to its lightweight and durable properties, high corrosion resistance, strength at low temperatures, impermeability, and odorlessness (Berk, H., 1976).

In the fifth stage, modeling work was conducted, followed by three-dimensional modeling using the SketchUp program (see Figure 4).

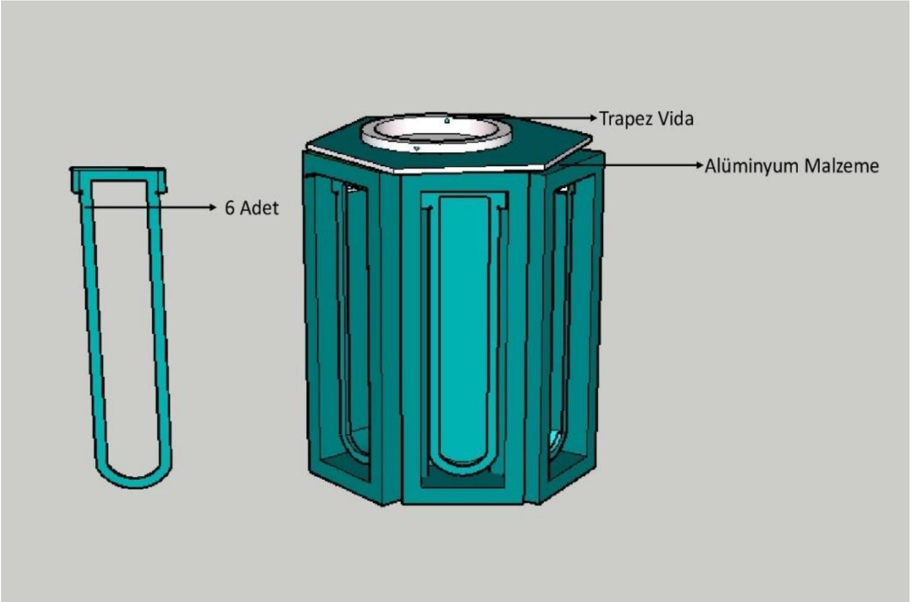

Figure 4. Techno Bicycle Stand 3D Model (Original, 2024)

In the sixth stage, the model created using the SketchUp 3D drawing program was transferred to the Luban program to produce a prototype of the developed product. After making the necessary adjustments in the Luban program, the drawing was sent to the Snapmaker A350T series 3D printer, and the printing process began (see Figure 5). During the printing process, the product was divided into five separate parts, with individual printing operations carried out for each part (see Figure 6). The parts obtained from the printing process were then assembled to create the prototype of the product. This process ensured that the 'Techno Bicycle Stand' product emerged as a functional and durable prototype**.**

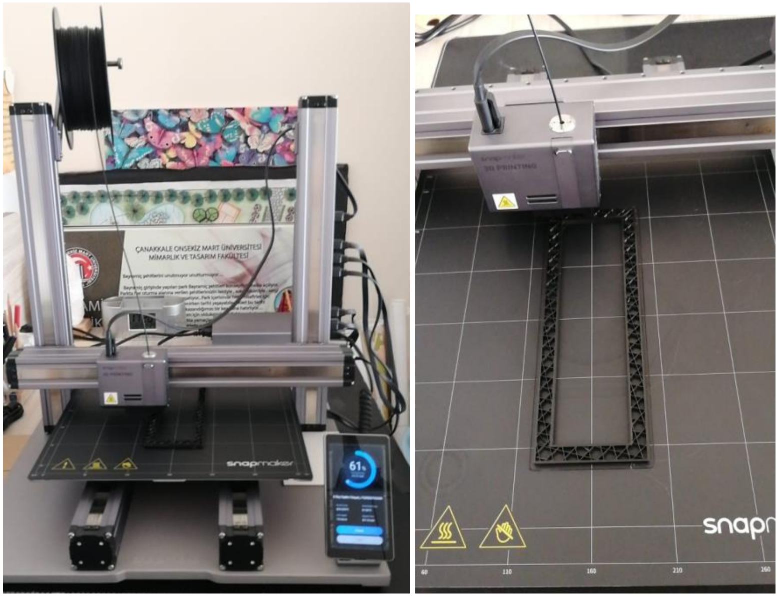

Figure 5. Prototype Printing Stages with 3D Printer (Original, 2024)

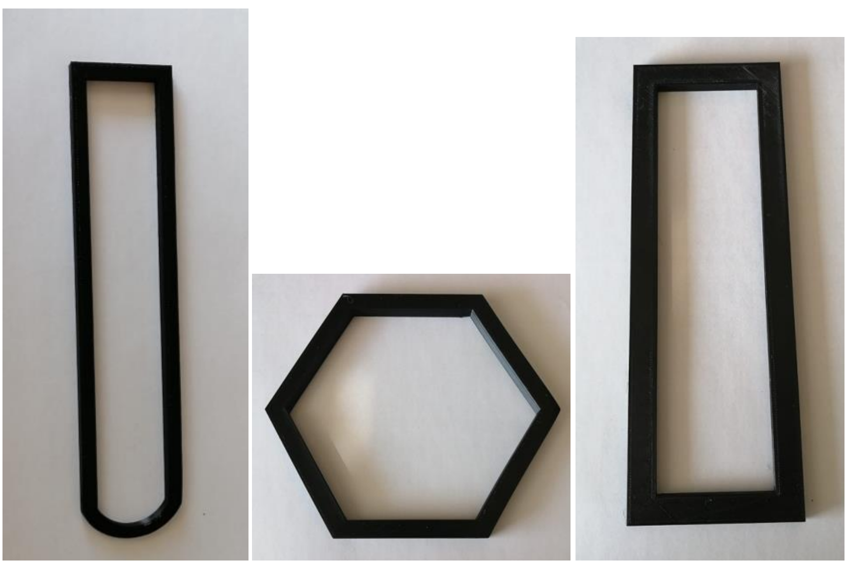

Figure 6. Some Prototype Parts Printed with 3D Printer (Original, 2024)

The Snapmaker A350T is a multifunctional device that integrates various manufacturing techniques, including 3D printing, laser engraving/cutting, and CNC milling. It features a large build volume of 320 x 350 x 330 mm, Snapmaker Luban software, and a 5-inch touchscreen. The heated build platform, automatic focusing system, and powerful CNC module provide extensive production capabilities, enabling effective results on a variety of materials (Figure 7).

Figure 7. Snapmaker A350T 3D Printing Device (URL 3)

3. Findings and Discussion

To ensure the safety of bicycle users and other individuals, enhance the functionality of urban equipment, eliminate unsightly appearances, and provide more comfortable space usage, effective and practical areas are being created. These areas aim to increase bicycle usage for a healthier society and environment while removing dysfunctional parking facilities and stands to provide individuals with free movement space. The designed bicycle stand plays an effective role in preventing damage to urban equipment and addressing existing problems through its technical and functional features.

3.1. Design Process and Challenges

During the prototype work conducted with a 3D printer after the design, issues related to scaling and other technical aspects emerged during the printing phase. Each issue encountered during this process was carefully analyzed and necessary corrections were made. The printing process was then restarted, and this cycle was repeated several times until the prototype met the planned dimensions and technical specifications.

3.2. Technical Details of the Design

The design was carried out considering the technical and functional adequacy of the product. The upper part of the product consists of a 25 cm long hexagonal connector and a 50 cm wide connection opening. The lower part includes an external connection face of 75 cm in length, six 60 cm long parking stands, and mounted pistons (10 cm / 10 N) for the stands (see Figure 8).

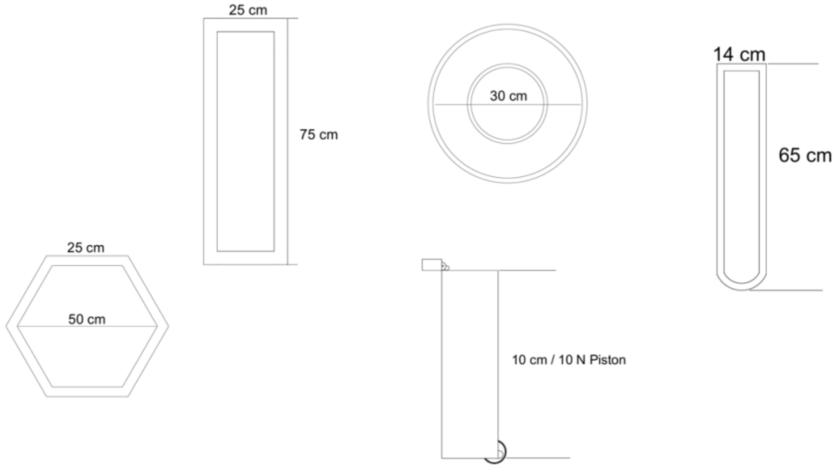

Figure 8. Techno Bicycle Stand Design Technical Details (Original, 2024)

In the product design, 4mm aluminum (hard plate) material was chosen due to its durability, suitability for outdoor conditions, and ability to provide safe use. A 10 cm gas piston was used for the piston mechanism (see Figure 9).

The bicycle parking stand, as shown in Figure 9, will be available for use. The bicycle tire will be placed into the parking apparatus by applying a light force and then positioned into the compartment. Once securely locked, the user can complete the parking process and leave the bicycle.

The dimensions of the bicycle parking stand, prepared considering anthropometric measurements and general bicycle dimensions, are shown in the dimension drawing. The product is designed with the most suitable dimensions to provide users with high-quality usage.

After using the parking area, individuals wishing to retrieve their bicycles must first unlock the lock and then break the contact between the tire and the parking area. Subsequently, the parking apparatus, with its automatic closing feature, will prepare itself for use in another parking spot and will slowly close towards the main module.

Figure 9. Computer-Aided Design of a Tekno Bicycle Stand with Specification and Detailing (Original)

3.3 Environmental Impacts and Sustainability Contribution of the Techno Bicycle Stand

The increase in bicycle usage has created a demand for bicycle parking spaces within urban areas. In a large majority of cities, there is either no bicycle parking available in common areas or the existing facilities are insufficient to accommodate the potential volume of bicycle use. As a result, cyclists often park their bicycles haphazardly in unsuitable locations such as trees, utility poles, and urban furniture. This leads to disorganized appearances in the city, pedestrian walkway obstructions, damage to urban furniture, and significant negative consequences for city residents, especially for those with disabilities, who may trip and fall due to improperly parked bicycles.

Addressing these issues is considered the primary objective of this study. Through the bicycle parking areas designed and developed in this project, unused spaces will be made functional, unsightly appearances in common areas will be prevented, damage to urban furniture caused by bicycles will be eliminated, damage to the city's green spaces will be avoided, and the difficulties experienced by disabled individuals in common areas will be reduced.

The Techno Bicycle Stand occupies less space compared to existing parking facilities, providing more comfortable and practical spaces for cyclists and pedestrians. It also addresses the poor appearance caused by congested parking in narrow areas (see Figure 10).

Figure 10. Common Bicycle Usage (Anonymous)

It also enhances the functionality of urban furnishings while minimizing potential damage to these elements. Sustainability aims to reduce the use of natural resources as much as possible while promoting social and economic improvement (Newman & Kenworthy, 2000). In this context, the bicycle stand contributes to sustainability by encouraging bicycle use within the community.

3.4 Economic Benefits

Millions of bicycles in various sizes and features are produced annually today. In China alone, approximately 40,000,000 bicycles are manufactured each year (Urban Bicycle Paths Guide, 2017). Bicycle parking facilities are constructed in parallel with the production volume. The economic benefits of such production are significantly substantial. In this context, the aim is to contribute to the national economy through economic interactions with other countries facing similar issues due to inadequate and inefficient existing parking facilities, facilitated by the Tekno Bicycle Stand.

3.5 Application Areas and Dissemination Strategies

With the increasing popularity of bicycle use, a reduction in air, noise, and sound pollution caused by vehicles has been observed, along with a relative decrease in traffic accidents. Bicycle use reduces carbon emissions, playing a significant role in sustainability (Demircan & Başgün, 2023). To ensure the growth and continuity of such benefits, the bicycle stand is intended to be implemented across a wide range of areas. Key application areas include city squares with bicycle parking facilities, streets, shopping mall entrances, university campuses, schoolyards, public garden areas, and parks commissioned by local authorities.

3.6 Dissemination and Marketing Strategies

Bicycles are the most effective mode of transportation in terms of environmental and natural sustainability (Erçetin, C., 2023). Due to the numerous benefits they provide, bicycle lanes and parking facilities are increasingly gaining importance in city, street, and square planning. To promote the widespread adoption of Tekno bicycle stands, the initial strategy involves enhancing usage through discussions with local authorities based on successful implementations. Additionally, informational booths will be set up at locations with existing bicycle parking to encourage users to adopt the Tekno bicycle stand.

In terms of marketing, discussions with local authorities, informational booths at high-traffic areas, and the creation of a website and social media accounts dedicated to the Tekno bicycle stand will play crucial roles.

Discussion

The design process of the Tekno bicycle stand, including its technical details, environmental impacts and contributions to sustainability, economic benefits, application areas, and dissemination and marketing strategies, has been executed with great attention and care, aiming for societal benefit.

The primary reasons for the need for the Tekno bicycle stand can be attributed to security shortcomings in existing bicycle racks and stands, which have led to bicycle thefts; the unsightly appearance caused by cramped parking in limited spaces; damage to urban amenities; and traffic accidents. These issues highlight the necessity for the Tekno bicycle stand, which has been designed to address these technical and functional shortcomings.

4. Conclusion and Suggestions

Rapid and unplanned urbanization has led to transportation problems, negatively impacting the quality of life at the city scale. With the increase in urban population, the use of motor vehicles has also risen, adversely affecting both public health and urban environments. Consequently, bicycle transportation has emerged as a preferred solution due to its health benefits, economic efficiency, speed, and environmental friendliness (Lorasokkay, 2011). In large cities, the increasing environmental pollution has made bicycle use an alternative solution to traffic problems (Akay, 2006; Kaplan & Ulvi, 2005). This solution positively impacts both public health and urban areas.

Despite the positive developments brought by bicycle use to cities and individuals, there are some notable drawbacks, with the most significant being the lack of secure bicycle parking facilities. Bicycle parking areas, signs, and designs must attract users' attention and provide necessary information. They should be comprehensible to a diverse range of users, considering their variety and differences. Bicycle parking signs, supported by various visual aids, are seen as helpful and supplementary elements (Bulut & Uslu, 2017). The lack of proper bicycle parking areas often leads to bicycles being parked in unsuitable locations, resulting in damage, deterioration, or theft. In response to these identified issues, the 'Tekno bicycle stand' has been proposed as a solution.

The Tekno bicycle stand is designed to provide more comfortable and efficient spaces for bicycle users, eliminate traffic accidents caused by inadequate parking, ensure the safety of users and pedestrians, promote bicycle use, contribute to sustainability by reducing carbon emissions, prevent bicycle thefts, enhance the functionality of urban amenities, and eliminate damage to these amenities. Additionally, it aims to contribute to the national economy through the sale of the product in countries facing similar issues. Scientific and technical research and studies have been conducted in line with these principles and objectives to develop the product accordingly.

Once the necessary dissemination and marketing strategies have been implemented, the Tekno bicycle stand is expected to be applied in various locations such as city squares, streets, shopping mall entrances, university campuses, school and public area gardens, and municipal bike parks.

A design's potential for further development is essential for enhancing its functionality through modifications and improvements. Additionally, it aims to serve as a model for future similar projects, thereby providing guidance and inspiration for subsequent innovations.

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One size doesn’t fit all: Generative Approaches in Response to Vulnerable Cities Through Thematic Urban Design Guides

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1. Introduction

This chapter includes three main sections that progress on three different levels: an issue [urban vulnerability], a solution [urban design guides as a tool], and an educational interface [Urban Design Workshop II course syllabus] structured on the problem-solution axis, and a final section that contains a synthesis through the overlap of these three sections.

The cities of the 21st century, which have a multi-layered (environmental, social, physical, spatial, economic) pattern that constantly changes with global and local influences, have now become an object that is reconstructed to produce solutions to complex and intricate urban, environmental and social issues. (Critical question: With what purposes and means should this construction be realized?) The sensitivity and fragility of this multi-layered pattern and increasing resilience capacity and vulnerability levels of cities in order to be prepared for possible negative effects, various shocks and stresses are critical issues that constitute the 21st century urban agenda as contemporary urban issues. These issues, which are intertwined within this multifaceted mechanism of cities, are naturally now multi-stakeholder and require pluralistic discourses involving different actors.

Planning and design disciplines have a critical role in taking measures to increase the resilience capacity of cities among these actors, and even in creating policies and strategies for making and implementing emergency action plans. In this context, new approaches and discourses are being produced in the fields of planning, design and governance, and new interdisciplinary and even transdisciplinary areas of action are emerging.

At this point, urban design, as a field of expertise with a multi-faceted, multi-dimensional, multi-disciplinary, multi-actor, multi-sectoral character, comes into play as a political tool in producing solutions to urban issues. Urban design guides, which are prepared specifically for a project to draw the necessary framework for the implementation of urban design projects and to produce design standards, are the most effective implementation tools of urban design.

After the first section, which is about the fragility of cities, one of the current urban issues, the chapter continues with the second section, which draws a theoretical and conceptual framework with a brief look at the emergence and evolution of urban design. In this context, in the third section; the modules and original outputs of an educational interface designed around the urban issue and solution tool discussed in the first two parts are presented.

1.1. The Concept of Vulnerability in the Urban Environment

United Nations Disaster Risk Management (2024) defines vulnerability as the circumstance -which is controlled by physical, social, economic and environmental factors or processes- escalates the susceptibility of living beings, communities, assets or systems to the effects of hazards. It [vulnerability] is the likelihood that any elements exposed - including people, their livelihoods, and assets- will experience negative consequences when affected by hazardous events. (Cardona et al., 2012; UNISDR, 2004). It is crucial to understand how vulnerability is generated, increased and built up in order to manage risk effectively (Cardona et al., 2012). Patt et al. (2009) also points out that future vulnerability is embedded in the current communities' conditions such that a prospective hazard could disclose obscured vulnerability factors (Lopez-Calva & Ortiz, 2008; UNISDR, 2009). The critical role of urbanization on the global environmental problems has been acknowledged by the fact that urban settlement and lifestyle decision of the majority of humanity is associated directly or indirectly with the majority of environmental problems. To such an extent that, the urban centers affect the environment within their limits and further their immediate surrounding region with long term. (Srinivas, 2020). The vulnerability of urban environments also ranges from "physical structures to social and environmental processes, economy, disaster management, climate change adaptation, epidemiological and psychological fragilities, ecosystem sensitivity" conditions and drivers that human beings become vulnerable to natural and economic stressors. Urban vulnerability originates from a combination of factors, including (Cardona et al., 2012);

- **Physical infrastructure**: Inadequately designed or maintained buildings, roads, and public utilities can make urban areas more susceptible to disasters.
- **Social inequality:** Marginalized communities often live in less secure areas, with limited access to resources, making them more vulnerable to various risks.
- **Economic fragility:** Economic downturns or lack of diversified income sources can exacerbate vulnerability in urban populations.
- **Environmental degradation:** Cities with poor environmental management practices are more vulnerable to climate change, pollution, and other environmental hazards.
- **Governance:** Weak governance, lack of planning, and insufficient emergency response systems can increase a city's vulnerability to both natural and man-made hazards.

There are; however, a range of strategies to reduce the effect of vulnerabilities in cities. In terms of reducing **social vulnerability**, equitable access to essential services (healthcare, education, and public transportation) and community spaces (social hubs and support networks) can become instrumental (Cutter et al., 2003). In addition, **physical vulnerability** can be mitigated by disaster preparedness (such as, disaster resilient policy, strategy and design) and infrastructure resilience (such as, robust design to withstand with the environmental stress) (de Magalhães et al., 2022). **Environmental vulnerability** can be alleviated by providing integrity of green infrastructure, incorporating green roofs, urban parks, and other green elements (Sturiale & Scuderi, 2019), sustainable design with energy-efficient buildings and sustainable practices promotes resilience and reduce environmental stressors (Akande, Fabiyi & Mark, 2015). Inclusive design can also contribute to minimizing urban design vulnerabilities for people with disabilities, and the elderly by employing accessible design. (Hanson, 2004) and other marginalized groups by providing affordable housing for low-income residents (Vale et al., 2014). Even though, factors such as poverty, and inadequate social networks and support mechanisms could affect vulnerability levels independent from the hazard type (ICSU-LAC, 2010); it is worth noting that vulnerability should be addressed situation-specific since it coacts with a hazard to create the risk (Bull-Kamanga et al., 2003; Cutter et al., 2008). This book chapter investigates how urban design strategies could benefit urban development-related vulnerabilities through a research-based urban design studio for the city of Amasya, Turkiye.

2. Urban Design as a Remedy for Chronical Urban Diseases

2.1. Part-Specific Policy: Urban Design

Karaman (2008) emphasizes that the term urban design was first used in the 1950s; however, its origins actually date back to the beginning of human history, and that the initiatives, plans and practices made by societies to design, develop and redevelop settlements throughout history are actually urban design actions.

Lang (1994) states that in the mid-20th century, when the hegemony of the modern planning and architectural approach over the city continued, the phenomenon of urban design emerged and matured with the search for answers to the limitations in the rationalist and empiricist paradigms of urban planning and with the ideas that developed against this dominant approach (Post-Modern approach). With the waves of criticism brought by this Postmodernist approach and thought system, the place and role of urban design in urban practice was redefined and emerged as a new field of expertise in the 1960s. In the 1990s, there was a significant paradigm shift / axis shift in the thought system of urban design in parallel with the understanding of how fragile the natural system of the world was. This period, which covers the period until the first decade of the 21st century, constituted the main subject of new generation designs in urban design.

Karaman defines urban design as follows: “A design action aimed at integrating the built environment of human settlements whose social, economic, political, administrative, physical structure and recently ecological structure are in constant change, the relationships between buildings with different functions and the pedestrian and traffic movements that feed them, and the open spaces between them, with the larger system of the city under behavioral and cultural preferences and ecological conditions” (2008:37).

Barnett (1974) defined the term urban design as a **public policy**.

Lang (1994) points out four conflicting attitudes toward the concerns of urban design:

- as a financially pragmatic tool (demands of the market are crucial in the development of urban design schemes)
- as a problem-solving process (considering the needs of the users)
- as a community design
- as an art (having a social engineering aspect)

Due to the interdisciplinary nature of urban design, professional branches such as urban planning, economics, sociology, geography, environmental psychology and ecology are used. Lang (1987) states that the theoretical information obtained from these branches should be gathered under the headings of ecological issues, behavioral issues and physical issues.

As a result; the normative principles developed to increase the quality of urban life in urban design projects can be listed as follows:

- being sensitive to environmental conditions
- being specific to the place, sensitive to local symbols
- being suitable for human scale
- being mixed-functional
- having diversified activity areas and social facilities
- being easily accessible
- being readable
- being permeable
- having flexibility to allow for growth and change

Therefore, Karaman (2008), who states that the theoretical and practical framework of each urban design project is unique in the context of the dynamics of the area to be intervened, emphasizes that urban design projects naturally vary in terms of scale, content, goals, methods, intervention tools, process and actors.

Oktay (2008), who states that urban design is a “shared” responsibility rather than an independent responsibility within this diversity, emphasizes that a multidisciplinary, holistic and collective urban design development strategy should be adopted in order to create a quality living environment. In updated and revised third edition of the book *“Public Places Urban Spaces”*, Carmona (2021), incorporates new thinking on technological impact, climate change adaptation, strategies for urban decline, cultural and social diversity, place value, healthy cities; and besides six key dimensions (temporal, perceptual, morphological, visual, social, functional), adds on two new dimensions (design governance and place production) of urban design in theory and practice.

2.2. Part-Specific Operation: Urban Design Guide

Since urban design is an action-oriented discipline that requires intervention and operation in a problematic part of the city rather than the whole, its theoretical framework is also about developing area-specific design principles to produce solutions to these problems. The most effective application tool in the implementation of urban design projects is urban design guides. Lang (1994); states that urban design guides are explanatory and guiding “technical booklets” that include all design standards that may be valid for a specific place, region, and area; in this context, these “specific guides”, which address various issues such as transportation on a human scale, architectural character, detail, material, and are more advanced than the zoning plan report, are specific/specific to the characteristics of that area, time, and the project developed for that area.

Through urban design guides, the ecological, economic, social and political aspects of the urban environment where the project will be developed are examined and physical arrangements that offer solutions to the problems are put forward. In this way, a part-whole relationship is established between the upper and lower scales from regional planning to architectural design, and spatial perception is provided at both the city and building scales. In the process of redeveloping urban space, interventions can only be made without "disrupting the DNA of the city" with the use of correct urban design guide applications (Orhan, 2015). Oktay (2008); states that design guides provide a series of written and drawn guiding rules specific to the place, time and project in order to provide the theoretical design principles and objectives developed in the process of creating an urban design project.

Cowan (2002) defines urban design guides in four types:

- **Guides relating to specific places:** urban design frameworks (for areas), development briefs (for sites) and master plans (for sites).
- **Guides relating to specific topics:** cover topics such as shopfronts, house extensions, lighting and cycling.
- **Guides relating to specific policies:** for example policies on conservation areas, transport corridors, waterfronts, promenades and green belts.
- **Guides relating to a whole local authority area:** general urban design guidance for the whole district.

Cowan (2002) defines urban design as the collaborative process of shaping the setting for life in cities and claims that socially, economically and environmentally successful urban places requires high standards of urban design. To do this, a framework of planning and design policy have to be developed by local authorities as a project realization tool. This effective tool for good design is named as urban design guidance.

2.3. "Think Globally, Produce Locally": Contemporary Trends in Urban Design

As cities develop (as piece-by-piece or whole) through time (slowly or suddenly) under the influence of global and local dynamics, a variety of vulnerabilities could emerge. When the emerged vulnerabilities of cities are not mitigated and resolved, susceptibility to a prospective hazard could increase for the cities (United Nations, 2005). Following that it could become challenging for the city (built environment and the community) to recover and rebuild itself. The concept of vulnerability in relation to cities should be addressed with spatial, social, economic and environmental infrastructure components of the urban environment (Birkmann, 2006). This book chapter claims that to mitigate vulnerabilities of cities, thematic urban design approaches could be employed as urban design guidelines for a specific vulnerability case of the city. In this regard, the Urban Design Workshop course participants of Department of Urban Design and Landscape Architecture at Amasya University, were asked to investigate an urban design approach based on vulnerabilities of the urban environment of the city of Amasya. The following urban design approaches has been addressed (Figure 1).

URBAN DESIGN APPROACH

AS A TOOL TO INCREASE THE IMMUNITY OF THE CITY

- *Healthy and Active Cities* Focused Urban Design Approach
- *Woonerf* (A Street for People) Focused Urban Design Approach
- *The 15-Minute City* Focused Urban Approach
- *Tourist-Historic City* Focused Urban Design Approach
- *Ecology and Urban Agriculture* Focused Urban Design Approach
- *Smart Cities and Tourism* Focused Urban Design Approach
- *Riverfront Regeneration* Focused Urban Design Approach
- *Carbon Footprint and Micro-Climate* Urban Design Approach
- *Child friendly* Focused Urban Design Approach
- *Slow City* Focused Urban Design Approach

Figure 1. Urban Design Approach (Created by the authors)

Child friendly Urban Design Approach

Krishnamurthy et al. (2018) emphasize that as urbanization continues and more families with children are drawn to cities, urban environments are becoming crucial for the development of the next generation. The authors highlight the importance of integrating children's needs into urban analysis to address contemporary challenges they face. By promoting children's participation in decision-making and focusing on equal opportunities, public space quality, and safety, cities can adopt child-friendly strategies in planning and design. The role of urban design and planning is essential in creating such environments and should be prioritized. Research shows that outdoor play offers numerous health benefits, which is increasingly recognized in urban planning literature. It enhances social skills (Jambour & Gils 2007), motor and cognitive development (Evans 2021), learning performance, and concentration. Additionally, outdoor play significantly contributes to daily physical activity, helping to prevent obesity and chronic diseases in children (Jiménez-Pavón et al., 2010). Globally, there is an ongoing debate about how cities can be made child- and family-friendly. To address this issue, the research on developing child-friendly communities and spaces is gaining momentum (Schulze & Moneti 2007). Child-friendly urban planning as a growing concept focused on designing streets, parks, and public spaces to encourage children to be active. The goal is to use planning and design to enhance their opportunities for play, exploration, and mobility within their neighborhoods and cities (Gill, 2021).

Healthy and Active Cities Focused Urban Design Approach

In the 1970s, there was global dissatisfaction with health services failing to meet emerging health needs. This led to the "Health for All by the Year 2000" strategy, launched in 1979. This strategy emphasized that improving health and wellbeing required action beyond the formal health sector. The 1986 Ottawa Conference further stressed that health depends on fundamental conditions like peace, shelter, education, and social justice. The international Healthy Cities movement, also launched in 1986, aimed to implement these principles in cities by improving physical and social environments and fostering community support, with a focus on intersectoral collaboration and public health at the local level (The Public Health Advisory Committee, 2007). In 1998, the WHO introduced a revised strategy called "Health for All in the 21st Century" (Health 21) and backed it with a ‘World Health Declaration’. The WHO strongly supports that a comprehensive approach to healthy urban planning should consider all physical environment factors that impact health and incorporate ‘the WHO Health for All’ principles of community participation, intersectoral collaboration, and equity (World Health Organization, 1999) **(Figure 2)**. The London Healthy Urban Development Unit (2012) emphasizes that healthy urban planning seeks to create thriving environments for people to live and work in. This involves ensuring access to necessary housing, jobs, and services, minimizing environmental risks, and designing well-crafted buildings and urban spaces that support healthy, active lifestyles.

- *The meeting of basic needs (for food, water, shelter, income, safety and work) for all the city's people*
- *A clean, safe physical environment of high quality, including housing quality*
- *An ecosystem that is stable now and sustainable in the long-term*
- *A diverse, vital and innovative economy*
- *A strong mutually supportive and non-exploitative community*
- *A high degree of participation and control by the public over the decisions affecting their lives, health and wellbeing*
- *The encouragement of connectedness with the past, with the cultural and biological heritage of city-dwellers and with other groups and individuals*
- *Access to a wide variety of experiences and resources with the chance for a wide variety of contact, interaction and communications*
- *A form that is compatible with and enhances the preceding characteristics*
- *An optimum level of appropriate public health and sick care services accessible to all High health status (high levels of positive health and low levels of disease).*

Figure 2. Healthy City Checklist (World Health Organization, 2024)

Tourist-Historic City Focused Urban Design Approach

The original model of the tourist-historic city, developed by Ashworth and Tunbridge in 1990, aimed to understand how 'historic city tourism' fits within the broader urban structure and to examine the effects of tourists' spending and behavior on the cities they visit (Ashworth & Tunbridge, 2004). The tourist-historic city can be understood as (Ashworth & Tunbridge, 2000):

1. **Form and Function:** It represents both a specific urban morphology and an evolving urban activity.
2. **Type and Region:** It is a distinct type of city as well as a specialized area with morphological-functional characteristics.
3. **History and Tourism:** It involves using history as a tourism resource and leveraging tourism to preserve historical artifacts and emphasize the city's historical significance.

The model describes an ideal scenario where the historic city, the tourist city, and the central commercial district partially overlap. This overlap occurs as some commercial activities move out of the historic city, allowing the tourist city to expand into both the historic and modern commercial areas.

Woonerf (A Street for People) Urban Design Approach

'Woonerf,' or 'living yard,' as a significant Dutch innovation in urban traffic management over the past decade. Introduced in a 1975 report by the Netherlands Association of Local Authorities, the concept has been widely implemented in Dutch towns and cities and has attracted considerable interest from professionals in other countries (Kraay, 1986). A 'woonerf' is a shared urban space primarily designed for residential areas, where pedestrians, cyclists, and motorists coexist. It is typically paved and allows for walking and playing throughout the area. While cars and cyclists can access the space, it is not intended for through traffic, and various physical and visual elements like narrow passages, trees, and varied paving designs are used to slow down vehicles. Unlike traditional streets, 'woonerfs' lack conventional sidewalks with raised curbs, promoting a mixed-use environment where all forms of traffic intermingle (Kraay, 1986). As the design reduces vehicle traffic, encourages social interaction, and enhances walkability, prioritizing the well-being and safety of pedestrians and cyclists. Originating in the Netherlands and Belgium, 'woonerf' use traffic calming strategies like street furniture, trees, bollards, and narrow paths to improve the overall quality of life for residents, rather than focusing on vehicle speed (Gooden, 2020). A key feature of a ‘woonerf’ is its emphasis on landscaping, including community gardens, plant boxes, and city trees. These natural elements create a calming and inviting atmosphere, enhancing the city experience by encouraging pedestrian interaction and prioritizing the well-being of individuals over vehicular traffic in local streets.

Ecology and Urban Agriculture Focused Urban Design Approach

By 2030, urban populations are expected to make up 60% of the world's population, creating significant strain on urban resources, particularly food security. Urban areas rely heavily on a stable and affordable food supply that supports residents' health and well-being. As cities grow, the distance from rural areas increases, leading to competition for the same rural resources, known as overlapping foodsheds (Diehl & Kaur, 2021). To address these challenges, Bloem and de Pee (2017) recommend strengthening rural-urban linkages to improve urban food systems, ensuring cities can maintain their food supply as they expand. Urban agriculture offers environmental, social, and economic advantages. Key environmental benefits of organic urban farming include preserving biodiversity, managing waste, and lowering the energy needed for food production and distribution (Viljoen et al., 2005). Incorporating ecology and urban agriculture into urban design is a vital strategy for creating sustainable cities. Several urban design strategies have emerged to integrate these concepts effectively into the fabric of urban environments.

Smart Cities and Tourism Focused Urban Design Approach

The term "smart" refers to advancements in technology, economy, and society that are enhanced by internet communication technologies (ICT).

These developments rely on sensors, data, and new methods of connectivity and information exchange (Gretzel et al., 2015). Respectively, ‘smart tourism’ refers to the growing use of emerging internet communication technologies (ICT) in tourism, enabling destinations, industries, and tourists to convert large amounts of data into valuable experiences and offerings (Gretzel et al., 2015). Components and layers of smart tourism are; Smart Destination, Smart Business Ecosystem, Smart Experience by incorporating collection, Exchange and processing of the data. The main feature of smart destinations is the incorporation of internet communication technologies (ICTs) into their physical infrastructure. For example, touristic information and bus arrival times, USB ports for charging mobile devices, location embedded codes for travelers for smartphone app. The ‘smart experience’ component emphasizes technology-enhanced tourism experiences, improved through personalization, context-awareness, and real-time monitoring (Buhalis & Amaranggana 2015). For example, tourists as active players by posting photos on social media, making comments. The ‘smart business’ component involves a dynamic business ecosystem that facilitates the exchange of tourism resources and the co-creation of tourism experiences. For example, online shopping and marketing activities.

Carbon Footprint and Micro-Climate Urban Design Approach

Urban communities are significant contributors to carbon emissions, but they also play a crucial role in reducing them. This has led to an increased emphasis on building cities that are both high-quality and low in carbon emissions (Hu, 2023). As a key element of low-carbon urban development, urban green spaces are essential for reducing carbon emissions and enhancing carbon capture (Zheng & Zhang 2023). To reduce a city's carbon emissions, low-carbon planning and design must take into account key factors such as urban land use, transportation, energy, and building practices (Chen & Zhu 2013). Low-carbon technologies are essential for the development of low-carbon cities, playing a vital role in reducing emissions and promoting sustainability in urban construction (Liang et al., 2022). Renewable energy, energy-saving technologies, and intelligent transport systems are key tools that can help cities significantly reduce their carbon footprint (Lv & Shang, 2023). Microclimate urban design involves the careful planning and development of urban spaces to manage and enhance the local microclimate—conditions such as temperature, wind, humidity, and air quality in specific areas like neighborhoods or streets. The goal is to improve the comfort, health, and sustainability of urban environments by controlling these environmental factors (Yang et al., 2023).

Riverfront Regeneration Focused Urban Design Approach

Waterfronts are appealing urban interfaces for the human settlements, acting as the zone where urban development meets water. This interaction blends the needs of the city and its inhabitants, making waterfronts integral to urban life (Breen & Rigby, 1996). Rapid urban development could lead to deterioration of the visual identity, ecological vitality and biodiversity of the waterfronts and its surroundings. Therefore, the waterfront is in need of sustainable revitalization strategies with consideration of its physical, social, environmental and economic dimensions (KoGirard et al., 2014).

Keyvanfar et al. (2018), defines a framework for waterfront revitalization strategies (Figure 3).

Slow City Focused Urban Design Approach

‘The Slow City,’ or ‘Cittaslow,’ movement started in Italy in 1999 as an extension of the Slow Food movement. By 2011, it had expanded to 147 member towns across four continents, focusing on smaller communities with populations under 50,000. The movement emphasizes creating a more relaxed, slow-paced lifestyle and preserving local traditions, products, and cultural traits, contrasting with the homogenization seen in modern life. While promoting sustainability and environmental improvements, it also values embracing new technologies and enhancing the historical features of towns. Additionally, the movement encourages hospitality, food education, and community awareness of slower living. However, it faces challenges in balancing the preservation of each town's uniqueness with the need to incorporate ideas from different cultures (Ball, 2015).

1. Social and Cultural Revitalization:

Identity: *Enhancing the local culture and background is crucial for establishing a distinct identity that appeals to visitors and enriches the waterfront's vitality.*

Authenticity: *Respecting cultural contexts and heritage ensures that the community's story is meaningfully and truthfully conveyed to visitors, enriching their experience.*

Safety and Well-being: *Waterfront revitalization improves safety and access to downtown areas, potentially boosting economic conditions.*

Sense of Place: *Preserving heritage values and historical buildings helps create a unique sense of place, attracting both visitors and investors.*

Gathering Areas: *Developing outdoor spaces like amphitheaters, plazas, and promenades encourages social interaction and connection with other activities.*

Sense of Enjoyment: *A diverse range of activities and functions on the waterfront fosters an inclusive, enjoyable environment for people of all ages.*

2. Physical and Environmental Revitalization

Habitat and Natural Preservation: *It's essential to reserve green areas as habitats for flora and fauna and maintain river reserves as buffer zones to prevent environmental issues like soil erosion. Features like mangrove forests also act as natural defenses against flooding, erosion, and storms.*

Pollution Moderation: *Water ecosystems, such as wetlands, help reduce pollution by absorbing excess nutrients, sediments, and human waste.*

Accessibility: *The waterfront should be designed to be welcoming and easy for visitors to navigate, enhancing their experience.*

Dynamic Site Design: *The riverfront should incorporate flexible design elements that adapt to changes over time, avoiding incompatible land uses and ensuring a clear layout for visitors.*

Walkable Outdoor Environment: *Developing a walkable streetscape in commercial areas can create an attractive and enjoyable environment, boosting economic opportunities.*

Facilities and Amenities: *Providing recreational facilities like parks, gazebos, and benches along the waterfront is essential to encourage activities and enhance the area's appeal.*

C3. Economic and Functional Revitalization

Mixed-use Development: *Integrating retail, office, and housing in a mixed-use setup is aimed at creating a vibrant outdoor shopping and commercial environment.*

Diversification: *Diversification of activities and industries helps support communities that may rely heavily on a single industry, ensuring economic sustainability.*

Employment Opportunities: *Tourism in waterfront areas boosts employment, offering a range of job opportunities from entry-level positions to high-paying professional roles, contributing to the local economy.*

Figure 3. Waterfront Sustainable Revitalization (Keyvanfar et al., 2018)

3. Materials and Method

By the instructors of Urban Design Workshop Course II, conducted in the Department of Urban Design And Landscape Architecture at Amasya University an “analogy” was established between the city and the human immune system: when a “city as an organism” activates its life-creating, life-giving and life-supporting systems and features, in other words, the immune system, it is a treatment that heals the problematic area of the organism, that is, its fragility; it produces a solution specific to that problem. In line with the issue defined under the title *City As An Organism: An Urban Approach As A Tool For Boosting Immune System*, students were asked to research contemporary planning and design paradigms given by the instructors, choose one, and create “Thematic Urban Design Guides” to generate solutions specific to the “place” and “issue”; because these guides will be an effective tool to reduce the vulnerabilities of cities shaped by global and local interactions and to produce solutions.

In this context, the research commenced by selecting a contemporary urban design approach that is well-suited for addressing the vulnerabilities identified in the city of Amasya. The selection process involved a thorough analysis of current urban design trends and methodologies that emphasize decentralized urban functions and services. Second, a comprehensive literature review was conducted to gather insights on thematic urban design guides and existing strategies employed by cities to mitigate urban vulnerabilities. Third, to contextualize the selected approach, a detailed case study analysis was conducted. This involved examining cities that have successfully implemented thematic urban design guides and strategies similar to those proposed for Amasya. The case studies provided real-world examples of how cities address existing vulnerabilities through interdisciplinary collaboration and strategic urban planning. The findings from these case studies were instrumental in shaping the development of the master plan and urban design guide for Amasya. Following the literature review and case study analysis, the research team conducted a analysis in Amasya. This involved a thorough examination of the city's current urban fabric, identifying vulnerabilities within the context of the selected approach. Based on the insights gained from the literature review, case studies, and site analysis, the research team developed a comprehensive master plan for Amasya. The final phase of the research involved creating an urban design guide tailored to the needs of Amasya, based on the master plan and strategies developed in the previous steps. The guide addresses specific vulnerabilities identified during the research and offers practical solutions for creating a sustainable city. Posters are visual summaries of the research and were used to communicate the key themes and strategies to stakeholders. The feedback from the mentors was integral to refining the urban design guide and ensuring that it was aligned with the overarching goals of the project.

4. Findings and Discussion

With the given theoretical base of the contemporary urban design approaches in the previous sections, this section unfolds thematic urban design guides developed for the city of Amasya.

4.1. Healthy and Active Cities Focused Urban Design Approach

Through the lens of ***healthy and active cities*** the team has identified several strategies that could be applicable to the city of Amasya;

- ***Balancing Inequalities:*** *Improving and increasing the use of lanes for people with disabilities, supporting households and individuals in need of financial support.*
- ***Community Participation:*** *When making decisions affecting the health and well-being of the public, public participation should be taken into consideration. A certain day of the week is designated as a public day, and it is aimed for the authorities to interact directly with the public on that day.*
- ***Street Infrastructure:*** *The city's narrow street structure and the dirty and unsafe nature of some streets also affect the city's health. Private vehicle entry should be prohibited in narrow streets, parking should be allowed for a maximum of 10 minutes in the city center, and some roads should be pedestrianized within the alternative vehicle route.*

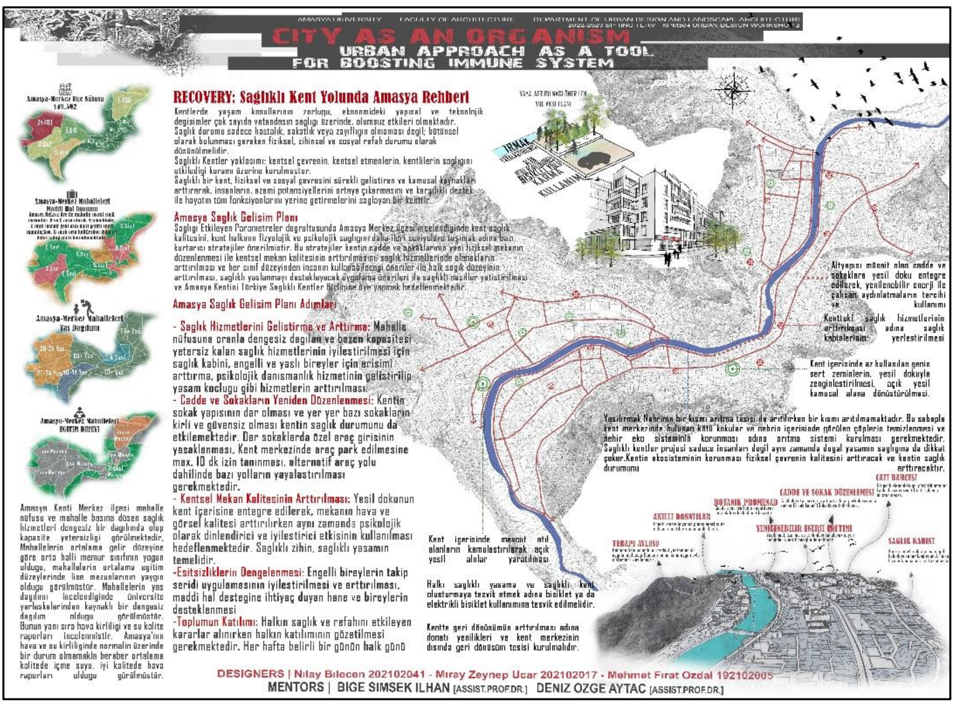

Figure 4. Master Plan, Amasya Guide On The Way To A Healthy City (Nilay Bilecen, Miray Zeynep Uçar, Mehmet Fırat Özdal)

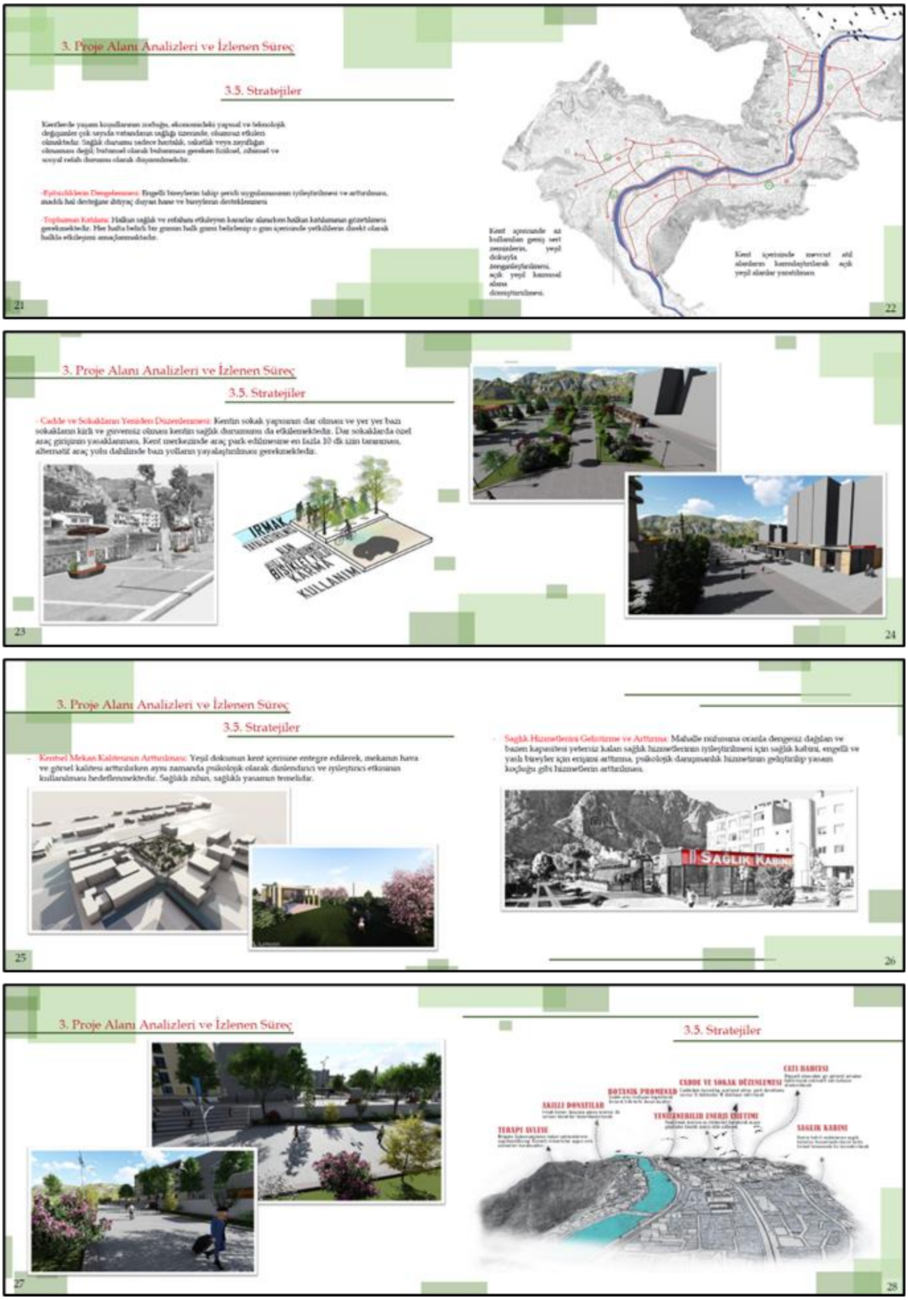

Figure 5. Amasya Guide On The Way To A Healthy City (Nilay Bilecen, Miray Zeynep Uçar, Mehmet Fırat Özdal)

4.2. Woonerf (A Street for People) Focused Urban Design Approach

Through the lens of ***woonerf*** the team has identified several strategies that could be applicable to the city of Amasya;

- *It is aimed to reduce vehicle speeds to a certain level and increase speed bumps and pedestrian crossings along the route to give pedestrian priority.*
- *Supporting the existing bike path by creating an uninterrupted bike axis around the spaces that will be designed to encourage mobility of the users.*
- *Due to the lack of existing green space, a sustainable uninterrupted green passage should be created throughout the circulation and aesthetic and usable plant designs should be created that encourage users to use the green space.*
- *Developing activity areas for every user on the street by reducing traffic speed and making the street livable for the user.*
- *Recreational areas to be created, underutilized areas to be restored, seating areas around the green area, activity areas, graffiti walls, ground games, landscape areas, sports areas, music areas, viewing bridge, vista areas that allow pedestrians to reach certain areas will guide the design.*

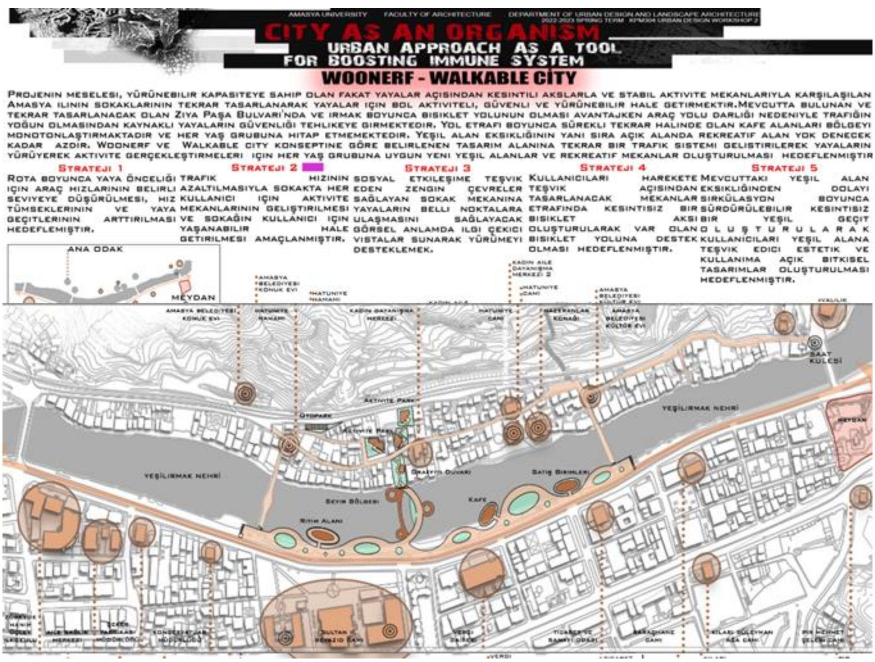

Figure 6. Master Plan for Amasya within the context of *Woonerf* (Rabia Bulut, Dilara Yaşar, Melike Çabuk, Büşra Nur Yıldız)

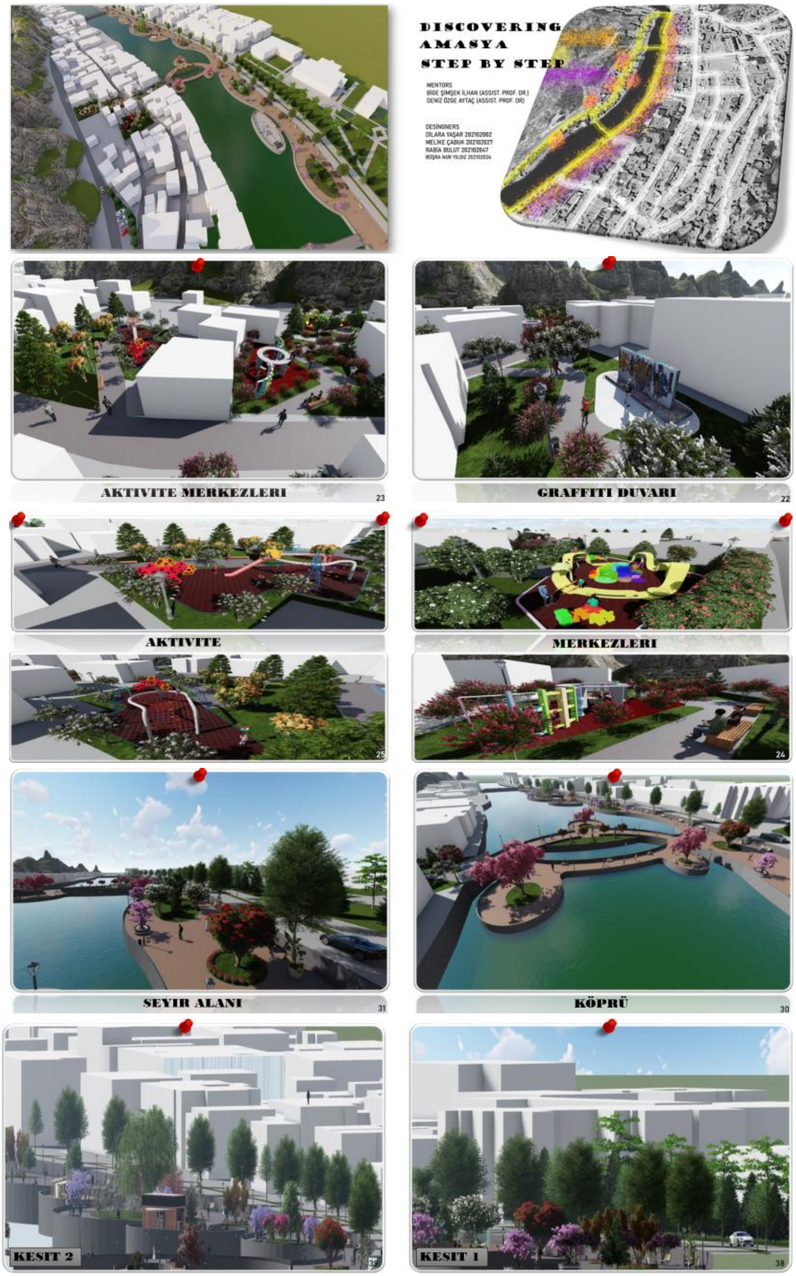

Figure 7. Urban Design Guide for Amasya within the context of *Woonerf* (Rabia Bulut, Dilara Yaşar, Melike Çabuk, Büşra Nur Yıldız)

4.4. Tourist-Historic City Focused Urban Design Approach

Through the lens of ***the tourist-historic city*** the team has identified several strategies that could be applicable to the city of Amasya;

- ❑ *Creating a transportation axis for tourists to historical sites via Ziya Paşa Boulevard. Creating centers and intermediate centers on the formed axes and providing tours to historical sites in Amasya.*
- ❑ *Placing information boards that can provide information about historical sites on the axes.*
- ❑ *Local character and identity should be emphasized.*
- ❑ *Historical and cultural continuity should be preserved.*
- ❑ *The quality of the space should be increased.*
- ❑ *A human-centered transportation approach should be adopted, and accessibility should be provided.*
- ❑ *The space should be readable and easily perceived.*
- ❑ *The space should have a high adaptability to social, economic and technological changes.*
- ❑ *Mixed uses should be taken into consideration.*
- ❑ *It should include sustainable and ecological approaches.*

Figure 8. Master Plan for Amasya within the context of *Tourist-Historic City* (Özge Balcı, Göktuğ Kaan Dikal)

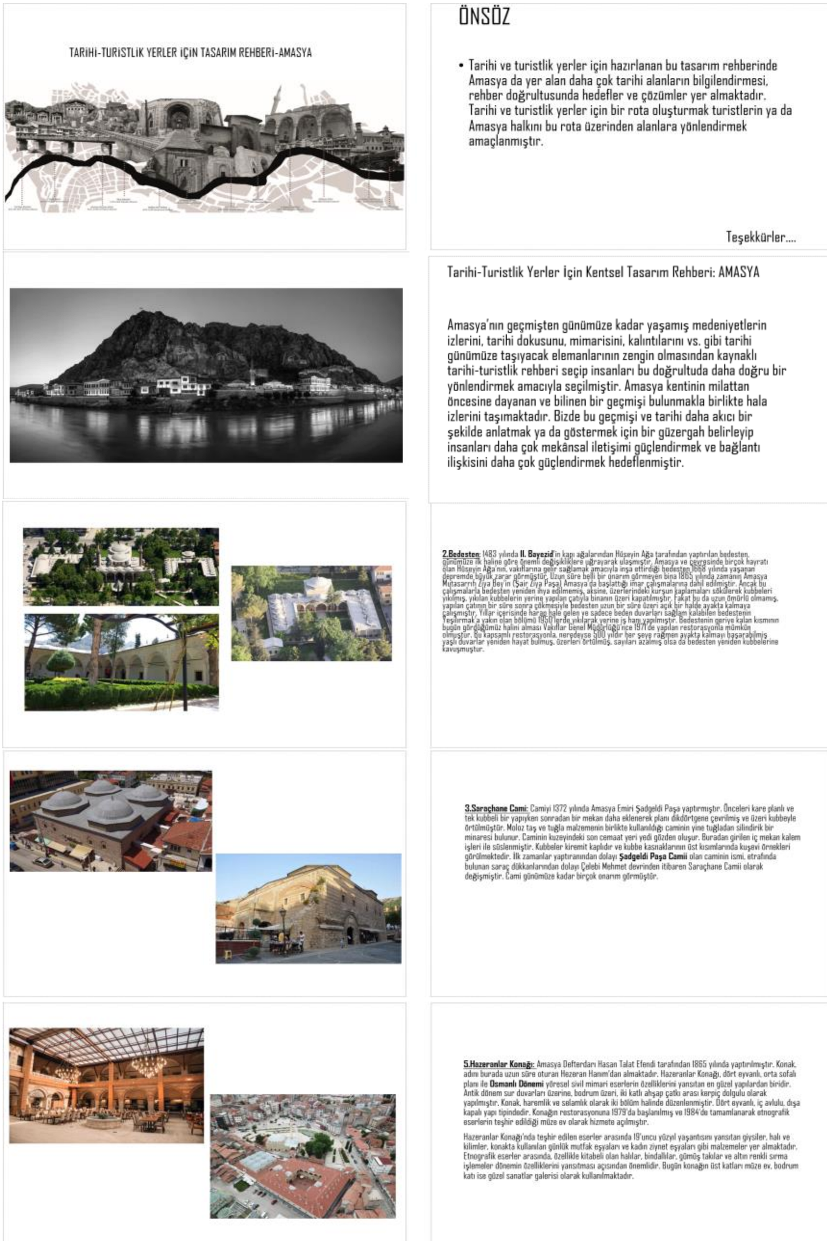

Figure 9. Urban Design Guide for Amasya within the context of *Tourist-Historic City* (Özge Balcı, Göktuğ Kaan Dikal)

4.5. Ecology and Urban Agriculture Focused Urban Design Approach

Through the lens of ***ecology and urban agriculture*** the team has identified several strategies that could be applicable to the city of Amasya;

- ❑ *Yeşilırmak, river basin and valley green infrastructure will be restored*
- ❑ *Pedestrian circulation and micromobility opportunities will be evaluated*
- ❑ *The use of natural and environmentally friendly building materials will be supported*
- ❑ *The use of sustainable renewable energy will be encouraged*
- ❑ *Urban farming and green roof applications will be encouraged*
- ❑ *Stormwater management strategies and infrastructure will be updated*

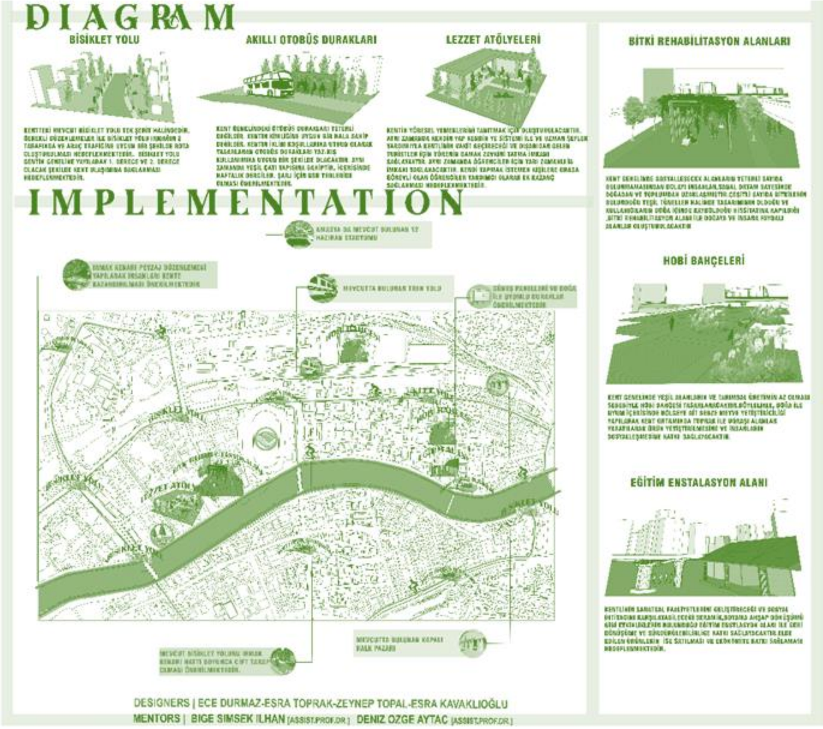

Figure 10. Master Plan for Amasya within the context of *Ecology and Urban Agriculture* (Ece Durmaz, Esra Toprak, Zeynep Topal, Esra Kavaklıoğlu)

Figure 11. Urban Design Guide for Amasya within the context of *Ecology and Urban Agriculture* (Ece Durmaz, Esra Toprak, Zeynep Topal, Esra Kavaklıoğlu)

4.6. Smart Cities and Tourism Focused Urban Design Approach

Through the lens of ***smart cities and tourism*** the team has identified several strategies that could be applicable to the city of Amasya;

- ❑ *Developing local cuisine and gastronomy tourism in an integrated manner with ICT*
- ❑ *Amasya Tourism application will be developed*
- ❑ *Smart micromobility and mass transportation infrastructure will be integrated*
- ❑ *Strengthen the biodiversity of Yesilırmak river basin and conduct marketing through an ICT based application*

Figure 12. Master Plan for Amasya within the context of *Smart Tourism* (Hamide Nur Coşkun, Yiğit Pehlivan, İsmihan Nur Bayraktar)

Figure 13. Urban Design Guide for Amasya within the context of *Smart Tourism* (Hamide Nur Coşkun, Yiğit Pehlivan, İsmihan Nur Bayraktar)

4.7. Riverfront Regeneration Focused Urban Design Approach

Through the lens of ***riverfront regeneration,*** the team has identified several strategies that could be applicable to the city of Amasya;

- ❑ *Create a safe and pedestrian friendly walking route by the riverfront*
- ❑ *Strengthen river – user experience through open public space activities*
- ❑ *Strengthen biodiversity in and around Yesilirmak river basin*

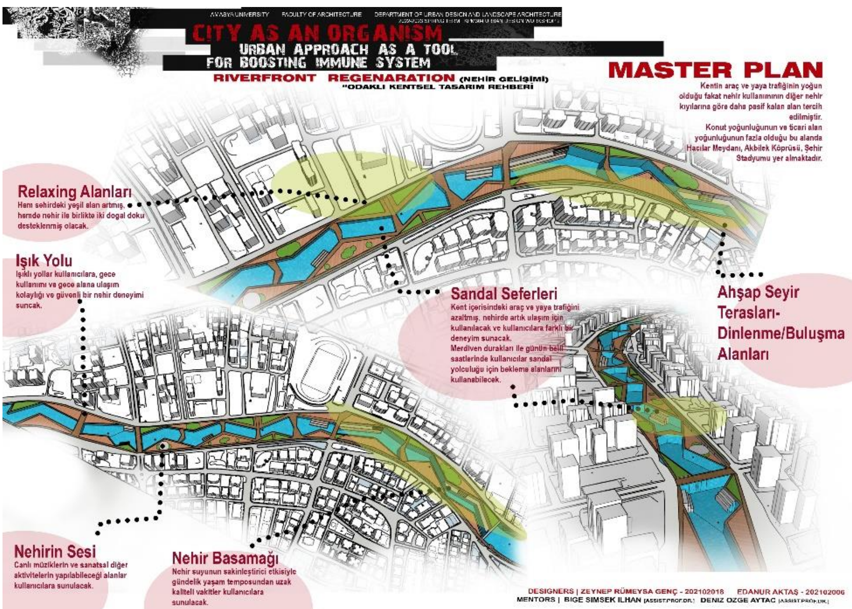

Figure 14. Master Plan for Amasya within the context of *Smart Tourism* (Zeynep Rümeysa Genç, Edanur Aktaş)

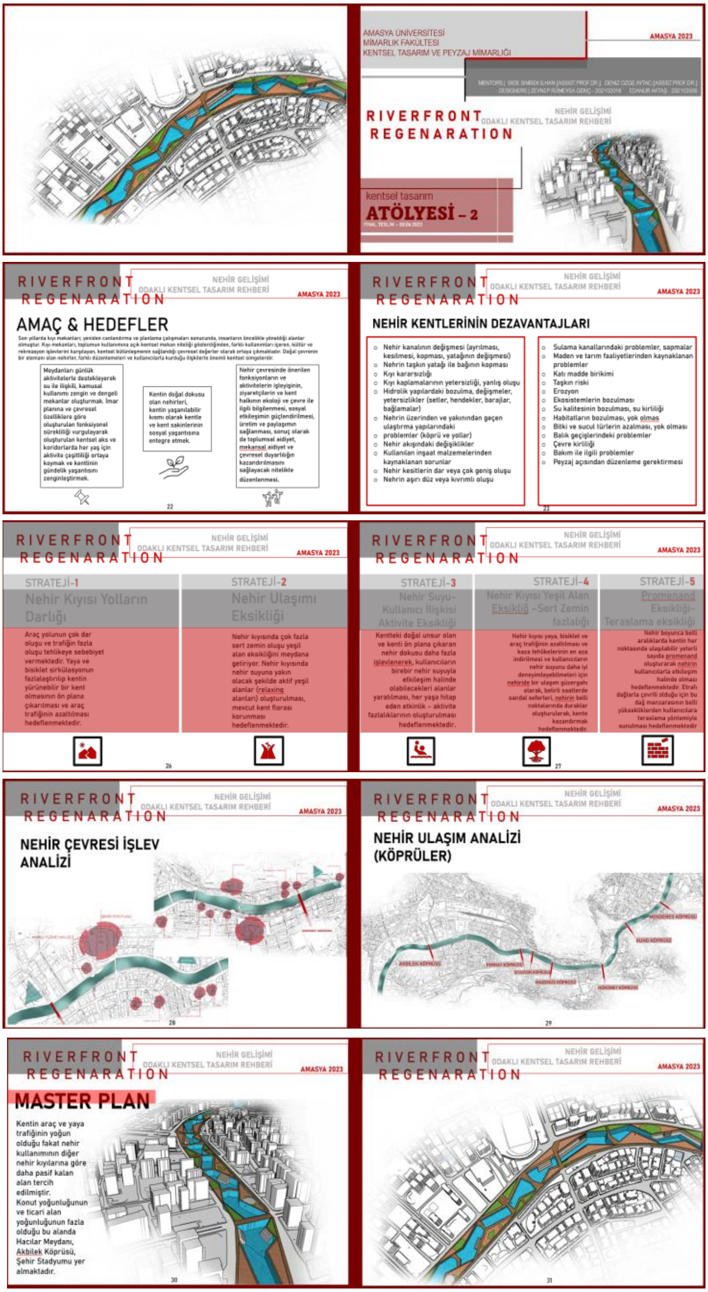

Figure 15. Urban Design Guide for Amasya within the context of *Smart Tourism* (Zeynep Rümeysa Genç, Edanur Aktaş)

4.8. Carbon Footprint and Micro-Climate Urban Design Approach

Through the lens of ***carbon footprint and micro-climate,*** the team has identified several strategies that could be applicable to the city of Amasya;

- ❑ *Create permeable surfaces*
- ❑ *Wide and pedestrian friendly, walkable city principles will be applied*
- ❑ *Green infrastructure will be strengthened to combat with urban heat island*
- ❑ *Environmentally friendly solutions to micromobility*
- ❑ *Directly and indirectly use of natural resources (i.e. the Sun)*

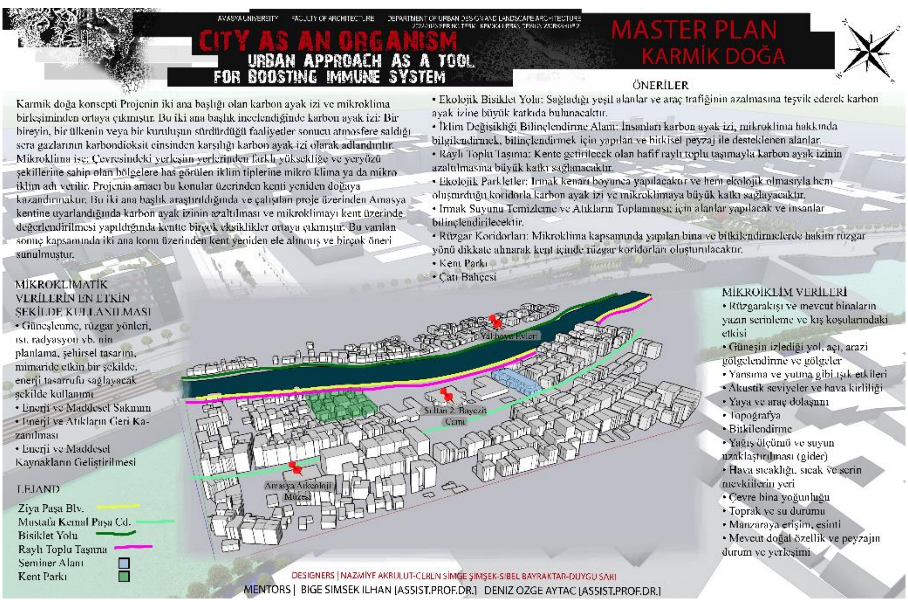

Figure 16. Master Plan for Amasya within the context of *Carbon Footprint and Micro-Climate* (Sibel Bayraktar, Duygu Sarı, Nazmiye Akbulut, Ceren Simge Şimşek)

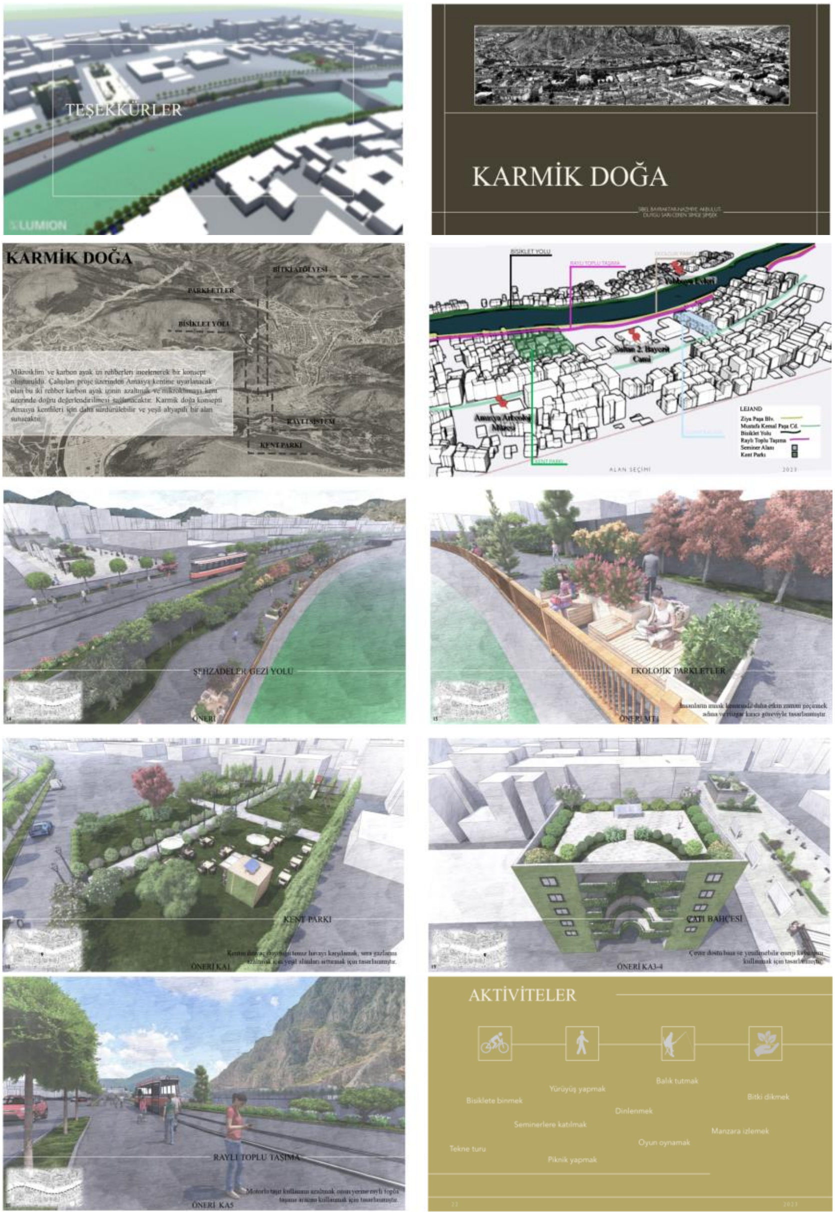

Figure 17. Urban Design Guide for Amasya within the context of *Carbon Footprint and Micro-Climate* (Sibel Bayraktar, Duygu Sarı, Nazmiye Akbulut, Ceren Simge Şimşek)

4.9. Child friendly Urban Design Approach

Through the lens of ***child friendly,*** the team has identified several strategies that could be applicable to the city of Amasya;

- *Near Environment And Traffic Safety*
  1.1. Providing transportation to places
  1.2. Increasing traffic awareness in children
  1.3. Increasing the number of pedestrian crossings for the safety of all users
- *Same Friends Group*
  2.1. Children of all ages can play in the same area with the same group of friends.
- *Presence Of Natural Elements*
  3.1. Increasing the number of green areas.
  3.2. Creating playgrounds with water elements, trees, rocks, wooden playgrounds, etc. 3.3. Using local plants.
- *Suitable And Adequate Equipment Of Playing Tools And Equipment*
  4.1. Increasing urban equipment.
  4.2. Playgrounds made of durable and suitable materials.

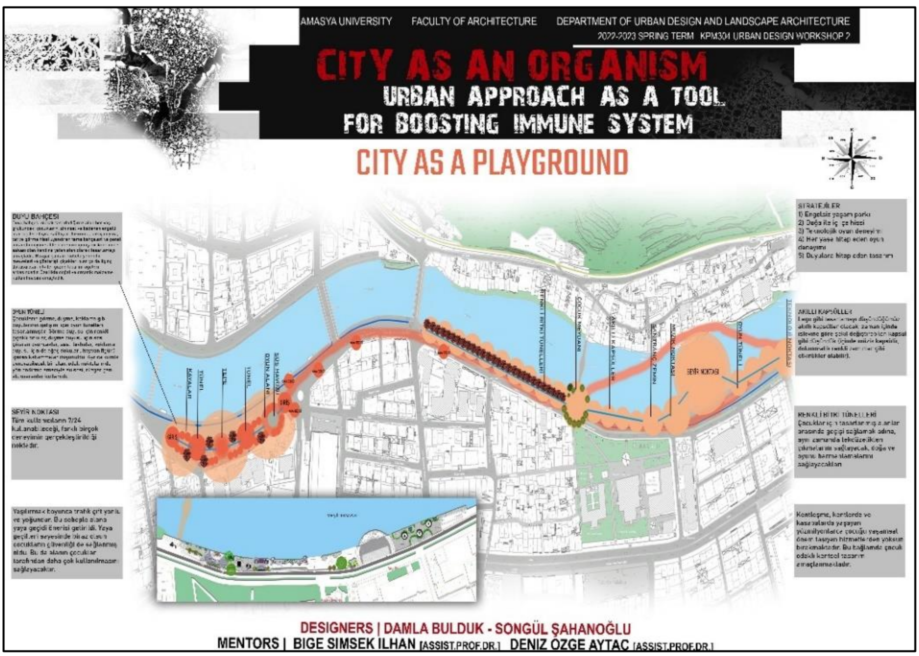

Figure 18. Master Plan and Proposed Urban Design Project (Damla Bulduk, Songül Şahanoğlu)

Figure 19. Urban Design Guide for A Child Friendly Urban Design for the City of Amasya (Damla Bulduk, Songül Şahanoğlu)

4.10. Slow City Urban Design Approach

Through the lens of ***slow city,*** the team has identified several strategies that could be applicable to the city of Amasya;

- *Helping people adopt a healthier lifestyle, with places that encourage physical activities such as walking, cycling and nature walks.*
- *Trams are public transport vehicles that run on electricity. This reduces dependence on fossil fuels and contributes to environmental sustainability by reducing carbon emissions. The use of trams within Slow City promotes sustainable transport options.*
- *Sales units can convey the cultural heritage and local stories of Slow City to customers. By sharing the local values, traditions and stories behind the products, customers can feel connected to these values and contribute to the local culture.*

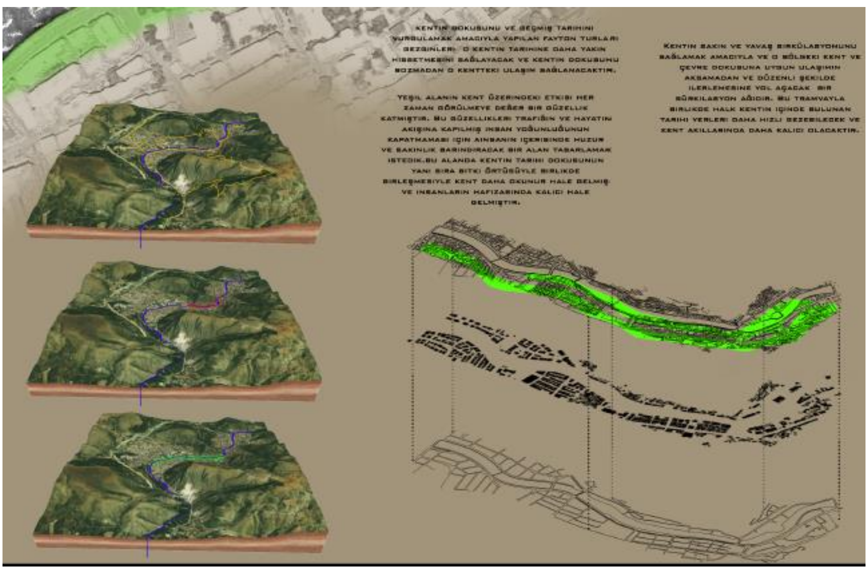

Figure 20. Master Plan for Amasya within the context of *Slow City* (Taha Eren Karataş, Mustafa Ünlü, İsmail Emir Altunbaş)

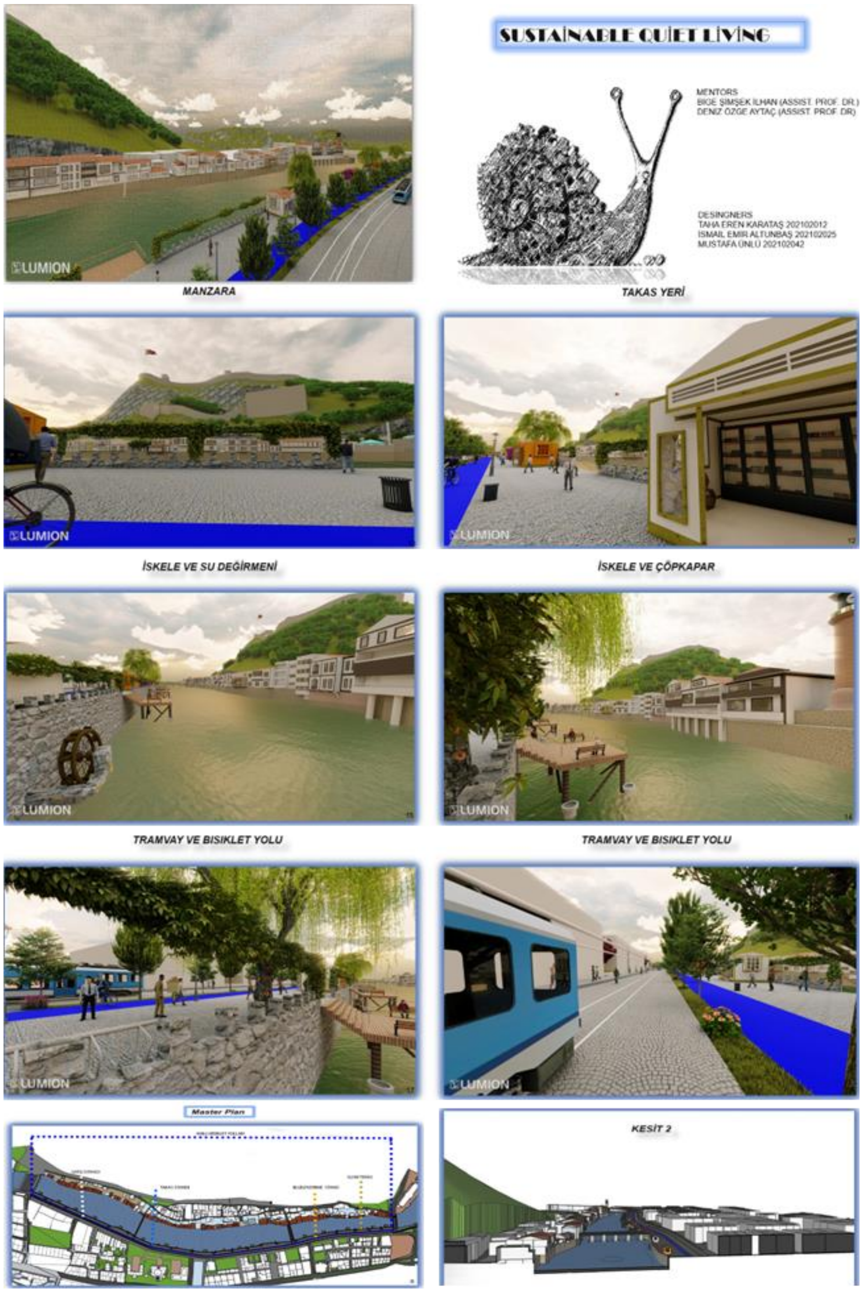

Figure 21. Urban Design Guide for Amasya within the context of *Slow City* (Taha Eren Karataş, Mustafa Ünlü, İsmail Emir Altunbaş)

5. Conclusion and Suggestions

A part cannot be considered separately from the whole; in this context, the field of urban design expertise emerged as a necessity in the second half of the 20th century in order to intervene and operate to improve and develop problematic parts of the city while considering the whole city, and in the process until the first quarter of the 21st century, it has reached a rich accumulation of knowledge, an advanced theoretical and conceptual framework, effective implementation, monitoring and control tools, and a project diversity on a global scale. Today, the essence of urban design is to have knowledge of the functioning of the built environment to be intervened in the context of urban dynamics, to understand the urban context and to develop an intervention framework appropriate to this context; and urban design guides have become the most effective implementation tools of urban design by providing site-specific/customized application guides in order to develop strategies, principles and design standards appropriate to the issues in this functioning. Urban design, especially in the subjects it relates to social sciences, has a normative nature, that is, a discourse-producing nature. In this context, urban design guides can be defined as a set of application principles produced based on this discourse-based theoretical framework.

Professional training plays a major role in establishing the connection between theory and practice. Studio courses, which form the backbone of education in the pedagogy of the disciplines of planning, architecture and design, which are spatial organization sciences, are the most important learning and experiencing platforms as they are applied production environments where the mechanism of establishing a relationship between theory and practice is operated and thus the professional perception and identity profession are developed. In this sense; course interfaces that motivate and create a driving force in organizing the knowledge that needs to be transferred from theory to practice and in developing creative, innovative and original approaches should be designed so that students can handle the environment they are asked to construct, whether based on hypothetical or real data, in a multi-faceted, sustainable and contemporary way that can respond to issues specific to the era.

In the third section of the chapter, the modules and original outputs of an educational interface designed around the urban issue [urban vulnerability] and solution tool [urban design guides] discussed in the first two sections are presented. The course as mentioned is the studio course called "Urban Design Workshop II" which is a compulsory course in the 3rd grade, 2nd semester of the Urban Design and Landscape Architecture in the Department of the Faculty of Architecture of Amasya University. In the first stage; instructors asked the students to choose one of the contemporary planning and design approaches that would approach the unique fragility issues of the city (Amasya, traditional Anatolian city) chosen within the scope of the course from different perspectives, do their research and examine the projects produced on a global scale. In the second stage, the students were expected to identify the problematic areas of the city in the context of the approach they chose, to understand its evolution by revealing its chronological development, and to prepare guide bases that produce "site-specific" solutions based on this information; because an urban design guide is an effective tool, a design control, in the transformation of each approach from theory to practice. Students, who are expected to develop approaches to given issues on the axis of determined themes and produce solution-oriented thematic urban design guides through the tools used in formal and/or informal education, have produced correct and valid current tactics for the dual relationship between theory and practice thanks to this interface.

During the course, a collective sharing platform was created, and an up-to-date professional repertoire was created in which contemporary approaches produced in the face of global urban, environmental and social issues were comprehended through different thematic guides that respected the city's past, considered global developments and suggested contemporary solutions compatible with the natural and cultural structure through local dynamics, and thus; it was ensured that the professional candidate students understood their critical roles in an interdisciplinary production environment.

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Author Contribution and Conflict of Interest Declaration Information

All authors contributed equally to the article. There is no conflict of interest.

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Student Experiences at the Intersection of Upcycling-Interior Design: An Evaluation on Upcycled Furniture Examples

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1. Introduction

The concept of sustainability is among the most current issues of the age, and efforts to put the idea into practice with different methods in different disciplines are evident. The increasing population, changing needs/expectations, and accompanying consumption habits have made (solid) waste management a problem in every aspect of life, and serious waste has become unavoidable. Therefore, this problem arising from unconscious consumption also increases the burden on the environment (Elibol et al., 2018). The basis of achieving a sustainable and ecological structure is the correct consumption and use of resources without polluting the environment (Türkeri, 2021). Like all other disciplines, design disciplines (such as architects, interior designers, industrial products and fashion designers) focus on sustainability and therefore sustainable design issues, such as how to use or achieve the concept in action on materials, products, structures or interiors. Especially in the interior design discipline discussed within the scope of the study, interior designers aim to design/practice sustainable spaces and products/furniture at different scales to prevent the (solid) waste problem with awareness of the problem. Sustainable design is the design of physical objects, built environments and spaces, services, etc. It is based on the philosophy of designing by the principles of ecological sustainability (Loftness et al., 2007). It is a planned, strategic and solution-oriented holistic form of structuring to global environmental problems and enables to control the negative effects of destructive processes on the environment (Aytepe Serinsu, 2022; Celadyn, 2019). With a similar approach, Mclennan (2004) defines sustainable design as a design philosophy that minimizes and eliminates negative impacts on the natural environment and aims to maximize environmental quality. In the book "The Philosophy of Sustainable Design", he explains sustainable design principles as (Mclennan, 2004 cited in Özsoy, 2020);

- Respect for natural life,
- Respect for people,
- Respect for space,
- Respect for the life cycle,
- Respect for energy and natural resources
- Respect the process

To eliminate amounts of waste; evaluate and improve the life cycle of products and practices; address the status of waste-free natural systems; Items such as obtaining long-term products are among the Hannover Criteria described for sustainable design (McDonough & Partners, 1992). Besides the Hannover Criteria, McDonough defines the concept as "comprehension and put into practice of the expression environmentally sensitive and responsible as a part of the developing structure of nature" (McDonough & Partners, 1992). While the sustainable design approach manifests itself in every aspect of life, it also has an importance for design disciplines.

In the context of the interior design discipline, sustainable interior designs aim to avoid the use of materials that will cause environmental degradation, to protect natural resources, and to rationalize in an innovative way that draws attention to waste management (Winchip, 2011 as cited in Alfuraty, 2020). In the interior design process, consumption decreases and it becomes possible to obtain sustainable interior designs thanks to the harmony of the volumes in the entire space with each other, flexible design ideas from spatial organization to furniture, and the multiple use of other elements that complete the space (Halliday, 2008 as cited in Alfuraty, 2020). Interior elements that are brought back to life with simple processes without the need for serious redevelopment and placed in different or the same functional and spatial context become improved products with a discreet profile (Celadyn, 2019). Therefore, interior designers need to know new and existing sustainable materials and methods in the local and international market (Reham & Eldin, 2017). Methods that encourage the management and use of waste (solid) materials include design approaches focused on "reduce", "reuse" and "reuse/recycle" (Bekar & Nayeb, 2022). Yılmaz and Bozkurt (2010) emphasize that these methods are a solid waste management method mostly preferred by developed or developing countries. When the "use-throw away" approach is replaced by the "don't throw away-recycle-use" approach and with this awareness and the ability of consumer and producer groups to purchase products, waste will be prevented, the amount of waste will decrease and economic recovery will manifest itself. Architects, interior designers, artists, etc., within the scope of sensitive goals, transform/interpret waste materials into art, product, space, building and can provide the same or different functions with aesthetic concerns (Aytepe Serinsu, 2022).

Within the scope of the study, one of the most important complementary elements of interior design, which the interior architecture students were asked to upcycle and form the sample of the study, is undoubtedly the furnitures. In order for this furnitures to comply with the definition of sustainable, they are either expected to be long-lasting and durable, or they must be brought back to life with the awareness of restoration/upcyle. The durability of the furniture makes it sustainable and the necessity of using new resources to replace it is eliminated (rosagres.com). Increasing furniture lifetime will reduce not only waste but also carbon emissions (Brunet-Navarro et al., 2017; Bumgardner & Nicholls, 2020). However, when the lifespan of furniture, like every product, is considered, the trend towards upcycling emerges so that they can take part in the life cycle again.

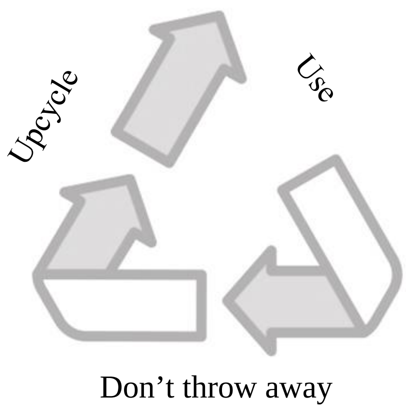

Figure 1. Upcycling Process (created by author)

It is seen that upcycling trends have started to attract more attention from everyone, especially in the last few years, due to the simultaneous increase in environmental negativities due to increasing resource consumption and waste volumes (Singh, 2022). The most fundamental feature that distinguishes upcycling from the concept of recycling is that objects/products/furnitures that have completed their useful life are brought back to life in a way that remains true to their original purpose or serves different actions. Unlike the concept of recycling, which is known as breaking down the material or product and turning it into something else with more energy, upcycling provides energy savings. Upcycling has some advantages for humans and the environment, such as sustainability, environmental wisdom, and creative approaches (Ali, et al., 2013). With a similar definition, Singh et al. (2019) define the concept of upcycling as a process in which products or materials that are no longer used or about to be thrown away are repaired and produced or used in a way that increases their value. Re-functioning furnitures not only contribute to sustainable design, but also offer creative and innovative design solutions. This upcycle process can occur in various ways, some of which are;

- **Repainting, and varnishing** (can be considered as a method that increases the aesthetic value and lifetime of the furniture)
- **Repair** (replacing broken or worn parts allows the furniture to become functional again)
- **Creative design ideas** (designing an old unused or broken furniture to use another action)

It is possible to list these as simple and low-cost methods. These methods, which are very practical to do individually, have become an important tool to increase environmental sustainability, reduce the amount of waste (solid) and offer creative solutions.

In this study, within the scope of the relevant course conducted in the 2023-2024 spring semester at the Interior Design department of a state university, students are asked to choose idle/unused furniture and use it in the context of "design, production, maintenance, repair, reuse" under the subheadings of upcycling. They were asked to adopt a sequential lifecycle approach and redesign. An evaluation will be made on the beneficial/positive effects of the upcycling trend in both design education and life practice, based on the resulting furnitures.

2. Material and Method

Within the scope of the study, it is desired to evaluate the furniture upcycle/restoration by the students of the interior design department and the experiences they gained. Student groups consisting of two students were expected to bring discarded or unused small furniture (such as coffee tables, chairs, etc.) back to life with the same function or by incorporating different functions into the design at little cost/without spending too much money. To achieve this, they followed three different processes:

1. Selection process
2. Idea/sketch process
3. Practice process

During the selection process, students went out to the field to identify and acquire idle furniture, examined the physical, functional and aesthetic potential of the equipment they found, and identified any wear or damage on the existing equipment. For the furniture that has been decided to be upcycled, the second stage, the idea and sketch development process, has begun. At this stage, student groups shared their creative ideas with the lecturer on how they could reuse the furniture they found and improved their designs in line with the criticism they received. As a result of the developed sketch and design, the practice process started. In this process, which is the last stage, the final furniture(s) were obtained as a result of the necessary cleaning, material preparations, additional material selections and user tests in the ergonomic-functional-aesthetic context for the relevant furniture.

3. Findings and Discussion

From the course output studies, the upcycled equipment of seven (7) student groups was selected as a sample design and each design was named UCSG1, UCSG2, etc. A code name was given as (upcycling student group 1, upcycling student group 2, etc.) and each example was evaluated on its own.

- **<u>Group coded UCSG1</u>**

Furniture type: Wooden chair

Upcycle process: UCSG1, who wanted to transform the chairs that were thrown away to be unused, observed that the coverings of the chairs were quite worn out and their frames had lost their durability. They stated that they wanted to first remove the upholstery of the chairs and go for a design approach based on the remaining skeleton. As a result of the criticism they received, they started the practice process with a different design decision to be used as a chair.

Figure 2. Image of The Wooden Chair Chosen by UCSG1 and The Upcycle Process (From The Lecturer Archive, 2024)

With the waste mdf pieces purchased from the furniture store, the backs of two chairs were connected so that they faced each other, and a chair with a larger surface area was obtained. To eliminate the unaesthetic appearance because the flooring cannot be completely cleaned from the frame, a pleasant appearance was obtained by covering the back part with waste rope, as in mdf pieces. The fact that the additional materials used in the practice process of the furniture are also waste and recycled has made this upcycling example more important.

Figure 3. Image of The Final Version of The Furniture
(From the lecturer archive, 2024)

- **<u>Group coded UCSG2</u>**

Furniture type: Wooden table

Upcycle process: Although it was not in a bad condition and had the potential to be used, the wooden coffee table, which was found to be idle and possibly with a broken middle glass, was wanted to be upcycle/restored by UCSG2. In line with the sketch process and the criticisms obtained, a design approach that preserves its current use but will also be used for different actions was decided.

Figure 4. Image of The Wooden Table Chosen by UCSG2 **a**nd The Upcycle Process (From The Lecturer Archive, 2024)

By leaving the upper surface of the wooden table partially open, the relevant area allows for multiple alternatives such as newspaper holders, magazine holders and flower holders, all depending on the user's decision, while the lower part has been turned into a surface where our pawed friends at home can sleep. After removing the legs, changing the definition of the legs that support the area offering multiple alternatives, creating the top table surface, sanding, painting the table in anthracite and gray, varnishing and placing the cushion, an upcycled design with both functional and aesthetic value was obtained.

Figure 5. Image of The Final Version of The Furniture (From the lecturer archive, 2024)

- **<u>Group coded UCSG3</u>**

Furniture type: Wooden chair

Upcycle process: UCSG3 decided to restore an old chair whose seat cushion was separated from its frame and worn out for reuse. A detailed cleaning process has been carried out and dirt and dust have been removed. After the cleaning process, the sanded chair was made ready for painting. After it was painted white, it was waited for it to dry and then the second and third coat of paint was applied again.

Figure 6. Image of The Wooden Chair Chosen by UCSG3
and The Upcycle Process (From The Lecturer Archive, 2024)

The existing torn and dirty fabric covering was peeled off and re-covered with a different fabric with a more modern appearance, resulting in a more aesthetically pleasing appearance.

Figure 7. Image of The Final Version of The Furniture
(From the lecturer archive, 2024)

- **<u>Group coded UCSG4</u>**

Furniture type: Wooden chair

Upcycle process: It has been observed that this coffee table, whose table surface is made of chipboard, has been exposed to a lot of moisture, its coating has swelled and peeled off, and there is decay in the main frame. UCSG4 carried out the preliminary cleaning process by sanding as the first step.

Figure 8. Image of The Wooden Table Chosen by UCSG4 and The Upcycle Process (From The Lecturer Archive, 2024)

As a result of the exchange of ideas with the concern of designing a multifunctional coffee table, a folding table surface was obtained with a simple mechanism by cutting mdf on this cleaned/sanded furniture, which went through the design process to fulfill the function of both a game table and a coffee table in daily life as it used to be. In addition to its clean appearance, it has been brought back to life so that it can be used both as a coffee table and as a game table when desired.

Figure 9. Image of The Final Version of The Furniture
(From the lecturer archive, 2024)

- **<u>Group coded UCSG5</u>**

Furniture type: Wooden drawer

Upcycle process: For the furniture to be obtained within the scope of upcycling, UCSG5 wanted to use an old drawer that was used in the past but had some deterioration and was no longer used.

Figure 10. Image of The Wooden Drawer Chosen by UCSG5 and The Upcycle Process (From The Lecturer Archive, 2024)

A holistic design that will serve storage and seating was achieved by incorporating different side functions during the sketch and design process. With the help of the furniture master, two pieces of wood were cut for the seating surface, the drawer was cleaned and the drawer handle was installed, and six metal legs taken from unused chairs were attached to make it stand. The practice process was completed by coating the drawer to match the color of the wooden piece. In this way, this unused and old drawer has been brought into life by gaining both functional and aesthetic value.

Figure 11. Image of The Final Version of The Furniture
(From the lecturer archive, 2024)

- **<u>Group coded UCSG6</u>**

Furniture type: Wooden bedside table

Upcycle process: UCSG6 wanted to bring an unused bedside table to life by upcycling it to serve sitting and storage purposes. During the practice phase after the design ideas, first the cleaning process was carried out, and then the necessary areas were sanded to eliminate any surface roughness. After taking the legs of another idle furniture and mounting it to the relevant furniture with the help of a drill, all surfaces of the furniture were painted in several layers with the selected wood paint. After painting the body, the legs were painted with matte black spray paint, the previously

broken drawer handle was replaced to match the legs, and a new one was installed.

Figure 12. Image of The Wooden Bedside Table Chosen by UCSG6 and The Upcycle Process (From The Lecturer Archive, 2024)

To make sitting comfortable, UCSG6 sewed the cushion with the help of the leftover fabric pieces and sponge they bought from the fabric store and placed it in the relevant area. In addition, the space created when the seating surface is slid on two rails and the drawer section in the original of bedside table can be used for storage. Offering practical use in small spaces, this exemplary furniture has regained its place in the life cycle both functionally and aesthetically.

Figure 13. Image of The Final Version of The Furniture (From the lecturer archive, 2024)

- **<u>Group coded UCSG7</u>**

Furniture type: Wooden table

Upcycle process: The wooden coffee table, which has cracks, damage, and discoloration in places, was selected by UCSG7 to be improved while preserving its current condition. The coffee table was completely cleaned and sanded, then the broken or damaged areas were filled with furniture putty to complete the physical integrity. After the sanding and repair process, primer was applied to all surfaces to obtain a smooth and clean appearance.

Figure 14. Image of The Wooden Table Chosen by UCSG7 and The Upcycle Process (From The Lecturer Archive, 2024)

After all surfaces were painted white, a dark blue color that would harmonize with the white color was applied to the worn upper surface. Then, to contribute to its aesthetic value, strips were drawn around the edges of the surface with the help of paper tape, a stencil template was placed in the remaining middle space and a pattern was created with a brush and sponge. As a result of all these practice steps, the furniture has been made ready for reuse with a more modern and aesthetic appearance compared to its previous state.

Figure 15. Image of The Final Version of The Furniture
(From the lecturer archive, 2024)

Since students were asked to find small-scale, singular furniture, upcycling examples, generally focusing on coffee tables and chairs, were examined. It is possible to say that the common point that all of them meet is that upcycled furniture is obtained at low cost, which does not deviate from functionality and aesthetic value, and in which students play the leading role, except for a few simple supports in the design /practice process. In addition, it is thought that the study is important for all design disciplines and education, especially interior design in terms of helping students redesign the furniture they choose, optimize production processes by evaluating existing materials and components, apply the necessary maintenance and repair techniques, and ultimately make the equipment reusable.

4. Conclusion and Suggestions

Unconscious consumption and the resulting ever-increasing waste volume have become a matter of significant concern and debate on both a local and global scale. Due to the seriousness of the issue, various solution suggestions and methods have begun to be developed. It is observed that the sustainable design concept mentioned in the study and the up/recycling tendencies that this concept brings with it are increasingly finding a place among the mentioned methods. Design disciplines such as interior design also contribute to environmentally friendly creative design processes by offering various solution suggestions within the framework of these concepts. Every business, from small to large scale, can gain economic profit by redesigning or improving idle products/materials, and the local economy is supported. Thus, a more sustainable and innovative lifestyle begins to be adopted through individual and social upcycling. Thanks to the seven upcycled/improved furniture samples evaluated within the scope of the study and obtained at the end of the course process, interior design students were able to gain knowledge about the concept of upcycling, thus environmental sustainability, correct resource use, reducing the amount of solid waste, creativity, functional and aesthetic concern, applied learning, material knowledge, It was concluded that they gained significant awareness on issues such as economic benefit. Therefore, in the context of interior design education, it is necessary to increase students' awareness of current and vital issues such as up/recycling. When they learn sustainable design principles that respect nature, the environment, humans, and other living things, they will develop their design ideas with environmentally friendly approaches both in their student projects and in their future professional lives. This awareness and knowledge will enable them to grow up as individuals who have the potential to create a positive change not only in the field of design but also in the social structure. Such an educational approach will activate creative and innovative thinking skills, and they will create designs with high functional and aesthetic value by reusing existing materials or products. In addition, they will equip themselves in the context of professional awareness on many issues such as problem-solving skills, practical implementation of theoretical knowledge, waste management awareness, and social responsibility awareness. Therefore, interior design education will undertake the mission of training conscious and responsible interior designer candidates by focusing on the mentioned concepts and problems.

Acknowledgments and Information Note

The article complies with national and international research and publication ethics. Ethics Committee approval was not required for the study.

Author Contribution and Conflict of Interest Declaration Information

There is no conflict of interest in the article.

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Dynamics of Urban Ecosystems: Inputs, Outputs, and Management Strategies

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1. Introduction

Urban ecosystems are complex systems where human-made and natural environments interact. These ecosystems are characterized by dense populations and infrastructure, which significantly alter the natural landscape, energy flow, soil, climate, and biodiversity. The study of urban ecosystems is crucial for understanding their mechanisms and for promoting sustainable urban development. Urban ecosystems, as mentioned, incorporate both green spaces like parks and water bodies, as well as built environments. The rapid urbanization observed over recent decades has led to significant ecological changes, and addressing these is essential for human well-being and environmental health.

The rapid growth of urban populations and the expansion of infrastructure have led to significant alterations in ecosystems. These changes are characterized by high resource consumption, increased waste production, and habitat destruction. Urban ecosystems face sustainability challenges, including altered climate, reduced biodiversity, and increased pollution. Managing the balance between the inputs (resources consumed) and outputs (waste generated) in these ecosystems is critical for addressing these challenges and ensuring the long-term sustainability of cities.

This study focuses on the inputs and outputs within urban ecosystems, examining the flow of materials, energy, and waste, and how these processes are shaped by human activities. The analysis of these flows is crucial for understanding the sustainability challenges in urban environments. The study also includes considerations for urban management strategies that could help mitigate the negative effects of urbanization, such as pollution, habitat loss, and climate alteration.

The aim of this study is to provide a comprehensive understanding of urban ecosystems by analyzing the inputs (resources like energy, water, and materials) and outputs (waste, emissions) and their environmental impacts. It also aims to propose management strategies that balance these inputs and outputs for more sustainable urban living.

The methodology for this study included the following steps:

1. **Literature Review**: Existing studies and reports on urban ecosystems were reviewed, focusing on ecological dynamics, material flows, and urban management strategies.
2. **Data Collection**: Data on urban population growth, energy use, waste production, and material consumption were gathered.
3. **Input and Output Analysis**: A detailed analysis was conducted on how urban ecosystems manage resource consumption and waste production.
4. **Evaluation of Urban Management Strategies**: Current sustainability initiatives and urban management practices were assessed.
5. **Proposals**: Based on the findings, nature-based and policy-driven solutions were proposed to enhance sustainable urban development.

1.1. What are urban ecosystems?

Urban ecosystems are those where people live in high densities or those where the built infrastructure covers a large proportion of the land. The infrastructures in these areas incorporate both planted vegetation such as urban forests, parks and gardens and water bodies like ponds, small lakes and wetlands. However, in a broader sense, areas around the cities, anyhow linked to or directly managed and affected by material and energy from core urban or suburban parts, are also components of urban systems (Pickett et al., 2001). Urban ecosystems are considered a ecosystem functional group within the intensive land-use biome. They are structurally complex ecosystems with highly heterogeneous and dynamic spatial structure that is created and maintained by humans (European Commission, 2015). Urban ecosystems are cities and the surrounding, socio-ecological systems where most people live (Maes, et. al., 2016). Urban ecosystem services are defined as the services provided specifically by urban ecosystems and their components (Burkhard et al., 2018).

1.2. Importance of urban ecosystems

Urbanization has large impacts on human and environmental health, and the study of urban ecosystems has led to proposals for sustainable urban designs and approaches to development of city fringe areas that can help reduce negative impact on surrounding environments and promote human well-being (Steenberg, et al., 2015).

Urban ecosystems differ from natural ecosystems in terms of soil, climate, energy flow, and population dynamics. Understanding the mechanisms that constitute urban ecosystems is crucial for sustainable urban planning. Human factors disrupt and alter the balance of ecosystems, contributing to the establishment of a new equilibrium. Change is an inherent characteristic of ecological systems. The capacity of urban ecosystems to respond to and adapt to these changes is a critical factor in ensuring the long-term sustainability of cities. (Anonymous, 2008).

According to the MAE 2005 report, it has been determined that ecosystems have rapidly changed over the past fifty years, resulting in irreversible changes in biodiversity (Figure 1),(Turner et al., 1990).

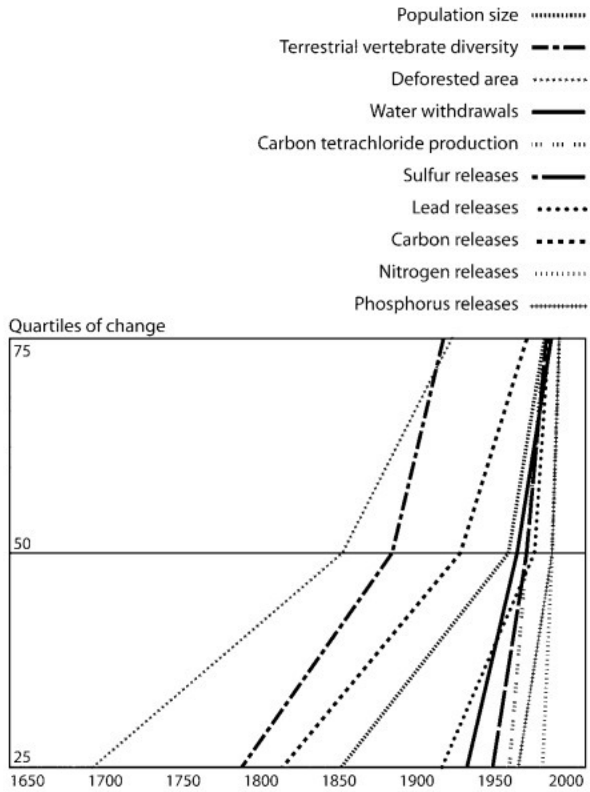

Figure 1. Trends in selected human-induced drivers of environmental change (Turner et al, 1990)

An important factor in the rapid changes of ecosystems in cities is the continuous increase in urban populations Created by statistics portal Statista, breaks down urban populations by region in 1990, 2014 and 2050 (Figure 2).

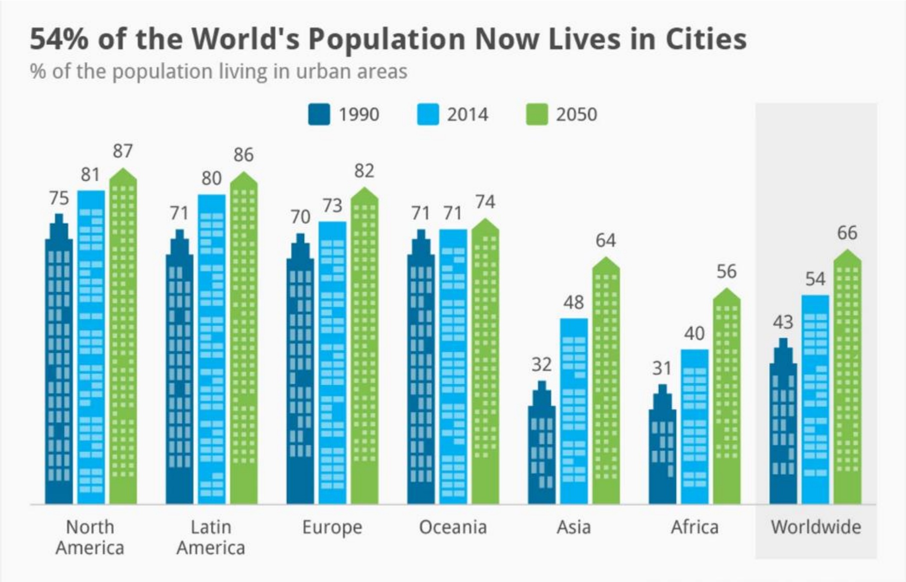

Figure 2. Urban populations by region in 1990, 2014 and 2050 by Satista (https://mashable.com/archive/urbanization-city-growth).

2. Definition and Characteristics of Urban Ecosystems

Urban ecosystems are complex and dynamic systems characterized by interactions between natural and human-made environments within urban areas. Pickett et al. (2001) define urban ecosystems as areas where people live at high densities or where built infrastructure covers a large portion of the land, including built infrastructures, urban green spaces, and urban water bodies. Additionally, areas surrounding cities that are connected to or directly managed and influenced by materials and energy from core urban or suburban parts are also components of urban systems. The characteristics of urban ecosystems are outlined below (Gilbert, 1989; Francis & Chadwick, 2013; Pickett, & Grove, 2009, Russo & Cirella, 2021)

1. The most important feature of urban ecosystems is the high population density. Resource consumption and waste production are high in urban areas.
2. Urban areas are characterized by dense grey zones (buildings, roads, infrastructures). This significantly affects water flow, soil structure, and habitats.
3. The natural landscape has been altered, impacting climate, water cycles, and biodiversity.
4. Urban ecosystems are characterized by high inputs of energy (electricity, fossil fuels) and materials (food, consumer goods), as well as significant outputs of waste and emissions. These flows are often linear rather than cyclical, leading to sustainability issues.
5. Urban areas experience altered climatic conditions compared to their surrounding rural areas.
6. In terms of green spaces and biodiversity, urban ecosystems exhibit distinct characteristics. They support a unique mix of native and non-native species adapted to urban conditions. Green spaces like parks, gardens, and green roofs are important for preserving biodiversity, providing ecosystem services, and enhancing the quality of life for urban residents.
7. Water management in urban ecosystems is highly complex. Providing drinking water, managing stormwater, treating wastewater, and dealing with increased surface runoff and changes in natural water cycles contribute to challenges like flooding and water pollution, which impact the ecosystem.

8. Human activities in urban ecosystems are driven by social, economic, and cultural factors. Cities are centers of economic activity, innovation, and cultural change, which shape the structure and function of urban ecosystems.
9. Urban areas are significant sources of pollution, including air, water, and soil pollution, as well as noise and light pollution.

3. Inputs and Outputs in Urban Ecosystems

Natural ecosystems are sustainable systems that maintain balance within themselves. In urban areas, the presence of direct and indirect inputs and outputs from the environment complicates the system, making it more complex. Urbanization disrupts the natural landscape, replacing it with hard surfaces such as roads, buildings, and other infrastructure. Significant changes occur in energy flows, and large populations require substantial inputs, resulting in equally large amounts of waste. For this reason, urban ecosystems hold great importance in terms of sustainability and environmental management. Balancing inputs and outputs is a critical factor for the sustainable growth of cities. Figure 3 illustrates the interaction between inputs and outputs in ecosystems (Kenworthy, 2006, Pouyat, 2009, Brown, 2013; Brown et al., 2014; Coman & Cıoruta, 2019).

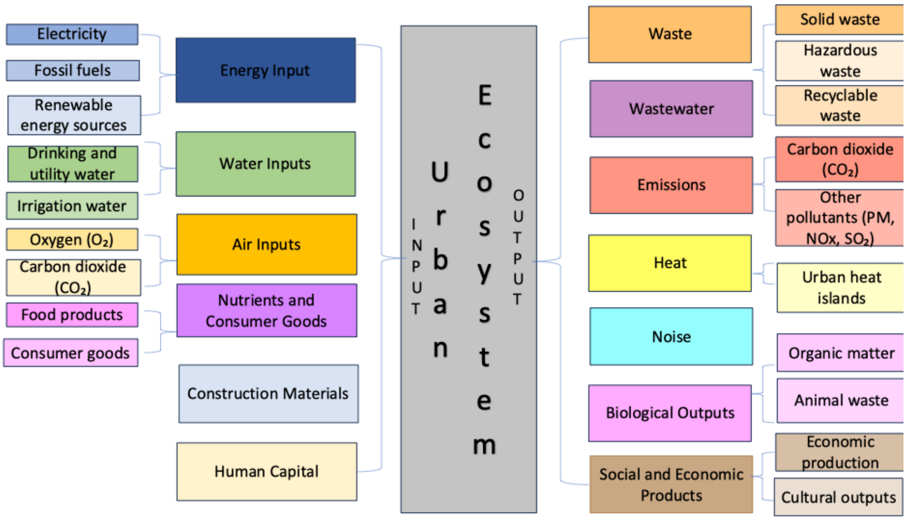

Figure 3. Inputs and Outputs in Urban Ecosystems

To fully understand the impacts of urban land use change on biogeochemical cycles, it is essential to thoroughly analyze the energy and material flows in urban ecosystems influenced by the built environment. Ecosystems utilize materials and energy to meet human needs (Kenworthyet et al., 2006). The increasing use of electricity and fossil fuels for residential, industrial, transportation, and heating purposes, along with the growing importance of renewable energy inputs, are key components of ecosystem inputs (Endlicher et al., 2007). Urban ecosystem inputs also include the use of drinking and irrigation water, essential gases like oxygen and carbon dioxide needed by humans and other living organisms, agricultural products, animal products, and processed foods necessary for nourishment, as well as consumer goods like textiles and electronics, construction materials, and the labor, knowledge, and skills that form the foundation of economic and social activities in cities (Zhao & Sander, 2018).

Urban ecosystem outputs consist of domestic, industrial, and construction waste, chemical and electronic waste, recyclable waste, domestic, commercial, and industrial wastewater, emissions from fossil fuel combustion such as particulates, sulfur, carbon dioxide, and the like, urban noise, heat emissions from grey surfaces, biological outputs from organic and animal waste, and economic production outputs generated by cultural, goods, and services activities (Bai, 2016).

4. Management of Inputs and Outputs in Urban Ecosystems

Maintaining the balance between inputs and outputs in urban ecosystems is crucial for sustainable urban living. Planning urban ecosystems with their broad social, environmental, and economic aspects is important for sustainable cities. Urban planners should pay close attention to the sustainable use of cities. For example, they should focus on reducing carbon emissions and providing rational solutions to transportation issues, establishing public transportation systems, concentrating on clean energy use, and developing solutions to prevent the formation of urban heat islands. They should also help minimize pressures on vulnerable areas in cities, such as wetlands, biodiversity areas, urban green spaces, and coastal areas. Alberti & Marzluff (2004) explained the resilience of cities in their study on system dynamics of urban ecosystems using a diagram (Figure 4).

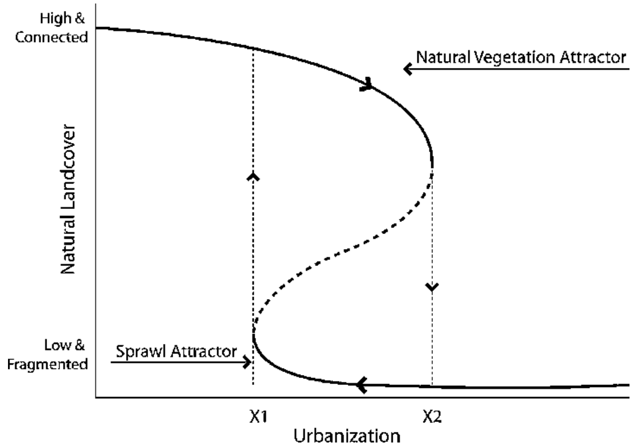

Figure 4. Impact of urbanization on resilience (Alberti & Marzluff, 2004)

In urbanizing regions, ecological and human functions are interdependent. As urbanization increases, the system moves away from the natural vegetation attractor toward the sprawl attractor and beyond, until increasingly urbanized ecological systems become unable to support the human population. As we replace ecological functions with human functions in urbanizing regions, the processes supporting the ecosystem may reach a threshold and drive the system to collapse. As urbanization increases, natural vegetation decreases. The system moves along the upper solid line (Natural vegetation attractor) until a point (X2) is reached where natural vegetation is too degraded and fragmented to perform vital ecological functions and the system becomes unstable (dashed portion of curve). As urbanization reduces ecosystem function the system flips into a sprawl state (the lower solid line, sprawl attractor) where human functions replace ecosystem functions. Eventually, ecosystem function is degraded to a point that cannot support human function, urbanization declines and the system becomes unstable again (X1). The system eventually returns to the natural vegetation state (Alberti and Marzluff, 2004).

Sustainable urban planning is crucial for securing the long-term wellbeing of citizens and can play a transformational role in shaping the cities. To be effective, the planning system must be capable of dealing not only with land use but with the broader social, environmental and economic aspects of urban ecosystems and strike a balance, in which the development needs are met in the most sustainable way. In addition, successful urban revitalization needs an integrated long-term strategy that includes measures related to several policy areas such as mobility, housing, cultural heritage, start-up support (Anonymous, 2020)

A sustainable urban energy system will need low carbon technologies on the supply side, and efficient distribution infrastructure as well as lowered consumption on the end-user side. Cities therefore need to shift from the current unsustainable fossil fuel energy generation towards using renewable energy sources, not only because of looming resource depletion but also to curb the negative externalities such as pollution and greenhouse gas emissions. At the same time, energy consumption must be reduced by changing consumption patterns and adopting energy saving techniques (Anonymous 2023)

In sustainable urban planning, water management is as complex and critical as energy management. To ensure the health of urban ecosystems, environmental, social, and economic sustainability should be prioritized in sustainable water management. A holistic approach encompassing water supply, distribution, treatment, reuse, and drainage should be adopted.

Strategies that integrate water supply, reuse, and drainage should be developed to meet current needs without compromising future access to clean water. This includes optimizing water use, improving wastewater management, predicting hydro-climatic variability, distributing innovative water management technologies, promoting efficient infrastructure, and increasing resilience to climate impacts. (Salomons et al., 2023)

Another issue threatening urban ecosystems is emissions. Exceeding air quality standards and pollution from ozone, nitrogen dioxide, and particulate matter (PM) pose serious health risks, making this a significant problem in many cities. (Anonymous, 2023) international agreements have been adopted to address these issues threatening cities. In addition, increasing the use of renewable energy, clean fuels, and low-pollution or pollution-free vehicles like electric cars plays a significant role in reducing air pollution. Solutions such as reducing car usage and establishing free public transportation systems support the overall effort. (Jafari et al., 2021).

Urban heat islands and noise pollution are critical urban phenomena. Green vegetation is one of the primary sources of ecosystem services, considering the sustainability of urban areas and human quality of life. To build sustainable cities, the widespread use of energy-efficient devices, increasing urban green spaces, implementing green roofs, walls, and facades in new and existing buildings, greening streets and medians, and creating water-retentive sidewalks significantly mitigate UHI effects and noise pollution. (Yang et al., 2016; Carvalho & Szlafsztein 2018, Irfeey et al., 2023).

4. Conclusion and Suggestions

Urban ecosystems are dynamic structures that rapidly develop and expand in modern societies. The inputs and outputs of these ecosystems profoundly affect not only the local environment but also global environmental balances. This study aims to examine the complexity of inputs and outputs in urban ecosystems, how these processes are shaped by interactions between natural and human-made elements, and the impacts of these interactions on the urban environment.

Urban inputs shape and alter the structure of urban ecosystems. They influence and guide urban functions that affect natural ecological processes, resulting in system outputs. The input portion of urban metabolism includes various tangible materials such as food, water, construction and other materials, products, energy, capital, information, and people. These inputs support social activities and direct urban functions within a city; they create urban stocks such as housing, buildings, infrastructure, and green parks, and produce products, services, as well as managed and unmanaged waste and emissions. Cities require large amounts of energy and resource inputs, which are often processed as linear flows. This situation complicates the sustainable use of resources and creates significant pressures on the urban environment. The output portion consists of industrial products, services, information, and various wastes and emissions. These outputs can lead to environmental degradation at both local and global levels. Particularly, emissions such as carbon dioxide and other greenhouse gases play a significant role in climate change. The scale of the city correlates with the extent of ecological imbalance and the acceleration of biodiversity loss. Urban development fragments natural habitats and pressures local species, leading to a reduction in ecosystem services. Issues such as air pollution, deterioration of water quality, noise, and heat islands adversely affect the quality of life for urban residents.

Suggestions for Urban Ecosystems:

1. **Sustainability of Urban Management:** This factor forms the framework for all other measures. It is essential to adopt a strong, community-focused understanding of sustainability. Balancing inputs and outputs in urban ecosystems is key to a sustainable system. High-quality public spaces and the application of sustainable urban design principles are crucial in this context.

2. **Nature-Based Solutions and Green Infrastructure:** Greener cities mean reduced energy use and improved environmental impact. Practices such as parks, green roofs, vertical gardens, and green corridors contribute to the sustainability of urban ecosystems. Water management also supports the creation of green spaces. Urban ecosystems have a strong relationship with transportation. Nature-based solutions, compact planning, robust public transportation systems, and extensive bicycle and pedestrian pathways offer more effective solutions.

3. **Policy and Planning:** Local governments should adopt innovative approaches, policies, and planning strategies that support the sustainability of urban ecosystems.

4. **Community Awareness and Participation:** Users of cities are the owners of cities. Raising environmental awareness plays a significant role in urban ecosystems. Increasing community awareness and reducing pressure on cities are necessary for contributing to urban life.

Conclusion: Balancing the inputs and outputs of urban ecosystems exerts significant pressure on the sustainability and livability of cities. Minimizing ecosystem inputs and outputs is crucial for creating sustainable citiesInnovative solutions for urban ecosystems should continue to be explored. The findings of the study indicate that the imbalance between resource consumption and waste management in urban ecosystems is a critical issue in terms of sustainability. These findings support the study's objective, which emphasizes the need for developing sustainable management strategies for cities. The results show that strategies such as green infrastructure, energy efficiency, and nature-based solutions are effective in maintaining ecological balance and reducing carbon emissions in urban areas, directly aligning with the goals of the study.

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