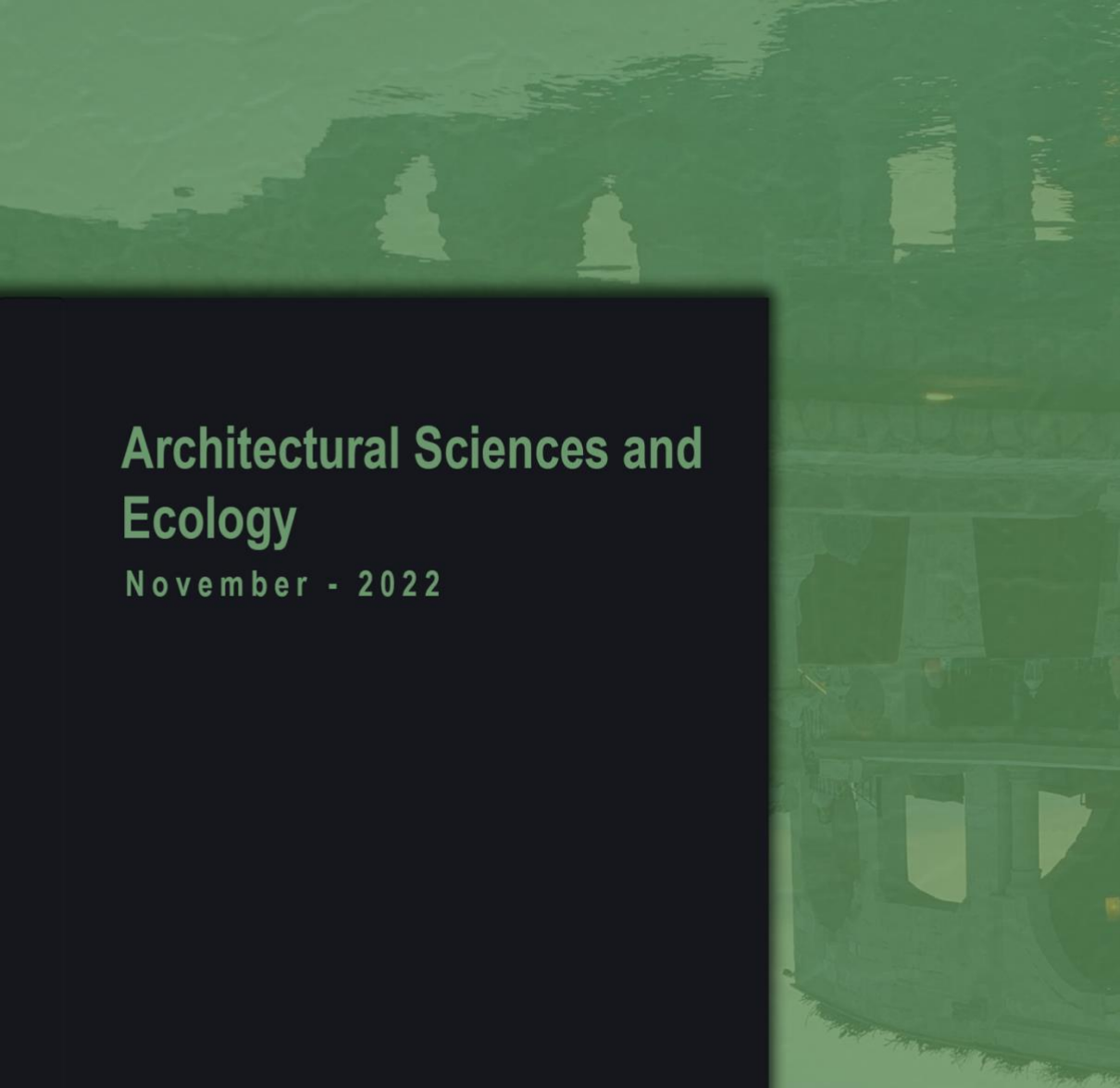


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Assist. Prof. Dr. Mert ÇAKIR

Assist. Prof. Dr. Mahmut TUĞLUER

Dr. Pelin FIRAT ÖRS

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TÜRKİYE: +90 342 606 06 75 USA: +1 631 685 0 853

E mail: iksadyayinevi@gmail.com

www.iksadyayinevi.com

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been published in order to provide an opportunity to share information and ideas among researchers related to **"Architectural Sciences"**.

This book aims to be an important source for discussing the features and challenges of this vision in architecture and ecology. In the **Architectural Sciences and Ecology** book, examples are presented on subjects such as design with nature, ecological and cultural sensitivity, measuring sustainability in architecture, conservation of resources, rehabilitation, sustainable conservation, smart cities, urban landscapes, and plant use in urban landscapes.

Architectural Sciences and Ecology is the sixth volume of the **Architectural Sciences** book series. There are a total of 14 chapters in the book, each authored by a different group of 25 authors. Along with this book, "Architectural Sciences and Spatial Planning", "Architectural Sciences and Spatial Design", "Architectural Sciences and Building Materials", "Architectural Sciences and Urban Agriculture", and "Architectural Sciences and Building & Construction" books were also published.

We are delighted to have accomplished both objectives as JASA editors. These initiatives will continue as long as our objectives are made permanent and information is created and shared.

We would like to express our gratitude to all of the authors, reviewers, IKSAD Publishing House, and Prof. Dr. Atila GÜL, the general coordinator of the architectural sciences book series. We hope that the book will be useful to all disciplines in the field of architectural sciences, as well as scholars and other interested parties.

Regards,

EDITORS
Assist. Prof. Dr. Mert ÇAKIR
Assist. Prof. Dr. Mahmut TUĞLUER
Dr. Pelin FIRAT ÖRS

Plant Material Use in Urban Landscape Design: The Major Problems and Potential Solutions

Prof. Dr. Füsun ERDURAN NEMUTLU [1]

[1]Çanakkale Onsekiz Mart University, Faculty of Architecture and Design, Department of Landscape Architecture, Terzioğlu Campus, Çanakkale/Türkiye.
ORCID: 0000-0002-0104-5994
E-mail: fusunerduran@gmail.com

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1. Introduction

Urban areas are built environments equipped with hard surfaces, isolated from nature, with a growing population increase. Cities, which are shaped by their own natural and cultural resources in each region, offer many public services. Green spaces, which are one of those public services, provide an environment for urban ecosystems and also a ground for a range of social and cultural activities for urban society. Atıl et al. (2005) defined the term 'city' as "a city is a cultural ecosystem consisting of living things living in a certain area and constantly interacting with each other, and their inanimate environments as a whole". Man-made ecosystems in cities can be improved and upgraded thanks to technology. If this variable structure is not well planned, they can cause various problems by sometimes adding additional loads to the natural structure. Because each region has its own unique resources and a design character should be created in accordance with them. Thus, a sustainable and aesthetically pleasing green environment should be designed, constructed, and maintainied in cities for the health of urban dwellers. For this reason, all decisions and applications in the processes of selecting, designing, using and maintaining the plant materials that form make up the green areas require a special topic of interest. Sarı & Karaşah (2018) emphasized that a sustainable relationship between humans and nature should be established to design such an environment in cities. Besides, such an approach can contribute to the aesthetic, functional and

ecologically sustainability of urban landscapes. In fact, the main goal of landscape architecture studies is to regulate the relations between human and nature and to use plant material in functional and aesthetic designs for this purpose (Erduran Nemutlu & Çelik Çanga, 2021). Within this context, one of the major goals of Landscape Architecture profession is to design and ensure a well-balanced relationship between humans and nature by using functionally and aesthetically suitable plant materials and relevant species.

Accordingly, the purpose of this study is to evaluate the major problems implemented in landscape planting design as well as to explore potential solutions.

1.1. Planting Design in Urban Green Spaces

Urban outdoor spaces are spaces open to the use of all ages, genders and occupational groups, where all the activities of public life, unlike private life, continue (Bakan & Konuk, 1987). Green areas, which are an important element of outdoor spaces, form the character of cities, provide a livable environment for urban dwellers, and contribute to the mental and physical health of society (Çelik, 2012a).

Urban green spaces consist of green areas, parks, playgrounds, recreation areas, road trees, public space gardens belonging to public and private institutions, and residential gardens, each of which has different uses (Erduran Nemutlu, 2013).

Basically, widespread, effective and successful plant design throughout the city provides multi-faceted contributions to the citizens

and investors. Every planting is an investment. However, this investment requires time, which is even more valuable, as well as labor and money. Because woody plants, especially trees and shrubs, are generally slow-growing perennials and can achieve the functions expected from them in many years.

The fact that the city has an effective green system and planting design increases the land prices and makes it a center of attraction. Because the city becomes a healthier and more comfortable living space. In addition, the urban area has many different uses and planting design should be made conducted according to the functions of those areas. Just like the functions of a hospital garden and the functions of playing grounds.

1.2. The Major Functions of Plant Materials in Urban Landscapes

Plants improve the environment, protect and support nature (Scarfone, 2007). In urban areas, softening the hard lines of the structural elements, increasing the visual quality and creating a fund are the most important functions (Robinson, 1992). Thus, plants integrate the city with nature and bring it closer to humans. They realize these features only in a certain period of time and give the landscape the fourth dimension, time (Erduran Nemutlu, 2012). At the same time, plants control foot traffic, prepare an environment for different scientific studies and research, create recreational potential, relieve people from the pressures of daily life and create the opportunity to meet with nature (Eroğlu et al., 2005; Çelik & Yazgan, 2007; Karaşah

& Var, 2012; Çelik, 2012b). To be able to fulfill these, they must be well designed. Because the landscape planting designs created function with each other and in combination with inanimate materials according to their usage situations. We can briefly summarize these functions as follows: Plants define the space by strengthening the structural lines of the city and increase the perception of space. They carry the two-dimensional lines on the ground into the third dimension and are effective in the organization of the spaces. Properly made plant designs take on ecological, climatic, engineering, architectural, aesthetic and socio-cultural functions and can maintain this for many years.

1.3. Sustainable Landscape Planting Design

From the point of a landscape designer, we can define sustainability at the urban level as follow: Sustainability is not exceeding the carrying capacity of global ecosystems despite the increase in the quality of life of societies (Oktay, 2001). If we adapt this to the planting design, the desired function and aesthetic appearance with the composition can be obtained in the same way during the maturity period of plants.

Booth (1990) states that the sustainability of a landscape is possible when the use of planting design criteria (harmony and contrast, balance, emphasis, sequence and diversity) are in harmony with each other (Bekçi et al., 2013; Sarı & Karaşah, 2018). According to Çelik Çanga (2021a), the most important in sustainable landscape architecture studies are; to benefit and apply the opportunities offered

by natural plants. These plants, which are part of the natural balance, have very important ecological functions in terms of repairing ecosystems, creating and ensuring the continuity of habitats.

With the provision of sustainable planting design in urban landscapes, the urban ecosystems can be preserved and used in future. The sustainability of cities also increases the life quality of citizes by providing solutions to environmental problems. Thus, it is possible to create livable cities today and in future. For this, interprofessional studies should be carried out, and the human-nature-economy triangle should be established with urban landscape designs (Atıl et. al., 2005).

2. Material and Method

The main materials of the study are the plant materials used in urban landscape architecture designs. As a method, literature review was conducted, and landscape architecture practices in Turkey were examined. The experiences gained in the past years was also used in the study. In addition, the information obtained as a result of the studies related to planting design was brought together and the problems were determined. As a result, it has been suggested to use a report card in which the characteristics of the plants can be compared by making use of visual icons in a chart prepared. With this method, it is aimed to make more accurate plant selection according to the characteristics of each region.

3. Findings and Discussion

Design solves problems, brings innovation and carries aesthetic concern. In this direction, first of all, the functions of planting design are determined. Then, the most suitable composition and the plant species to be used in this composition are determined. It is also very important that the design creates an aesthetic effect.

3.1. Mistakes and Precautions in the Design of Landscape Plants

When it comes to plant design in any region, it is necessary to consider many factors together to determine the correct species to be selected. For this reason, it should not be forgotten that landscape architecture studies should be very comprehensive. Considering that the plant kingdom is very wide, detailed studies should be carried out, knowledge should be acquired and connections should be established with different professional disciplines. In addition, one of the most important problems of today is the creation of the urban green system without complying with scientific data and design principles, and insufficient care is taken in the selection of plant materials. We can briefly list the most common mistakes made in planting design studies as follows:

3.1.1. Lack of individual approach

The first and most important mistake of designers is that they do not design individually for each project and client. According to Starke & Simonds (2013), this problem can be caused by the fact that the landscape designer, who is a professional, has a wide background and

creates a monotonous, mechanical working style over time. However, each project is unique and its character should be different. In fact, the designer also develops himself by learning different things from each project. Which style will be used in herbal design depends on the concept and idea decided to express it with the design. Like the difference between the elegant, subtle plant design of the Porsche Pavilion and the naturalistic plant design of the Royal Bank of Canada's London Wetland Center (Starke & Simonds, 2013).

3.1.2. Ignoring the universal principles of design

The basic design principles; unity (balance, harmony, color, scale and proportion, symmetry-asymmetry, diversity, rhythm, similarity, contrast and emphasis) should not be ignored in herbal design works. If the final version of the design is considered in three dimensions at the beginning, this error will not occur. It is necessary to be inspired by the practices of designers who are successful in the design process, and the preliminary research part should not be neglected. In this direction, first a list of design principles is prepared and plants are added and removed until the most suitable design is obtained. At this stage, the natural vegetation and climatic conditions of the region should also be taken into account. At the same time, plantings made in cities without considering design principles create afforestation areas. It can cause different problems such as the formation of a closed area more than necessary, excessive shade, incompatibility with the structural elements, closing other plants, not being aesthetic,

damaging the infrastructure and culturally invading the new area to be created. In fact, the fact that these areas become neglected and uncontrolled green areas makes it easier for them to turn into areas that can be used for criminal purposes and for bad purposes.

3.1.3. Recon without the design features, size and area ratio of plants

The most important design features of plants are size, form, texture and color. In planting designs, different senses and perceptions can be activated by using a wide variety of plants with different colors, shapes, sizes, textures and scents (Çelik Çanga, 2021b). The size of the plant directly affects the dimensions of a space, the interestingness of the design and the whole skeleton of the design. Size is the most striking feature, as people react to the outward appearance of plants as a first reaction (Booth, 1990; Erduran Nemutlu, 2014). Therefore, roads, boulevards, squares, etc. It is necessary to establish the space-measure relationship well in the vegetative designs of the areas (Var, 1997). The person who observes a successful design in terms of scale freely without getting lost in the space and feels comfortable (Karaşah & Var, 2012).

According to the genetic characteristics of each plant, the design elements are different and have different effects. In addition, the plant type should be selected by taking into account the dimensions of the working area, the emotions and perceptions to be created. Otherwise, the plants will not be perceived well. Of course, the plant species used

in a small private garden and a city park should not be the same. Because if the species that will develop in accordance with the size of the area is not selected, the plants will grow unevenly, cover the area more than necessary, hang over the adjacent structures, and a very closed and dangerous area will be created. In order to prevent this problem, it is necessary to show with drawings how the plants will change and grow from the beginning of the design process to the final state. Hand drawings or different digital programs that make it easier to do this can be used. These images should be prepared according to all seasons, and the texture and color characteristics of the plants should be added to this.

3.1.4. Not having enough command of the characters of the plants

How plants will develop over time and their characteristics should be well known. Because in this way, it can be understood how it will look in the future in the field of design. If the designer knows the following features of the plant well, he/she can make a healthy and aesthetic design that will satisfy the user: What height and crown width it will reach, branch and stem characteristics, when and how long it will flower, leaf and fruits characteristics or important for human health whether there are any harms (Starke & Simonds, 2013). Although this information can be obtained from different publications, in order for the designer to use this information, he or she must observe the plants throughout the year, examine them together with different species and calculate the planting intervals, and follow the

nurseries produced. Because many different compositions can be created from plant species according to their changing images every season. These compositions should be able to fulfill the functions that users need.

3.1.5. Using little or no planting at all by area

A large grass area can be preferred due to its visual effect. However, it should not be forgotten that maintenance is expensive, consumes a lot of water, and requires time and effort. This situation should be explained to users and customers with sufficient convincing and scientific facts and they should be enlightened about the functions of woody plants. Different plants or alternatives can be used as ground covers.

3.1.6. Ignoring the time dimension of design

The biggest mistake of designers is to create short-term solutions. Of course, the design should have an impact at the time it was made. However, the long-term results of the project and its sustainability should be well calculated from the beginning. The best way to achieve this is to give priority to species belonging to families from the region's vegetation cover, which are easily adaptable to the area and require low maintenance. Thus, effective and aesthetically sustainable herbal designs can be obtained for many years.

Landscape plants to be used in open and green areas should make the environment high quality and should have an ecological approach in order to integrate it with the ecosystem (Çelik et al., 2017). In other

words, it should be chosen from the species found in the flora of the region. Because plants that are foreign to the region, which we call exotic species, can be used to add interestingness and effect to designs. However, they should be chosen well and should not take up too much space. Otherwise, they may invade the biodiversity of the region and cause the deterioration of the food sources that the wildlife is accustomed to over time.

3.1.7. Using the same vegetation list for each project

Some experienced designers always use plants they are used to. Sometimes a designer cannot give up any plant like a collector. These practices drag the designer into a vicious circle or reduce the quality of his design. However, plant design is unlimited. It should constantly produce new designs and try to create more attractive compositions. In addition, in the designs to be made, the needs of the citizens, the function of the area and the function and aesthetic of the design plants to be created should be handled one by one and the plant should be selected accordingly.

3.1.8. Ignoring the characteristics of plants according to the seasons

Designers often imagine the design taking into account the period when plants are most effective. However, not all plants bloom at the same time of a year and have different visual effects at different times. What determines the talent of the designer is which plants she/he designs by bringing together and the garden has an aesthetic

appearance in all seasons. This is the important professional perspective that distinguishes a landscape architect from other professional design groups. For this reason, designing alternatives should be created by creating diagrams for each season. Flowers blooming in spring, beginning, middle or end of summer, fruits forming in summer or autumn, colors formed by leaves in autumn, rustling of leaves, evergreen plants in winter or carigraphic effect of branches in winter should be taken into account one by one.

Space design with plants begins with the positioning of trees: Trees, with their trunks and leafy masses, form the main lines and spatial closure of the planting design. Then, small trees, shrubs, climbing-climbers and ground cover plants are included in the design.

3.1.9. Continually and enough failure to take care of plants

Continuous maintenance should be implemented to achive the sustainable landscape design. In order to avoid problems during the maintenance, some precautions should be taken during the landscape planting design. Such as not planting trees too close to structures, paying attention to road elevations and leveling curves when determining the planting point, giving planting intervals in a way that will not prevent pruning, not planting broad-leaved trees too close to conifers. Another precaution is to group the trees with shrubs surrounding their trunks to prevent damage to the trees when mowing the lawn. In addition, in order to organize the plant layers better, a sequence should be made in the form of trees first, then small trees,

shrubs, ground weavers and flowers, and their distances should be taken into account.

3.1.10. Not using the right plants in the right places

Each plant can grow well in different climatic conditions. If the light and humidity conditions required by the plants are suitable, all their genetic characteristics will emerge (flowers, fruits, etc.) and their aesthetic effects will be fully visible. In order not to choose the wrong plant, the ecological conditions of the region should be discovered before hand. In addition, plants can create different effects depending on the nature and function of the place where they are used. For example, if the design used to emphasize the road on both sides in vehicle road vegetation is used in the same way on a park road, which is a walking road, it can narrow the perspective by preventing the wide view of the road's surroundings.

4. Conclusion

While planting design, first of all, the sunshine status of the study area, location of the site, surrounding vegetation, structural elements, climatic data of the region, water possibility should be evaluated well with field studies. In addition to the analysis of these features together, the designer must first know the plants very well and follow the innovations well in order to the plant designs to be accurate and sustainable. Because the diversity in cultural species is very high and new species and varieties are constantly being added. Their characteristics should be examined comparatively in detail, and the

most suitable species should be preferred according to the field studies. Considering the design to be created by combining these genres, it is clear that many combinations will occur. For this reason, morphological features such as leaves, flowers, fruits, stems and their ecological demands should be well known. In order to compare these individual qualities, a report card stated in Figure 1. has been prepared as an example. In this report card, the characteristics of different plants are expressed together, visually, and perception becomes easier. The synthesis of these evaluations constitutes the decision-making process, the most suitable for the purpose and the most effective species can be selected. In addition, the external appearance of the plants, in which the most effective images are reflected, should also be drawn. While these features add quality to the city in terms of aesthetics, they also balance the emptiness of the city. In addition, since it is desired to ensure success in their use with structural elements and to maintain the desired effect for many years, with this report card, the designer can well predict the effect of time, called the fourth dimension, in the designs to be formed. At the same time, the designer must successfully construct the relationship between the elements he uses and the five senses throughout the design process, and design solutions that appeal to all five senses must be created.

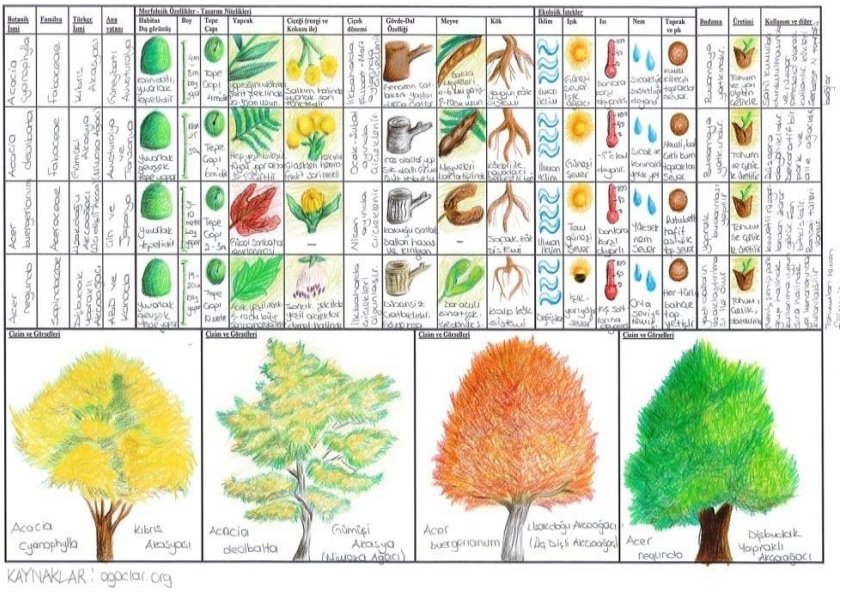


Figure 1. Definition of designing plants

Positioning the plants in different ways in herbal compositions shapes their relations with each other and the resulting design effects. Likewise, different individuals of the same species in the compositions or differences in the size and form characteristics of different species also affect the creation of design principles (Kösa & Aksöğüt, 2020). Kösa (2019) emphasizes that while the provision of plant design principles is possible with the use of only one of the design elements, it can also be achieved by the use of several of them together. Therefore, these should be taken into account as well as plant characteristics.

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Prof. Dr. Füsun ERDURAN NEMUTLU
E-mail: fusunerduran@comu.edu.tr

Educational Status

BSc: Ankara University, Faculty of Agriculture, Department of Landscape Architecture, (1987).

MSc: Ankara University, Faculty of Agriculture, Department of Landscape Architecture, (1992).

PhD: Ankara University, Faculty of Agriculture, Department of Landscape Architecture, (2004).

Professional Experience

Ankara University, Faculty of Science, (1991-2004).

Kocaeli University, Arslanbey, (2004-2006).

Çanakkale Onsekiz Mart University Architect and Design Faculty (2006-…).