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Assoc. Prof.Zuhal ÖZÇETİN

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853 Sokak No:13 P.10 Kemeraltı-Konak/İzmir
Tel: 0 232 484 88 68

www.duvaryayinlari.com
duvarkitabevi@gmail.com

TABLE OF CONTENTS

Chapter 1

Participation Of Non-Local Plants In Biodiversity; Konya Kyoto Japanese Park Example

Büşra ALTAY[1]

INTRODUCTION

Biological diversity is the diversity of living organism species within a certain area. The biological diversity formed by species, genes, ecosystem, and other ecological elements in a region is classified as ecosystem diversity, species diversity, and genetic diversity (Kılınç et al., 2006). Species diversity refers to the number of species present in a region, while genetic diversity refers to the sum of genetic information determined by the genes of the living organism. The ecosystem is the ecological structure formed by interacting with living and non-living things in a defined area. The task of the ecosystem is to shelter living things and prepare a suitable environment for them to sustain their generations. Ecosystems exist in natural areas where biodiversity exists and in artificial regions. Cities are the most important of these regions. Especially the epidemic between 2020-2021, sabotage, and increasing forest fires due to global warming have caused green areas to gain more importance for people looking for an escape environment in the city (Güngör and Erbil, 2021). The urban environment has a dynamic ecological structure that ensures the development of biodiversity. The city ensures the sustainability of its ecosystem and surrounding ecosystems (Yılmaz, and Yalçın, 2017). Cities are generally perceived as places where living things in the ecosystem are driven out of human activities. Biodiversity, which is an important part of natural life, should not be considered separately from the city. Urban parks are important as biodiversity hotspots within cities. They help protect biodiversity in urban areas (Talal, and Santelmann, 2019).

In addition to their role in biodiversity conservation, urban parks are also integral components of green infrastructure in urban areas (Savard et al., 2000). Urban parks can also harbor rare species and help protect important populations of sensitive species.

[1] Arş. Gör. Büşra ALTAY; Selçuk Üniversitesi, Mimarlık ve Tasarım Fakültesi, Peyzaj Mimarlığı Bölümü. busra.altay@selcuk.edu.tr ORCID No: 0000-0001-7895-0450

Including as many elements from the natural environment as possible in these designed areas will also meet people's need to be in touch with nature (Akay and Polat, 2023).

Today, the changing aesthetic understanding of individuals causes them to want to see different landscapes. In the urban environment, green infrastructure system elements such as repair works of deteriorated landscapes or needed parks, recreation areas, and roadside plantings appear as artificial landscapes created by human interventions. This situation has also increased the use of foreign plants.

A general literature review reveals that there is considerable debate about whether the benefits of non-native species used in urban areas outweigh their negative impacts. On the one hand, there is the idea that many non-native species can increase urban biodiversity, while on the other hand, considering the reproductive potential of native plants, it is concluded that their contribution to urban biodiversity is greater.

As the name suggests, Kyoto Japanese Park, which is themed as a Japanese garden in Konya City, includes many Japanese plants. As a result of its design in harmony with Japanese garden arts, it is designed with plants that are compatible or adaptable to the Konya climate, most of which are not frequently encountered. The plants, most of which were imported from Japan, were kept in Kocaeli, which has a warmer and more humid climate, for a year to acclimatize, and then brought to Konya.

The study aims to show that if non-native plants are used in urban parks, which are the most important factor supporting urban biodiversity, it is possible to create areas with high biodiversity and to positively participate in urban biodiversity when the correct selection and acclimatization studies are considered based on micro-ecosystem, habitat, and species diversity.

MATERIAL AND METHOD

Kyoto Japanese Park, which was put into service by Konya Metropolitan Municipality in 2010 and is the largest Japanese Garden in Turkey with an area of 36 thousand square meters, was built to develop brotherhood relations between Konya and Kyoto. It was designed as a sign of the process that started with the declaration of 2003 as the "Turkish Year" in Japan and the declaration of Kyoto City of Japan and Konya as sister cities (Anonymous, 2021).

The park is designed with natural materials and plants, which are the general characteristics of Japanese garden art; teahouse, waterfalls, natural ponds, observation terraces by Japanese architecture, camellias, wooden bridges, rock and zen gardens, main entrance arch, stone lanterns and walls were used. In addition to its structural character, it draws attention to its Japanese plants that are suitable for the climate of Konya City or partially or completely adapted to the conditions with acclimatization studies. The plants that reveal the seasonal silhouette of Japanese gardens consist of certain species (Polat, Güngör and Kaklık, 2010). The park is home to 60 genera, 85 different species, and 6317 plants in total, most of which are imported from Japan.

Figure. Kyoto Japanese Park, Konya (Original,2023)

Biodiversity is divided into species diversity, taxonomic diversity, functional diversity, structural diversity, and genetic diversity. Within all these subjects of biodiversity, diversity is calculated at alpha (intra-unit), beta (inter-unit), and gamma (total) levels. Many formulas, entropy equations, and indices are used in biodiversity calculation (Anonymous, 2019).

If species diversity is calculated for each part of the ecosystem (on a sample area basis), this is called alpha diversity. In other words, if the number of species found in a single habitat is determined locally, this is referred to as "alpha diversity" (Gülsoy and Özkan, 2008).

There are many index used in determining alpha species diversity. Some of these indices such as Shannon Wiener, Simpsons D, Margelef D, Berger-Parker Dominance, McIntosh D, Brilouin D, Fisher's Alpha, and Q Statistic are widely used in determining alpha diversity.

Among them, the Shannon diversity index is much more widely used in environmental studies to express species diversity in an area (Heip and Engels, 1977). Shannon's index was also used to calculate the species diversity of Kyoto

Japanese Park. Considering the data on species diversity, the Shannon diversity index was calculated with the Excel software of the Microsoft Office 2019 program.

This index measures the uniformity of all species present in the sample. So, when there is only one species, the value of the index is zero. The H' value usually ranges between 1,5-3,5 rarely exceeding 4.

$$H' = -\sum p_i \ln(p_i)$$

$$p_i = N_i / N$$

pi: the proportion of the i-th species relative to the others
Ni: number of individuals of species a
N: Total individuals
ln: Denotes the base of natural logarithm (Gülsoy and Özkan, 2008).

RESEARCH FINDINGS AND DISCUSSION

Table 1: Table Kyoto Japanese Park species, number, and Shennon diversity index calculations

	SPECIES	NUMBER OF INDIVIDUAL	pi	ln(pi)	pi*ln(pi)	-1*(pi*ln(pi))
1	*Abelia sp.*	30	0,0047	-5,3498	-0,0254	0,0254
2	*Abies concolor*	17	0,0027	-5,9178	-0,0159	0,0159
3	*Abies procera "Glauca"*	10	0,0016	-6,4484	-0,0102	0,0102
4	*Acer negundo*	5	0,0008	-7,1416	-0,0057	0,0057
5	*Acer palmatum "Atropurpureum"*	25	0,0040	-5,5321	-0,0219	0,0219
6	*Acer palmatum "Dis. Atropurpureum"*	48	0,0076	-4,8798	-0,0371	0,0371
7	*Acer platanoides "Crimson king"*	21	0,0033	-5,7065	-0,0190	0,0190

8	*Acer platanoides "globosum"*	45	0,0071	-4,9443	-0,0352	0,0352
9	*Acer rubrum "Schlesingeri"*	25	0,0040	-5,5321	-0,0219	0,0219
10	*Aesculus hipocastanum*	15	0,0024	-6,0429	-0,0143	0,0143
11	*Albizia julibrissin*	6	0,0009	-6,9592	-0,0066	0,0066
12	*Bambusa Aurea*	35	0,0055	-5,1957	-0,0288	0,0288
13	*Berberis thunbergii "Atropurpurea"*	1444	0,2286	-1,4758	-0,3374	0,3374
14	*Betula alba*	6	0,0009	-6,9592	-0,0066	0,0066
15	*Betula pendula "Yongii"*	15	0,0024	-6,0429	-0,0143	0,0143
16	*Buddleia davidii "Nanho blue"*	100	0,0158	-4,1458	-0,0656	0,0656
17	*Buxus sempervirens "Suffruticosa"*	130	0,0206	-3,8835	-0,0799	0,0799
18	*Carpinus betulus*	9	0,0014	-6,5538	-0,0093	0,0093
19	*Catalpa bungei*	10	0,0016	-6,4484	-0,0102	0,0102
20	*Cedrus atlantica "Glauca pendula"*	7	0,0011	-6,8051	-0,0075	0,0075
21	*Cedrus atlantica "Glauca"*	20	0,0032	-5,7553	-0,0182	0,0182
22	*Cedrus dedora "Aurea alberetto"*	8	0,0013	-6,6716	-0,0084	0,0084
23	*Cedrus deodora Pendula*	2	0,0003	-8,0579	-0,0026	0,0026
2425	*Cedrus deodora "Aurea"*	2	0,0003	-8,0579	-0,0026	0,0026
26	*Celtis australis*	15	0,0024	-6,0429	-0,0143	0,0143
27	*Cercis siliquastrum*	25	0,0040	-5,5321	-0,0219	0,0219
28	*Chaenomeles superba*	72	0,0114	-4,4743	-0,0510	0,0510
29	*Cornus alba "Sibirica"*	75	0,0119	-4,4335	-0,0526	0,0526
30	*Cotinus coggyria "Royal purple"*	120	0,0190	-3,9635	-0,0753	0,0753

31	*Cupressus arizonica "Conica glauca"*	31	0,0049	-5,3170	-0,0261	0,0261
32	*Craetegus oxycontha "Coccinea plena"*	15	0,0024	-6,0429	-0,0143	0,0143
33	*Cupressusparis Leylandi*	14	0,0022	-6,1119	-0,0135	0,0135
34	*Daphne cneorum*	10	0,0016	-6,4484	-0,0102	0,0102
35	*Elaeagnus pungens 'Aurea'*	10	0,0016	-6,4484	-0,0102	0,0102
36	*Euonymus alatus*	33	0,0052	-5,2545	-0,0274	0,0274
37	*Euonymus fortunei "Emerald'n gold"*	200	0,0317	-3,4527	-0,1093	0,1093
38	*Fagus sylvatica "Purpurea pendula"*	4	0,0006	-7,3647	-0,0047	0,0047
39	*Forsythia xintermedia "Spring glory"*	95	0,0150	-4,1971	-0,0631	0,0631
40	*Fraxinus excelsior*	9	0,0014	-6,5538	-0,0093	0,0093
41	*Ginko biloba*	20	0,0032	-5,7553	-0,0182	0,0182
42	*Gleditsia triacanthos 'Sunburst'*	53	0,0084	-4,7807	-0,0401	0,0401
43	*Hedera helix*	90	0,0142	-4,2512	-0,0606	0,0606
44	*Hibiscus syracus*	144	0,0228	-3,7812	-0,0862	0,0862
45	*Ilex aquifolium Albererto*	10	0,0016	-6,4484	-0,0102	0,0102
46	*Juniperus alberetto*	15	0,0024	-6,0429	-0,0143	0,0143
47	*Juniperus media "Oldgold"*	1100	0,1741	-1,7479	-0,3044	0,3044
48	*Juniperus media "Pfitzeriana glauca"*	145	0,0230	-3,7743	-0,0866	0,0866
49	*Koelteria Peniculata*	20	0,0032	-5,7553	-0,0182	0,0182

50	*Ligustrum japonica*	500	0,0792	-2,5364	-0,2008	0,2008
51	*Mahonia japonica*	20	0,0032	-5,7553	-0,0182	0,0182
52	*Magnolia grandiflora*	3	0,0005	-7,6524	-0,0036	0,0036
53	*Malus purpurea*	20	0,0032	-5,7553	-0,0182	0,0182
54	*Morus alba apalla*	7	0,0011	-6,8051	-0,0075	0,0075
55	*Morus alba pendula*	3	0,0005	-7,6524	-0,0036	0,0036
56	*Nandia domestica*	20	0,0032	-5,7553	-0,0182	0,0182
57	*Paeonia arborea*	50	0,0079	-4,8390	-0,0383	0,0383
58	*Photinia fraseri "Red robin"*	65	0,0103	-4,5766	-0,0471	0,0471
59	*Picea engelmanni "Glauca"*	10	0,0016	-6,4484	-0,0102	0,0102
60	*Picea abies "Nidiformis"*	25	0,0040	-5,5321	-0,0219	0,0219
61	*Picea glauca "Conica"*	22	0,0035	-5,6600	-0,0197	0,0197
62	*Picea pungens "Glauca globosa"*	10	0,0016	-6,4484	-0,0102	0,0102
63	*Picea pungens globosa "Alberetto"*	30	0,0047	-5,3498	-0,0254	0,0254
64	*Pinus mugo "Mops"*	21	0,0033	-5,7065	-0,0190	0,0190
65	*Pinus exelsa*	50	0,0079	-4,8390	-0,0383	0,0383
66	*Pinus nigra pallasiana var."Pyramidata"*	6	0,0009	-6,9592	-0,0066	0,0066
67	*Prunus cerarifera "Pissardi nigra"*	61	0,0097	-4,6401	-0,0448	0,0448
68	*Prunus cerulata "Kiku Shidera Pendula"*	5	0,0008	-7,1416	-0,0057	0,0057
69	*Prunus cerulata*	63	0,0100	-4,6079	-0,0460	0,0460
70	*Pyracantha coccinea*	25	0,0040	-5,5321	-0,0219	0,0219
71	*Quercus rubra*	18	0,0028	-5,8606	-0,0167	0,0167

72	*Rhus typhina "Laciniata"*	50	0,0079	-4,8390	-0,0383	0,0383
73	*Robinia pseudoacacia*	4	0,0006	-7,3647	-0,0047	0,0047
74	*Rosa spp.*	500	0,0792	-2,5364	-0,2008	0,2008
75	*Salix babylonica*	5	0,0008	-7,1416	-0,0057	0,0057
76	*Salix coprea pendula*	5	0,0008	-7,1416	-0,0057	0,0057
77	*Salix tirisdis*	14	0,0022	-6,1119	-0,0135	0,0135
78	*Saxifraga longifalia*	100	0,0158	-4,1458	-0,0656	0,0656
79	*Sophora japonica - japon sofarası*	5	0,0008	-7,1416	-0,0057	0,0057
80	*Spirea bumalda "Anthy waterer"*	120	0,0190	-3,9635	-0,0753	0,0753
81	*Syringa vulgaris*	30	0,0047	-5,3498	-0,0254	0,0254
82	*Taxus baccata "Elegantissima"*	40	0,0063	-5,0621	-0,0321	0,0321
83	*Taxus baccata "Fastigiata aurea"*	10	0,0016	-6,4484	-0,0102	0,0102
84	*Thuja orienatalis "Compacta nana aurea"*	15	0,0024	-6,0429	-0,0143	0,0143
85	*Tilia tomentosa*	15	0,0024	-6,0429	-0,0143	0,0143
86	*Wisteria chinensis*	10	0,0016	-6,4484	-0,0102	0,0102
	Total: 6317			**Shannon İndex: 3,1107**		

The fact that the value above 4, which is usually measured between 1,5-3,5 is not seen much above 4, is above 2,5 indicates that the species diversity of the measured area is partially rich.

In the plant inventory study conducted in the park, 60 genera, 85 different species, and 6317 plants in total were observed. The Shannon index value, which aims to measure species richness based on species diversity, was found to be 3,1107 as a result of calculations. Based on this value, it is concluded that Kyoto Japanese Park is in very good condition in terms of species richness, and in this respect, it is an element of green infrastructure that supports urban biodiversity.

CONCLUSION

As a result of rapid urbanization, the areas under pressure from human activities are increasing day by day, but urban areas that host innovative ways of protecting and promoting biodiversity have become more and more accepted and obligatory. Due to their ecological conditions and plant diversity, parks, which are designed habitats in a wide variety of urban green space types that are sustainable, easy to implement, and worthy of protection with effective status, constitute the most important points that support and encourage biodiversity in the city.

Empirical findings on species richness in urban parks consistently show that parks are among the most species-rich urban green spaces for all species groups examined, with exotic species accounting for a particularly large share of plant species (Nielsen et al., 2014).

In any case, if the objective is to increase biodiversity in a given area, it is important to understand and define this objective and plan the work that needs to be done to meet it. It is important to recognize that concerted efforts at various scales that produce the best results.

Designed green spaces have some biodiversity value, but it should not be overlooked that in many cases it is possible to create high-level opportunities through the species chosen and the way the plantation is managed.

It is important to manage non-native species outside of their traditional ways of promoting wildlife in urban ecosystems. Staying sustainable requires rethinking our maintenance approach. Sustainable strategies for the integration of the non-native plant should be developed in terms of management and the most appropriate maintenance technique.

Starting with slow and incremental changes and moving forward with sure steps can be seen as an effective way to achieve a longer-term and bigger change and to identify new and different management development skills and ways of experimenting.

The invasion of non-native species in urban areas causes problems for many reasons. Invasive species can negatively affect the ecosystem services that people depend on, or they can be a waste of money and labor in areas where adaptation and management are not properly planned. On the other hand, many non-native species that are adapted to the climate or for which adaptation efforts have been successfully planned can improve the diversity of the region, provide nectar for animals due to the different flowering periods and timing with native plants, and improve the quality of ecosystem services. It is important to be willing to seize the opportunities to be gained along the way.

In this context, Kyoto Japanese Park can be shown as one of the successful examples for local governments to protect and enhance urban biodiversity and create similar green infrastructure components.

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Chapter 2

Evaluation Of Mevlâna Square Arrangement In Terms Of Users

Büşra ALTAY[1]
Zekeriya Can ERBİL[2]

INTRODUCTION

Historical buildings, monumental structures and their surroundings and squares have developed under different opportunities and conditions in interaction with the social, cultural and economic characteristics of the period and people's lifestyles from past to present. In recent years, reasons such as the increase in urban population due to increased migration from villages to cities, the pace of urbanization, and changing needs create the need for restoration and renewal in historically important areas.

In the renewal and re-evaluation of historical environments, they should be considered as living areas and conservation and use policies should be adopted. These policies should serve the purpose of keeping the historical environment alive and providing it with new functions (Arabacıoğlu and Aydemir 2007).

When the issues of revitalization, renewal and re-evaluation of historical environments and squares are examined, it is generally seen that the perceptibility, readability, ability to host different recreational activities and adaptation to the city are addressed.

In December 2012, Konya Metropolitan Municipality organized Mevlana Square within the scope of the 'Mevlana Culture Valley Urban Transformation and Development Project' on an area of 3,950,000 m². The project was carried out with the aim of creating new living and tourism zones that are safe, healthy, livable and integrated with the city by designing historical and touristic places, renewing the region and giving it a new identity (Anonymous 2016).

[1] Arş. Gör. Büşra ALTAY; Selçuk Üniversitesi, Mimarlık ve Tasarım Fakültesi, Peyzaj Mimarlığı Bölümü. busra.altay@selcuk.edu.tr ORCID No: 0000-0001-7895-0450
[2] Arş. Gör. Zekeriya Can ERBİL; Selçuk Üniversitesi, Mimarlık ve Tasarım Fakültesi, Peyzaj Mimarlığı Bölümü. can.erbil@selcuk.edu.tr ORCID No: 0000-0001-5830-5366

While the museum area was 6,500 m² with its garden, it reached 20,000 m² with the areas expropriated to enlarge the area and the sections organized as Rose Garden (Anonymous 2019).

It has been observed that the radical changes that took place in the newspapers and magazines in the square for a long time caused some discussions by private and legal persons.

In the study; Mevlana Square arrangement was evaluated from the perspective of the users, taking into account the historical landscaping criteria. It is aimed to be an example for the emergence of more successful designs by ensuring the active participation of the public in accordance with the wishes and needs of the users, as well as the new visual and functional features planned in similar renovation, re-evaluation and restoration works.

1. Mevlana Square and Arrangement Works

Mevlana Square; It is located in Konya city center, approximately 1 km from Alaaddin Hill, opposite Üçler Cemetery. It is originally the rose garden of the Seljuk Sultan. It covers a total area of 20,000 m², organized as the Sultan Selim Mosque, Yusuf Ağa Library and the Rose Garden, with the museum section containing the tombs of Mevlana Celaleddin Rumi, his family members, his descendants and those who devoted themselves to Mevlevi. The square serves the museum, which has been operating since 1926 (Anonymous 2020).

Mevlana Museum is the second most visited place in Turkey after Topkapı Palace. For this reason, it is aimed to build a square where 30-35 thousand people, mostly for tourism and worship purposes, can be present at the same time. Started by Konya Metropolitan Municipality in December 2012; In order to renew the region and give it a new identity, Mevlana Square arrangement, renovation and facade restoration works were carried out within the scope of the 'Mevlana Culture Valley' project.

The decisions taken for a larger area on the scale of the historical city center have greatly affected the square, especially in terms of transportation and pedestrianization. Mevlana Street, which connects Alaaddin Hill, the center of the city, and Mevlana Square, Museum, Martyrdom and Mevlana Cultural Center, with heavy vehicle traffic, has been supported by a tram line to increase accessibility.

Authorities expressed the aims of the reorganization of the square as follows;

• To obtain a view appropriate to the city with the historical building,

• To highlight the historical texture by ensuring that the Tomb and the Mosque can be seen easily,

• To facilitate pedestrian movements,

• Regulating vehicle traffic,

• To give the area a modern appearance,

• Ensuring square and road integrity,

• To create space for prayer on special days and nights such as Eid and Kandil, when the mosque is not enough,

• To provide a basis for activities such as exhibitions and gatherings.

To the west is the Mevlana Museum, to the south is the Selimiye Mosque and Yusuf Ağa Library, and to the square-shaped square with east and north facades facing the road; Qualities such as the shape and texture of the surfaces of the limiting structures, the square lighting, the equipment elements in the square, the formality of the square, the existing green texture in the square, the plants used and the users who benefit from the square are the elements that contribute to the landscape of the square (Gültekin, 1996).

If the current situation of the square is evaluated;

• The square design is quite simple, symmetrical, uniform and formal. This formality is also seen in the flooring (Figure 1).

Figure 1: General View of the Square (Original)

• Approximately 50 benches were placed in the square.

• There are no natural or artificial shade areas in the square where people can sit and rest. For this reason, people sit on the outer walls of Sultan Selim Mosque.

• There is a green area of approximately 150 m^2 in total.

• During the work carried out, the originality of the existing fountain in the area was preserved and its location was changed.

• No water surface was used in the square.

• Flower pots were preferred on the lighting elements, and 26 garbage bins were preferred next to the benches.

• There are approximately 33 simple designed, very high lighting elements in the square.

• The Green Dome and other domes, illuminated in different colors with the 'Mevlana Museum Lighting' project implemented on the occasion of the 2014 Şeb-i Arus ceremonies, contributed aesthetically to the night view of the square.

• There are no directional signs in or outside the square to direct people to the place and to indicate the entrances and exits of museums and mosques.

MATERIAL AND METHOD

In the study, the opinions of 158 female and 113 male users about the reorganization of Mevlana Square were taken, analyzed and evaluated. In this subject, the criteria of perceptibility, visibility of historical buildings, recreational activity, adaptation to the city, adequacy of shadow elements and adequacy of equipment elements determined within the scope of historical environment and square regulation principles are discussed. The number of surveys in the study was determined as 271, with a 5% type I error (α) and a 90% confidence interval, based on a population determined as 2,000,000 with the help of Neyman's non-refundable sampling width determination formula. The survey was administered face-to-face and online. Neyman non-refundable sampling width formula (Yamane 2001);

$$n = \frac{NZ^2 + pq}{Nd^2 + Z^2pq}$$

n: Number of samples

N: Population number

Z: Value from standard normal distribution d: Probability of making a type I error (α)

In terms of comparing and evaluating the old and new version of Mevlana Square in terms of the determined historical environment and square arrangement criteria, it was determined with the help of two ratio Z tests whether there was a difference between the obtained ratios. The independence check between gender and the criteria in question was made with the Chi-square (χ2) test. SPSS 18.0 (SPPS Inc, Chicago, IL, USA) statistical package program was used in the statistical analysis to determine the effect of application issues on the examined features in the study. Statistical analyzes were evaluated at 1% significance level and 99% confidence interval.

RESEARCH FINDINGS AND DISCUSSION

Table 1: Evaluation of user opinions on the reorganization of Mevlana Square

Criteria	Evaluation according to the old	Number (n)	Rate (p)	Difference ($\bar{p}_1 - \bar{p}_2$)	Z Test	P Value
Detectability	Good	188	0,693727	0,387454	9,78	**<0,000***
	Bad	83	0,306273			
Visibility of Historical Buildings	Good	247	0,911439	0,822878	33,71	**<0,000***
	Bad	24	0,088561			
Recreational Activity	Good	192	0,708487	0,442804	11,50	**<0,000***
	Bad	79	0,291513			
Adaptation to the City	Good	154	0,568266	0,136531	3,21	**<0,001***
	Bad	117	0,431734			
Adequacy of Shadow Elements	İyi	12	0,044280	-0,911439	-51,57	**<0,000***
	Kötü	259	0,955720			
Sufficiency of Reinforcement Elements	İyi	103	0,380074	-0,239852	-5,75	**<0,000***
	Kötü	168	0,619926			

(*P<0.01; The difference between the rates in terms of all characteristics considered is statistically significant at the 1% significance level)

The users found the new arrangement proportionally positive in terms of perceptibility (69.3% good, 30.6% bad), visibility of historical buildings (91.1% good, 8.8% bad), recreational activity (70.8% good, 29.2% bad) and harmony with the city (56.8% good, 43.2% bad) (Table 1).

If the user opinions on the square arrangement are interpreted with the observations made;

As a result of the Mevlana Square arrangement, the opinions of the regular users of the square and those who used it before the arrangement differ regarding the changes made in the square.

Some of the users described the removal of approximately 20 old trees that were integrated with the museum as leaving the square bare. In addition, they argue that historical monuments are beautiful with these green areas and trees. One of the biggest problems stated by users is that there is no shade area left in the square due to the removal of trees. In addition, this study aims to make historical monuments easily visible from afar, which is a rule of urbanism; The answer is that the places seen from a long distance spoil the surprise of the areas and structures encountered after some obstacles and lose the effect and attractiveness of the area. It is also among the opinions that the new arrangement is a plain, identityless work that loses the spirit of the square.

Some users; They argue that the square has gained a modern appearance with the new arrangement. They described the old version as a closed, low space that did not fully reflect the historical texture of the museum, mosque and library, which were the boundaries of the square. They were of the opinion that a more aesthetic arrangement was made in accordance with the purpose of the square and the identity of the historical texture.

Table 2: Determination of the relationship between the criteria considered in the evaluation and the gender of the users

Criteria	**Evaluation according to the old**	**Female**			**Male**			**Contingency Coefficient**	**χ^2**	**P Value**
		Number (N)	Percentage (%)	Expected value	Number (N)	Percentage (%)	Expected value			
Detectability	İyi	98	36,2	109,6	90	33,2	78,4	**0,185***	9,628	0,002
	Kötü	60	22,1	48,4	23	8,5	34,6			
Visibility of Historical Buildings	İyi	144	53,1	144,0	103	38,0	103,0	0,002	0,000	0,997
	Kötü	14	5,2	14,0	10	3,7	10,0			
Recreational Activity	İyi	113	41,7	111,9	79	29,2	80,1	0,017	0,082	0,774
	Kötü	45	16,6	46,1	34	12,5	32,9			
Adaptation	İyi	10	39,	89,8	46	17,	64,2	**0,265**	20,52	<0,00

to the City		8	9			0		*	5	0
	Kötü	50	18,5	68,2	67	24,7	48,8			
Adequacy of Shadow Elements	İyi	5	1,8	7,0	7	2,6	5,0	0,072	1,429	0,232
	Kötü	153	56,5	151,0	106	39,1	108,0			
Sufficiency of Reinforcement Elements	İyi	58	21,4	60,1	45	16,6	42,9	0,032	0,271	0,603
	Kötü	100	36,9	97,9	68	25,1	70,1			

(*P<0.05; Contingency coefficients are statistically significant at the 5% significance level)

The relationship between gender and the characteristics analyzed in the reorganization of Mevlana Square is given in Table 2. It was observed that the evaluation of perceptibility and urban adaptation criteria was related to gender (P <0.01). The dependency coefficients of the categorical variables perceptibility, urban adaptation and gender were 0.185 and 0.265, respectively, and were found to be statistically significant (P<0.01). Visibility of historical buildings, recreational activity, adequacy of shade elements, adequacy of equipment elements and gender categorical variables are independent of each other (P>0.01). The dependency coefficients of these features were determined to be quite low and statistically insignificant (P>0.01). In short; It was concluded that the evaluation of these criteria had no relationship with gender. In other words, there is no distinction made between these characteristics in terms of gender.

The results of the analyzes conducted in our current study appear to be generally positive. According to the study carried out by Altay 2019 on 4 large squares in Konya City, Mevlana Square; It can also be supported by the conclusion that it is the most preferred square by the users with a large rate of 60% in terms of visuality, 57.3% in functionality, 52.9% in accessibility, and 58.68% in general, compared to the other squares evaluated.

CONCLUSION

In the study; The sample size was found with the help of Neyman's non-refundable sample width determination formula. 271 in-person and online surveys were applied. In the survey conducted for the square users, the gender characteristics of the participants were also included. The purpose of this is to investigate whether the evaluation of these criteria is related to gender. Scope of research; It has created 6 parameters: perceptibility, recreational activity, visibility of historical buildings, adaptation to the city, adequacy of reinforcement elements, adequacy of shadow elements.

If we look at the results of the analysis in general terms; It is observed that users find the perceptibility, recreational activity, visibility of historical buildings, and adaptation to the city better than the old version of the square, but they find it worse in terms of the adequacy of the reinforcement elements and the adequacy of the shadow elements. Moreover; It is seen that the evaluation of perceptibility and urban adaptation criteria is related to gender, and the visibility of historical buildings, recreational activity, adequacy of shade elements and adequacy of equipment elements and gender variables are independent of each other.

Squares and areas of historical importance have been places where many civilizations have gathered and hosted various events over the years. These areas, which are a kind of focal point of social and cultural life, seem to have a great place and importance in society. However, such areas need to be well designed, renewed and managed in order to give the city an identity and increase spatial quality.

Squares; Historical environmental design and revision of existing areas should be carried out in the light of legal obligations and based on the opinions and demands of users in line with their needs, paying attention to the protection of cultural heritage, considering harmony with the environment, taking into account functionality, and with the coordinated work of various professional groups.

Squares and common areas should satisfy users visually, culturally and socially. Designs should be made in accordance with the intended use, historical characteristics and environment.

Local governments should not forget to ensure the participation of area users in the planning, design, restoration, renewal, re-evaluation and management stages of such areas. The study will also support similar scientific studies to be carried out in common areas with various features.

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Chapter 3

Green Roofs for Sustainable Cities

Elif Ebru ŞİŞMAN[1]
Burçin EKİCİ[2]

INTRODUCTION

The concept of sustainability refers to ensuring the balance between humans and nature and transferring living spaces to future generations without being damaged or destroyed. Green infrastructure systems, which contribute to the formation of sustainable cities, help reveal ecological designs.

Green infrastructure is a term that has its roots in planning and conservation efforts that began one hundred and fifty years ago. There are two important concepts on which green infrastructure is based. These; connecting parks with green areas and protecting and connecting natural areas by preventing the fragmentation of natural areas. (Benedict and McMahon, 2001; McMahon, 2000).

Green texture is important to reduce the heat island effect in urban areas and for urban residents to live in a healthier environment. (Lazzarin, et al. 2005; Velazquez, 2005, Ekşi ve Uzun, 2014).

Green infrastructure systems used in cities; they are listed as, rain garden, bio rain ditches, permeable surfaces, green streets, rainwater tree pits, cellular suspended pavement systems and green roofs.

It generally includes a cultural landscape carried out above the ground level, in other words, planting and arrangement works applied on the roof. Gardens created in this way are called roof garden.

"Ecological roofs" or "green roofs", which provide aesthetic and ecological benefits, are a concept used to adapt buildings to the environment. These structures, which are especially popular in Germany, have been used in the USA in recent years. Today, there are hundreds of green roof applications in Germany (Velazquez, 2005; Ekşi ve Uzun, 2014).

[1] Prof.Dr.; Tekirdağ Namık Kemal University Faculty of Fine Arts, Design and Architecture Department of Landscape Architecture. esisman@nku.edu.tr ORCID No:0000-0002-5114-7980
[2] Doç.Dr.: Tekirdağ Namık Kemal University Faculty of Fine Arts, Design and Architecture Department of Landscape Architecture. bekici @nku.edu.tr ORCID No: 0000-0002-2553-5656

These systems, which are named differently in the literature such as "roof garden", "green roof", "ecological roof", "vegetated roof", "grass roof", "living roofs", "eco roof", "sustainable roof", "sky roof", rooftop garden" actually define similar concepts. However, their intended use, structural layers and planting characteristics reveal some differences.

Due to the decreasing number of green areas in cities day by day, green roofs have started to gain more importance.

Green roofs, which have been widely used in northern countries for many years to protect from the cold, have developed with the idea of keeping the areas covered with soil or plants lost due to construction on buildings. This understanding overlaps with the concepts of ecological structures or ecological architecture.

The most used green roof system in our country and in the world is the system applied to terrace roofs with a 1% slope, has a shallow growing environment, and is planted with species that can adapt to drought and variable climate conditions on the roof. The most preferred plants on green roofs in the world are Sedum, which belongs to the Crassulaceae family.

HISTORY OF GREEN ROOFS

The first roof garden idea dates back to B.C. It emerged from the great ziggurat and temples of Ur, one of the ancient Sumerian cities founded in 2000 and known today as Iraq. These artificial hills, called "Ziggurat Form" in Mesopotamia, are a form developed by the Sumerians, who prayed on high hills in Central Asia, in the plain Mesopotamia. The idea of hanging gardens essentially developed from this Ziggurat form (Sarkowicz, trans.1998; Magill et al. 2011).

According to Osmundson (1999); The real terrace garden is the Hanging Gardens of Babylon, known today as the seventh wonder of the world, consisting of 7 levels, built by King Nebuchaddnezzar for his wife Semiramis in his capital, 1500 years later. This garden was established in a place overlooking the view, many plants were used on each terrace and the water was carried upwards and distributed to the terraces from the top point.

Roof gardens appeared later in the Renaissance and Greece. The Greeks were the first to use plants on terraces in different pots and crates. Later, in the Renaissance, in Rome and Florence, the Medici family had roof gardens built in their villas, although not in the modern sense. In 1400, a roof garden was built at the Villa Medici at Careggi in Florence.

A world exhibition was opened in Paris in 1867 and there were important developments in the design of roof gardens. A producer named Carl Rabbitz exhibited a plaster model of the roof garden he envisioned for his house in Berlin on this occasion, and it created a great impact all over the world. Additionally, the same person attracted attention by publishing a brochure called Modern Hanging Gardens.

In France, Le Corbusier (Charles-Édouard Jeanneret) pioneered roof and terrace gardens. In 1922, Corbusier developed a green city design that brought the garden into residences. Thus, the roof garden became one of the issues that he took seriously throughout his life. He first implemented these ideas in the La Roche villa, but this work did not satisfy him and he described the villa as "the easiest one" (Ercan, 1992; Ekşi, 2006) (Figure 1).

Figure 1 : Masion La Roche (Le Corbusier)(URL 1)

It becomes clear that the Stein villa in Garches is not enough for him. He found a solution to the problem in the Savoye villa in Poissy (Figure 2). By elevating the entire structure on carrier legs (pilots), both the best use of the view and the best aesthetic solution to the problem were provided. Thus, he finally succeeded in placing a plan that follows the natural movements of people within an architectural framework formed by a square or walls. Apart from the La Roche, Stein and Savoye villas, Le Corbusier also applied roof and terrace gardens in the Cook House, the Duval Factory in Sainte-Die, the Swiss Pavilion in Paris, and the Le Corbusier Center in Zurich.

Figure 2 : Villa Savoye (Le Corbusier)(URL 2)

The true pioneer of roof gardens was Frank Lloyd Wright. Its modern balcony lines, softened by hugging plants, have become the most fashionable motif of modern designs.

The roof garden, built in 1959 by the Kaizer Institute in Oakland, California, was created on the flat roof of a multi-storey garage and store complex, six floors above the street, for both visual and recreational purposes for employees (Figure 3). Since the roof garden is intended to have the appearance of a park with a non-architectural and informal structure, free forms were generally used (Tunbiş, 1987).

Figure 3: Kaiser Roof Garden (URL 3)

ADVANTAGES OF ROOF GARDENS

The multifaceted and interrelated different functions of roof planting occur in different ways depending on the region where the application is made and the characteristics of the building. In general, the functions of roof gardens and roof planting are;

Environmental Benefits

• *Protecting habitat and biodiversity*: Green roofs increase urban biodiversity and can also provide habitat for birds, insects, native plants and rare or endangered species. Green roofs studied across Europe were found to be ecologically rich with abundant insects, birds, wildlife and plants. Findings vary between countries, but generally include visitation and shelter of butterflies, birds, spiders and other macroinvertebrates, as well as some endangered plant species (Johnston & Newton, 1993; Dvorak and Volder 2010).

• *Stormwater management*: They provide a partially natural water cycle in cities by capturing stormwater. Green roofs are effective in reducing the pressure on infrastructure by reducing the runoff and volume of stormwater. Research has clearly shown that roof gardens replace the normally impermeable roof surface with a permeable substrate, which effectively delays peak runoff and reduces the rate and volume of runoff (Lui, 2002).

• *Air quality improvement;* Due to the filter effect of plant layers, they contribute to the cleaning of the air by retaining harmful particles and gaseous substances. They adjust the balance of O_2 and CO_2 (Johnston & Newton, 1993).

• *Water quality improvement*; Green roofs filter toxins such as nitrogen and phosphorus, preventing them from passing into streams and waterways. Heavy metals and nutrients in rainwater are retained by green roofs. Green roofs can remove more than 95 percent of cadmium, copper and lead and 16 percent of zinc from rainwater. They can also significantly reduce nitrogen levels (Velazquez, 2005).

• *Reducing the urban heat island effect;* They contribute to balancing temperature extremes within microclimate zones (Johnston & Newton, 1993).

Green roofs can also provide a degree of acoustic insulation (Johnston & Newton, 1993).

Understanding this full range of environmental benefits requires expertise in a variety of disciplines (Bates et al. 2009).

Economic functions

• *Roof life-extending effect:* Another savings of the green roof is that it protects the roof insulation material. Green roofs protect the roof insulation material from UV rays and high temperature changes, extending the standard membrane life of 25 years to 60 years. When people come across the idea of a green roof, the first thing they worry about is that green roofs are at greater risk of water leakage than a regular roof. However, if the construction is done appropriately, the lifespan of green roofs can be considerably longer than traditional roofs. Thus, it provides a noticeable cost benefit.

• *Insulation and Energy efficiency:* These systems; With the heat storage feature of the plant carrier layer, it transmits less thermal load to the interior environment, which is reduced by the plant layer on the surface in summer months; In winter months, it reduces the amount of heat transferred from the indoor environment to the outdoor environment, thus saving the cooling and heating energy consumed in buildings. Different vegetation has different insulation values. Grass mixture is considered one of the most effective insulators (Johnston & Newton, 1993).

• *Urban agriculture:* The pressure of overly dense cities and towns leaves us with the desire for green space at ground level. Garden areas are very limited due to over-density buildings in urban areas. That's why green roofs offer safe and important opportunities for urban residents to enjoy gardens and produce food.

Social functions

• *Aesthetic value;* If the roofs are considered as green roofs during the design phase of the building, it would be appropriate to consider them as a tool that provides aesthetic levels to the building and the advantages that they will provide in the design should be taken into consideration by the designer. Green roofs have many aesthetic benefits (Johnston & Newton, 1993; Velazquez, 2005).

• *Creating space for recreation:* Green roofs; It plays an important role in providing recreational areas to the city and its surroundings. This role is especially evident in regions where density is high and green areas are limited. Many activities such as barbecue, dining, sunbathing, exercise and golf take place in the green areas of these recreation areas.

• *Effects on human health:* Gardens are pleasant places and provide important benefits for human health. According to researches; By looking at trees and plants, stress decreases, blood pressure decreases, muscle tension is relieved, thus positive emotions increase. Plant elements are elements that have a visual effect that relaxes people psychologically, especially in urban areas with dense construction.

ROOF GARDEN TYPES

There are two types of planting in roof gardens in terms of benefit and function. These forms of planting are called "Intensive planting" and "Extensive planting". Mixed planting methods can also be applied to suit the characteristics of the area. These two main forms of planting are classified among themselves according to the following discrimination criteria.

Intensive Roof Gardens: Intensive planting includes planting consisting of grass, ground cover, shrubs and trees. Entensive literally means dense. Therefore, although this type of planting is not very dense in terms of density, it is dense in terms of soil thickness, plant types used or systems used (Figure 4).

In this type of planting, species that have high requirements from the growing environment can be used. Undoubtedly, in this type of planting, different environments must be prepared for plants with different demands, and irrigation and drainage systems must be perfect. Such areas require periodic maintenance. This type of planting can also be done using pots or plant containers.

These are gardens that are open to walking and recreation, so they are built on flat roofs.

Figure 4: Intensive roof garden

Extensive Roof Gardens: These are gardens that can be created on low-maintenance flat or sloping roofs. Mostly dwarf shrubs, mosses, meadows and succulent plants are used. Selected plants must be resistant to extreme climatic conditions. These plants must have high regeneration ability. This type of roof gardens have the opportunity to be applied on larger surfaces. They are not suitable for travel and recreation. The soil depth is not too much (10-15 cm). Maintenance costs are low (Figure 5).

Both roof garden types can be used mixed.

Figure 5: Extensive roof garden

CONSTRUCTION OF ROOF GARDENS

Any roof garden; It brings with it many problems such as additional structural load, wind protection, appropriate plant selection, appropriate soil depth, insulation and drainage system (Figure 6).

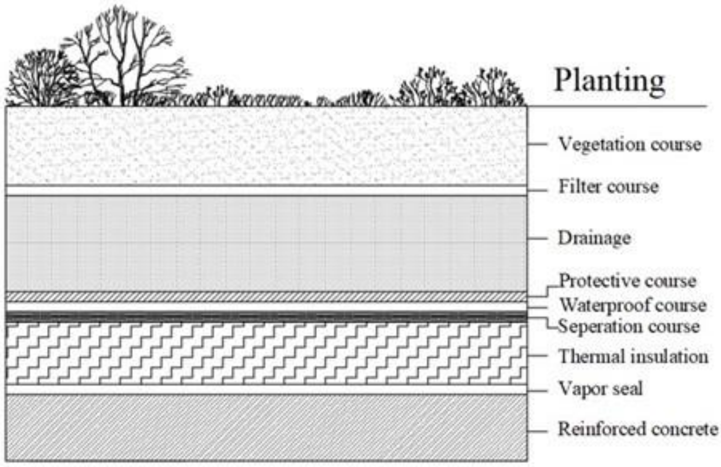

Figure 6: Green roof structure

There are guidelines containing standards for green roofs. The best known of these are the stands for Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau (FLL) Guidelines for Europe and The Association of Standards and Testing Materials (ASTM) for United States. These guides describe green roof terminology, design elements and construction in detail ((Dvorak and Volder 2010).

Creating green space on roof surfaces is different from that at ground level. The plant growing substrates on green roofs can generally be made of natural or artificial minerals and recycled or waste materials (Ampim et al. 2010).

Features and equipment that should be found in a building where a roof garden is considered; roof slope, roof statics, roof insulation and drainage system.

The most important problem to overcome in the design of roof gardens is the load. For this reason, the idea of a roof garden should be considered before, not after the design or construction of the building is completed (Table 1). The loads that may come on the roof can be considered in two groups: live and fixed loads. Dead loads include all materials permanently present on the roof. These are vegetation, heat and water insulation layers and saturated substrate. Generally, flooring puts the least load on the structure. Planting, on the other hand, has the highest load due to the weight of the soil. Maximum soil load should be calculated based on the water-saturated state of the soil (Table 2) (Rogers, 1976; Aslanboğa, 1988).

Table1: Loading Associated with Green Roofs

Building material	**The load it will bring to the surface (kg/m^2)**
Topsoil	16-20
Sand	20-22
Gravel	16-18
Standard soil	7-9
Aerated clay (diameter 8-16 mm)	3
Cattle manure	8-11
Soil, perlite, peat, cattle manure mixture	11-14

Kaynak: Aslanboğa, 1988; Johnston & Newton 1993

Table 2: Loads of Plant Material on the Roof (Aslanboğa, 1988)

Plant material	**The load it will bring to the surface (kg/m^2)**
Grass	5
Dwarf shrubs	10
Shrubs up to 150 cm tall	20
Shrubs up to 300 cm tall	30
Trees up to 6 m tall	40
Trees up to 10 m tall	60
Trees up to 15 m tall	150

Kaynak: Aslanboğa, 1988

Roof slope becomes important depending on the roof type. Roof gardens that are open to use can be created on flat roofs with a slope of up to 5.2%, while less commonly used roof gardens can be created on medium and high slope roofs as well as on flat roofs. However, in terms of planting and water economy, it is not desirable for the roofs to be too sloping.

Each use puts an additional load on the roof. The structure of the roof must have the strength and characteristics to bear this additional load. In the studies carried out; It is recommended that the total load per 1 m^2 in extensive roof plantings should not exceed 125 kg, and in intensive roof gardens it should not exceed 250 kg. Loads can be mobile or stationary.

Insulation of the roof, especially against water, is very important not only for roofs that will be planted, but also for other roofs. The most commonly used insulation materials are glass fiber and inorganic insulation sheets.

Water should never accumulate on flat roofs. For this reason, the slope should be adjusted when laying insulation material on the roof. There are different water drainage systems on the roofs.

PLANTING OF ROOF GARDENS

Plants are located on the top layer of green roofs. Roof gardens have extreme conditions for plants. Therefore, extra precautions may need to be taken (Koç and Güneş, 1998). It is necessary to take some precautions to protect especially grown large shrubs, and trees against the wind. In addition, the roots, which do not have the opportunity to develop well in the limited environment of the roof garden, have difficulty in meeting the high water consumption (Ürgenç, 1990). Plants should be selected taking into account the growing conditions on the roof.

The features required for successful planting in roof gardens are as follows: Sufficient environment for plant development, adequate and suitable water supply, adequate drainage, periodic feeding, spray application to reduce evaporation ((Koç and Güneş, 1998). The plants that can be used in roof gardens vary greatly depending on the climatic characteristics of the area where the application is made, the load-bearing capacity of the roof and the type of planting (intensive - extensive). In roof planting, the vegetation layer consists of suitable species to be selected among mosses, succulents, grass and cover crops, bulbous and tuberous plants, shrubs, shrubs and trees for these purposes (Küçükerbaş, 1991) (Figure 7). Various possibilities exist for applying the actual vegetation.Vegetation categories according to FLL guidelines for green roofs, (Zimmermann, 2015) are given Table 3.

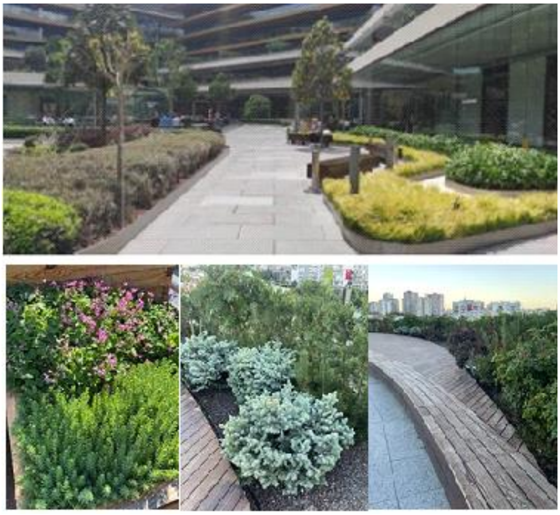

Figure 7: Various vegetation examples in intensive green roofs

Table 3: Forms of Vegetation for Green Roofs

Intensive Green Roofs Vegetation	Extensive Green Roofs Vegetation
Grass and herhaceous	Moss-sedum
Wild shurb-woody plant	Sedum-moss-herbaceous
Woody plant-shurb	Sedum-herbaceous-grass
Woody plant	Grass- herbaceous

Kaynak: Zimmermann, 2015

Lawn areas for intensive green roofs should generally be created using turf. On roofs where slope is a problem, fixing should be done with support material. Shurbs are added either as tub plants or as shallow root ball shurbs. Woody plants for intensive green roofs are generally planted as root ball or container plants. Solitaire woody plant and trees should be anchored on the roof so that they are stable (Zimmermann, 2015).

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