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Research Article

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Investigation of Noise Differences of Urban Parks in Düzce City

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Abstract Today, cities are facing various environmental problems. One of the most important problems, the noise phenomenon, has become a problem that annoys the metropolitan cities and urban residents. According to the researches, the most basic noise source in the cities is the highways. One of the most fundamental parts of the open and green areas, which are literally breathing organs of the cities, is the urban parks. In this study, the differences between the noise amounts of different sized parks in various urban areas in Düzce City were investigated. The basic material of the study is the city parks in Düzce. Noise measurements were made by Svan Svantek 957 noise measurement device. Thanks to the data obtained, the relations between the size of city parks, the uses in their buildings and the use of the surrounding area and the amount of noise were examined statistically. As a result, there were significant differences between the amount of noise in urban parks and the size of the parks and their use in urban areas.

Keywords Noise, urban park, Duzce

1. Introduction To make a general definition for noise; It is expressed as unwanted, unwelcome and intolerable sounds [1].

Urbanization, which has increased at a striking pace in the last decade, has directly affected biodiversity, energy flows and cycles, environmental noise and most importantly human health [2], [3]. Today, noise has become a serious environmental problem that negatively affects people physically and environmentally almost everywhere there are people [4]. In particular, noise, which negatively affects human perception, can disrupt people's psychological balance, affect people's performance in social and business life, and reduce the quality of environmental beauties. As a result of industrialization and urbanization, noise levels have increased significantly [5]. Noise is not only caused by humans but also by nature [6].

In cities where various activities are carried out, noise pollution, like other types of pollution, has reached levels that disturb people and the environment [7]. Creating a noise-free living environment in developed countries is accepted as an indicator of high personal and social quality of life [8]. Noise, which is one of the environmental problems especially in our big cities, makes our cities uninhabitable by having some negative effects on people and the environment, especially stress, which is the disease of our age, and in this context, noise is considered as environmental pollution [9].

Noise pollution causes various health problems in people. Depending on the duration and severity of noise exposure, its effects on human health occur in four main ways. These effects; physical effects such as hearing problems; Physiological effects such as increased blood pressure, irregular heart rhythm and ulcers; These can be listed as psychological effects such as irritability, restlessness and stress, and effects on performance such as decreased hearing and misunderstanding what is heard [10].

In order to create a noise-free environment, noise levels that are acceptable for human and public health should be determined and necessary studies should be carried out to control noise within a system [8].

Noise maps, which can be defined as the acoustic information of a certain region or a city in a certain system, in detail, as level curves, coloring system and/or numerical values, are included in the plan or section, and have many areas of use. In recent years, it has been observed that in many countries, local governments have

approached the environmental issue much more sensitively. This situation brings with it the need for advanced techniques to describe environmental conditions in detail and quickly. The most common use of these techniques in terms of noise is the creation of noise maps with the help of advanced computer programs [11].
Long-term planning and training studies should be carried out with the noise maps to be created, and action plans should be created in order to identify noise problems at local, regional and national levels and to raise public awareness about this issue. With the measures taken in this way, noise pollution will be reduced [4].
With intense migration to urban areas and the resulting population growth, cities are becoming overloaded, and while the existing infrastructure remains inadequate, new equipment and services are required [12]. Parks, especially those located in city centres, are under great pressure. Parks located in city centers are surrounded by important and busy vehicle roads. Vehicle density, which causes an increase in the noise level in parks, causes a decrease in the comfort of the parks and a decrease in the peace of mind that visitors get from the park [13].
Barrier walls used to reduce or block noise consist of three parts: the wall foundation, the wall surface and the end/top point of the wall. The foundation of the wall is a visually invisible section, and it must be structurally strong enough and integrate with the landscape features of the environment [12]. Especially in urban areas, it is necessary to leave a green area by reducing noise between residential areas, traffic roads, airports, railways and industrial facilities. If the elevation of this buffer area is changed (the land is raised), the noise level will decrease significantly with vegetation [16].
Curtains made of plants have more advantages. Plants have a significant positive impact on the physiological and psychological needs of the surrounding people with their constantly changing aesthetic structures, improving the climate, shading, filtering dust, preventing erosion, providing recreation opportunities and cultural effects [14]. Reductions in noise level with the use of plant materials depend on factors such as leaf size, leaf condition, leaf or needle density and branching. The effectiveness of plants in preventing noise is related to their structure rather than their width [15].
The aim of this study is to reveal to what extent the urban parks in Düzce City (Turkey) are affected by the amount of noise according to their size, land use types and green area densities around them. In this study, it is aimed to prove the accuracy of the assumption that there is a relationship between the size of the city park, the density of the green tissue in the park, the density of land use in the region where the city park is located, and the amount of noise the city park is affected by.

2. Materials and Methods

The main material of the study consists of ten selected parks in Düzce City. When selecting parks, their sizes and differences in land use density in the region where they are located were taken into account. The sizes of the parks are shown in Table 1.

Table 1: Parks and their sizes

The name of the park	Size (m^2)
Avni Akyol Park	10.000
Küçüksu Park	7.353
Konak Park	4.990
Kentpark	7.500
İnönü Park	14.840
Fettah Bey Park	4.000
Yeşiltepe Park	6.000
Güzelbahçe Park	4.500
Esentepe Park	3.200
Demetevler Park	9.300

Within the scope of the study, noise measurements were made around and inside each park. Noise measurements were carried out with a Svan brand Svantek 957 model noise measuring device. The calibration of the noise measuring device was carried out with the SV30 model calibrator, also from Svantek.
The basic method of the study consists of noise measurements made around and inside city parks in order to verify the assumptions. In addition, criteria such as size, density of green tissue, and density of land use type in

the region where the city park is located were noted for each city park. Considering the sizes of the selected parks, three size classes were created.

• Less than 5,000 m²,
• Between 5,000-10,000 m² and
• Greater than 10,000 m²

The density criterion of green tissue was evaluated under 4 classes: 0-25%, 25-50%, 50-75% and 75-100% green.

AutoCAD program, Duzce Zoning Plan and Google Earth images were used for the calculations. The land use types around the selected parks were evaluated under three headings: commercial zone, commercial + residential zone and residential zone. The data obtained was statistically analyzed and evaluated. The purpose of this is to determine whether there is a significant difference between the amount of noise affected by city parks with different characteristics such as size, density of green tissue, and density of land use in the region where the city park is located.

3. Result and Discussion

The minimum, maximum and average values obtained according to the measurement results made around and inside each park are shown in Table 2. Accordingly, the highest value in in-park measurements was measured in Küçüksu Park and the smallest value was measured in Demetevler Park. Similarly, the highest average value was measured in Küçüksu Park and the lowest average value was measured in Demetevler Park. In measurements around the park, the highest value was measured in Küçüksu Park and the smallest value was measured in Güzelbahçe Park. In measurements around the park, the highest average value was measured in Küçüksu Park and the lowest average value was measured in Demetevler Park.

Table 2: Noise values inside and around the park

		Average	Minimum	Maximum
Inside Park	Avni Akyol	57,3025	56,25	58,50
	Küçüksu	72,2575	70,24	73,58
	Konak	69,7925	65,15	72,25
	Kentpark	48,5750	47,04	49,49
	İnönü Park	50,9100	50,20	51,92
	Fettah Bey	67,3200	65,44	69,61
	Yeşiltepe	42,5350	40,44	46,73
	Güzelbahçe	42,4225	40,65	45,15
	Esentepe	46,7175	41,02	51,43
	Demetevler	40,2825	37,73	43,87
Around Park	Avni Akyol	66,8875	65,15	68,50
	Küçüksu	76,8850	75,74	78,20
	Konak	72,8200	70,45	76,70
	Kentpark	64,5200	62,25	67,20
	İnönü Park	72,0900	70,10	75,80
	Fettah Bey	70,3000	68,90	71,80
	Yeşiltepe	52,8775	50,16	55,39
	Güzelbahçe	50,5150	48,38	52,38
	Esentepe	56,2100	52,98	60,28
	Demetevler	51,6050	49,80	52,75

The change between the land use around the parks where noise measurements were made and the amount of noise is seen in Table 3. Accordingly, it is seen that the highest average noise level around the park is measured in areas where the land use type is commercial. It is noteworthy that the lowest average noise level is measured in residential areas. In the measurements made around the park, the highest noise value was measured in the commercial area with a value of 78.20 dB, and the lowest noise value was measured in the residential area with a value of 48.38 dB.

Table 3: Relationship between the type of land use around the park and the amount of noise

		Average	Minimum	Maximum
Around Park	Commercial	71,9542	65,15	78,20
	Commercial+Residential	69,2133	62,25	76,70
	Residential	52,8019	48,38	60,28

	F	Mean
Between Groups	104,454	,000
Within Groups		

In order to explain the differences in more detail, the Tukey test was applied and the results are given in Table 4. Accordingly, among the noise measurements made around the parks, the differences between the noise amount only in residential areas and the noise amount in both commercial and commercial + residential areas are meaningful and can be explained statistically. The amount of noise in residential areas is less than the amount of noise in commercial areas. The average of this difference is 20 dB. Similarly, the amount of noise in residential areas is on average 16 dB less than the amount of noise in areas where commercial + residential use is intense. In other words, it is seen that parks located in residential areas are approximately 15-20 dB quieter than parks in areas with commercial and commercial + residential density.

Table 4: Relationship between the type of land use around the park and the amount of noise Tukey test

	(I)Land Usage	(J) Land Usage	Average Difference (I-J)	Mean
Around Park	Commercial	Commercial+Residential	2,74083	,201
		Residential	19,15229*	,000
	Commercial+Residential	Commercial	-2,74083	,201
		Konut	16,41146*	,000
	Residential	Commercial	-19,15229*	,000
		Commercial+Residential	-16,41146*	,000

The change between green tissue density and noise amounts in the parks where noise measurements were made is given in Table 5. Accordingly, it is seen that the highest average noise level is measured in parks with 25-50% green texture, and the lowest average noise level is measured in parks with 75-100% green texture. In the measurements made in parks, the highest noise value was measured in parks with 25-50% green texture, with a value of 73.58 dB, and the lowest noise value was measured in parks with 75-100% green texture, with a value of 37.73 dB.

Table 5: Relationship between green density in parks and noise amount

	Average	Minimum	Maximum
% 25-50	65,0700	50,20	73,58
% 50-75	57,3025	56,25	58,50
%75-100	44,1065	37,73	51,43

	F	Mean
Between Groups	49,483	,000
Within Groups		

In order to explain the differences in more detail, the Tukey test was applied and the results are given in Table 6. The amount of noise in parks with green tissue density between 75-100% is less than the amount of noise in parks with green tissue density between 25-50% and 50-75%. The average of this difference is approximately 21 dB compared to parks with green texture density between 25-50%. Similarly, parks with 75-100% green tissue density are on average 13 dB quieter than parks with 50-75% green tissue density. In other words, as the density of green tissue in parks increases, the amount of noise felt decreases.

Table 6: Relationship between green density in parks and noise amount Tukey test

(I) Green density	(J) Green density	Average Difference (I-J)	Mean
%25-50	%50-75	7,76750	,085
	%75-100	20,96350*	,000
%50-75	%25-50	-7,76750	,085
	%75-100	13,19600*	,001
%75-100	%25-50	-20,96350*	,000
	%50-75	-13,19600*	,001

The change between the size of the parks where noise measurements were made and the amount of noise is given in Table 7. Accordingly, the differences between the noise amounts measured in parks classified as smaller than 5,000 m², between 5,000-10,000 m² and between 10,000-15,000 m² were found to be significant and can be explained statistically.

The average noise amount was measured as 68.5 dB in parks under 5000 m², 48.8 dB in parks between 5000-10000 m² and 54 dB in parks between 10000-15000 m².

Table 7: Relationship between the size of parks and the amount of noise

	Average	Minimum	Maximum
<5000 m²	68,5563	65,15	72,25
5000-10000 m²	48,7983	37,73	73,58
10000-15000 m²	54,1063	50,20	58,50

	F	Mean
Between Groups	13,991	,000
Within Groups		

In the literature, studies have been found proving that there is an inverse relationship between the size of green areas and the amount of noise. However, in this study, the noise levels in parks between 5,000-10,000 m² were lower than in parks between 10,000-15,000 m². The reason for this can be shown that these parks are located in Yenikent settlement. Because noise amounts may vary depending on the type of use of the area around the park, the density of green tissue in the parks, and the amount of road noise, which is the most basic noise source. The fact that the entire Yenikent settlement consists of residential areas and the amount of road noise is much lower than in the city center has created an exception in terms of size criterion.

In order to explain the differences in more detail, the Tukey test was applied and the result is given in Table 8. Among the noise measurements made in parks, the differences between the amount of noise measured only in parks smaller than 5000 m² and in parks with sizes between 5000-10000 m² and 10000-15000 m² are meaningful and can be explained statistically. This difference is positive for both density groups, that is, the amount of noise in parks smaller than 5000 m² is higher than the amount of noise in parks between 5000-10000 m² and 10000-15000 m². The average of this difference is approximately 20 dB compared to parks with sizes between 5000-10000 m². Similarly, parks with a size between 10000-15000 m² are on average 14.5 dB quieter than parks smaller than 5000 m². In other words, as the size of the parks increases, the amount of noise felt decreases.

Table 8: Relationship between the size of parks and the amount of noise Tukey test

(I) Size	(J) Size	Average Difference (I-J)	Mean
<5000 m²	5000-10000 m²	19,75792*	,000
	10000-15000 m²	14,45000*	,009
5000-10000 m²	<5000 m²	-19,75792*	,000
	10000-15000 m²	-5,30792	,341
10000-15000 m²	<5000 m²	-14,45000*	,009
	5000-10000 m²	5,30792	,341

4. Conclusion

There are similarities between the results of this study and the results of previous similar studies. Literature data also supports the results of this study.

According to the results of this study, the increase or decrease in noise levels in city parks depends on some factors. One of the factors that formed the basis for the emergence of the study is the type of land use around the city park. Accordingly, parks whose surrounding urban land use type is residential/residential are less affected by noise. It was concluded that the noisiest parks were those with a commercial zone around them.

Another factor is the density of green tissue in the park. According to the results of the study, as the density of green tissue in the park increases, the amount of noise affected by the park decreases. In this sense, it was found that the noisiest parks were those with low green tissue density.

The size of the park was also measured as another criterion. According to the results of the study, as the size of the park increases, the rate of being affected by noise decreases. The smallest parks in the city are also the noisiest parks.

As a result, it has been concluded that there is a relationship between the size of the city park, the density of the green tissue in the park, the density of land use in the region where the city park is located, and the amount of noise the city park is affected by. Based on these results, when creating city parks, careful attention should be paid to location selection, size, relationship with neighboring urban area uses and plant design. When creating park areas, especially in areas where the amount of noise impact will be high, such as commerce and industry, it should not be forgotten that the criteria of size and green tissue density will affect the amount of noise impact of the park.

References

[1]. Watts GR (1993) A Comparasion of Noise Measures for Assesing Vehicle Noisines. Journal of Soundand Vibration 180, 39, 493-512.

[2]. Z. Chi, H. Tian, G. Chen, A. Chappelka, X. Xu, R. Wei, D. Hui, M. Liu, C. Lu and S. Pan, 2012. Impacts of urbanization on carbon balance in terrestrial ecosystems of the Southern United States. Environ. Pollut. 164: 89-101.

[3]. X. Han, X. Huang, H. Liang, S. Ma and J. Gong, 2018. Analysis of the relationships between environmental noise and urban morphology, Environmental Pollution, 233: 755-763.

[4]. Bayramoğlu, E., Işık, B. Ö, Demirel, Ö. 2014. The Effect of Noise Pollution on City Parks and Solution Suggestions: Trabzon City Example. İnönü University Journal of Art and Design, 4 (9), 35-42.

[5]. K. V. P. Mahendra and V. Sridhar, 2008. The relationship between noise frequency components and physical, physiological and psychological effects of industrial workers, Noise Health, 10: 90-98.

[6]. J. M. Fields and J. G. Walker, 1982. Comparing the relationships between noise level and annoyance in different surveys: A railway noise vs. aircraft and road traffic comparison, Journal of Sound and Vibration, 81: 51-80.

[7]. Zannin PHT, Diniz FB, Barbosa WA (2002) Environmental Noise Pollution in the City of Curitiba (Brazil). Applied Acoustics 63, 351-358.

[8]. Önder S.,Gülgün B.,2010. Noise Pollution and Precautions to be Taken: Vegetative Noise Barriers, Journal of Agricultural Engineering, July-December 2010 l Issue: 355

[9]. Yılmaz Y. Özer S.1997. Evaluation of Noise Pollution in Terms of Landscape Planning and Solution Suggestions, Atatürk University Faculty of Agriculture Journal, 28 (3), 515-531

[10]. Job, R.F.S., 1996 The Influence of Subjective Reactions to Noise on Health Effects of The Noise.Environmental International, 22 (1), 93–104.

[11]. Akdağ Yüğrük, N. 2002 The Importance of Noise Maps in Urban Planning: Barbaros Boulevard Surroundings Example, 6th National Acoustics Congress, 26-28 October, Kaş, Antalya

[12]. Erdoğan, E. ve Yazgan, M. 2007. Landscape architecture studies to reduce the traffic noise problem in cities: Ankara example, Tekirdağ Faculty of Agriculture Journal, Tekirdağ, 4 (2), 201-210.

[13]. Özer S.2017. Current Situation Analysis of Noise Pollution in City Parks in the Example of Erzurum City Yüzüncüyıl Park, Atatürk University Faculty of Architecture and Design, Department of Landscape Architecture, Erzurum.

[14]. Gür, K. Önder, S. 2000. Noise Pollution in Konya and Biological Precautions to be Taken. 3rd GAP Engineering Congress. 24–26 May 2000 s:286-294. Urfa, Turkey.

[15]. Alparslan, E. 1987. Precautions that can be taken in terms of landscape architecture against noise on highways. Dokuz Eylül University Faculty of Engineering and Architecture, Department of City and Regional Planning, Seminar, İzmir, 13s

[16]. Yazgan, M. 1980. Noise Problem on Highways and Landscape Architecture. First Environmental Orientation Training Seminar, Prime Ministry Undersecretariat of Environment, Seminar Series: 6, Ankara.