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Original Article

The effects of recreational demand characteristics on space preference in urban forests

Kent ormanlarında rekreasyonel talep özelliklerinin mekan tercihine etkileri

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ABSTRACT

Natural areas are important in meeting the needs of people in recreation. While these areas are planned, care should be taken to create a sustainable space to protect the natural environment and meet the needs of visitors. It is also important to observe visitors to provide quality recreation facilities that meet the needs and demands of visitors while protecting nature. The types of functional areas used by visitors, the kinds of routes preferred by reaching these areas, the most or least visited places, and the kinds of activities preferred by different groups to determine the flow and density of the area provide the necessary information to plan these areas in a better way. Knowing this preference makes it easier to meet the demand of visitors. In the present study, the spatial distribution of visitors in Kocaeli Urban Forest was investigated to reveal the flow of visitors. The effect on the spatial distribution of road attributes with spatial features has been revealed. Furthermore, the relationship between the visit and the spatial distribution characteristics was analyzed. Finally, the study was revised completely, and suggestions were made about the urban forest.

Keywords: Recreation, spatial behavior, spatial distribution, urban forest, visitor flow

ÖZ

Doğal alanlar insanların rekreasyon ihtiyacını karşılamada önemlidir. Bu alanlar planlanırken, ziyaretçi ihtiyaçlarını karşılaması ve doğal çevreyi koruması amacıyla sürdürülebilir bir alan oluşturmaya dikkat edilmelidir. Doğayı korurken aynı zamanda ziyaretçilere ihtiyaç ve taleplerini karşılayan kaliteli rekreasyon olanakları sunabilmek için ziyaretçileri gözlemlemek önemlidir. Ziyaretçilerin hangi tür fonksiyonel alanları kullandığı, bu alanlara ulaşırken ne tarz rotaları tercih ettiği, en çok veya en az hangi yeri ziyaret ettiği, farklı grupların ne çeşit aktiviteleri tercih ettiği, alan içindeki akışı ve yoğunluğu saptamak, bu alanların daha iyi planlanması için gerekli bilgiyi sağlar. Bu tercihleri bilmek, ziyaretçi taleplerinin karşılanmasını kolaylaştırır. Bu çalışmada, ziyaretçi akışını ortaya koymak amacıyla Kocaeli Kent Ormanı'nda ziyaretçilerin mekansal dağılımları incelenmiştir. Spatial Features ile yol özelliklerinin mekansal dağılım üzerine etkisi ortaya konmuştur. Ayrıca ziyaret ve Visitor Characteristics ile mekansal dağılım arasındaki ilişki incelenerek, önerilerde bulunulmuştur.

Anahtar Kelimeler: Kent ormanı, mekansal davranış, mekansal dağılım, rekreasyon, ziyaretçi akışı

INTRODUCTION

Urbanization, as it does in the world, continues to increase in our country as well. Recreation has become the basic need of people with increasing population and urbanization. The lack of natural areas negatively affects the physical and mental health of the society (Uslu and Ayaşlıgil, 2007). It is important to bring the positive impacts of forests on community health to the service of urban people for a healthy community structure. Along with this understanding, efforts to establish urban forests in our country gained momentum (Kiper and Öztürk, 2011). Social function supremacy constitutes the basis for urban forests (Tyrväinen et al., 2005), and these areas have gained importance in outdoor recreation. It is difficult to define outdoor recreation exactly (Hansen, 2013). However, there are four basic elements that are common to all definitions: its impact on human well-being, its outdoors realization in natural and cultural landscapes, its inclusion of activities, and its exclusion of competition (Hansen, 2013).

The interaction between nature and man has been a research topic for a long time, and its positive effects on human beings were proven (Tsunetsugu et al., 2013). In the survey conducted by the Pro-

file of Mood States, participants showed that they felt bad about themselves as a result of staying 15 min in the urban environment, and that they spent time in the green areas to get rid of these adverse physiological effects (Tsunetsugu et al., 2013). This getaway to the green is also combined with a variety of physical activities, such as commonly jogging during brisk walking, trekking, and cycling. Whereas cultural and personal characteristics are of importance in defining a symbolic environment (Marwijk et al., 2007), environmental perception and socio-economic status also become more of an issue (Marwijk et al., 2007). The physical and social environments (the so-called symbolic environment) are inseparably related and must be examined together (Marwijk et al., 2007). The symbolic environment may be appropriate for different visitors (Elands and Marwijk, 2008). Therefore, it is necessary to monitor the visitors in recreation areas (Muhar et al., 2002). Arnberger (2003) added new factors to the perception of the crowd, such as different types of visitors, direction of the movement of the visitors, and the presence of leashed or unleashed dogs (Taczanowska, 2009). While physiological properties, such as the size and the type of the area, and visitor infrastructure are effective in recreational use (Taczanowska, 2009), characteristics, such as spatial orientation and direction finding, are also influential. While road signs and signposts affect the course choice preferences of the visitors (Taczanowska, 2009), superior landscape features, landscape viewing areas, recreation grounds, information centers, huts, and attractions are influential on visitor behavior (Taczanowska, 2009).

The identification of visitor characteristics through visitor observations is as important as the establishment of an inventory of biophysical properties of the area (Arnberger and Hinterberger, 2003). The systematic and continuous data collection process of visitor characteristics ensures the development of alternate planning models, thus achieving goals and targets in a short time with accurate estimations by noticing the changing levels of impacts resulting from user–resource interaction. In addition, understanding spatial behaviors makes the job of planners rather easier. Information on the aspects of recreational area usage level, recreational area visit characteristics, and recreational area visitor features is supplied with the identification of visitor characteristics (Kaptanoğlu, 2010).

In addition to the human–environment interaction in the recreation areas, spatial behavior of the visitors was not put forward yet (Cole et al., 2005). Nevertheless, recently, theoretical and applied researches on the spatial behavior of human beings are increasing (Gimblett and Skov-Petersen, 2008). Understanding the spatial distribution is the basis for defining the visitor profile and improving the visitor management (Lyon et al., 2011). The analysis and monitoring of the visitor flow is a key to understanding the visitor behavior required for the effective management of protection and recreation (Muhar et al., 2002; Orellana et al., 2011). To do so, it is necessary to obtain detailed information about the use of space and the preferences of different groups (Orellana et al., 2011). One of the most important aspects of the visitors' spatial behavior is their movements in the recreation area, in other words, their flow in the field. It is necessary to know the visitor's travel behavior, including route selection, destination selection, travel frequency, activity plans, his or her behavior during the trip, and pre-trip route decision,
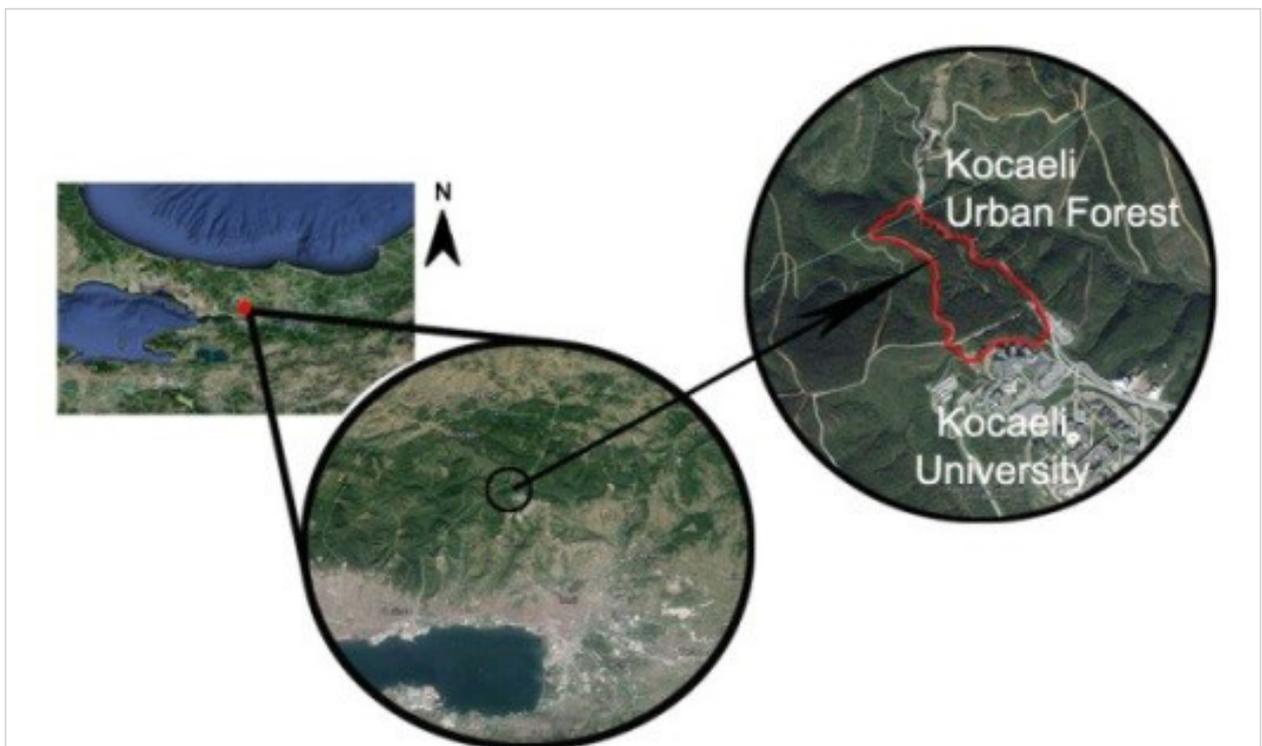

Figure 1. Kocaeli Urban Forest location (Google Earth image dated 10/21/2014)

when planning the transportation (Golledge and Gärling, 2003). Monitoring the visitors' movements helps us to learn about their preferences. Knowing these preferences facilitates balancing supply and demand.

By looking at the increasing demand for recreation and green areas, this research is aimed at determining the spatial distribution of the visitors in the area by identifying the functional areas used in the Kocaeli Urban Forest scale; the visitor density on the routes between the functional areas; which of the features are important with respect to road length, road type, road width, and so on in their preferences when visitors select these routes; and whether existing or non-existing in the area, the kind of things that affect them positively or negatively. The present study provides an insight on visitor density, spatial orientation, and preference in outdoor recreation areas. The investigation of visitor requirements and expectations, together with physical space and usage relationship, will enable the planning and design of these spaces according to today's conditions.

MATERIAL AND METHODS

Research area
Kocaeli is in Çatalca–Kocaeli Section of Marmara Region, and it has a population of 1,722,795 (TUİK, 2015). The climate forms a transition between the Mediterranean and the Black Sea climate (Kocaeli Metropolitan Municipality (KBB), 2015). It is one of the industry and trade cities. Kocaeli Urban Forest was established in 2005 with the practice of "A Forest in Every City" (OGM, 2008)

of the General Directorate of Forestry (OGM). It is located in İzmit Province, on the old highway of İzmit–İstanbul, near Kocaeli University and Kocaeli University Medical Faculty (Figure 1) (Şahinbaş, 2010). It is 10 km away from İzmit city center. Its current area is 20 ha and is planned to be extended to 100 ha in the following years (OGM, 2008). It is a plantation site established by planting, and wildlife is newly developing on this area. Topal (2014) identified a total of 19 different bird species in the urban forest.

Obtaining the variables and data used in the study
Three types of information form the basis to determine the spatial distribution of the visitors. These are "visit characteristics," "visitor characteristics," and "spatial features" (Figure 2).

Visit characteristics include "quantitative" and "qualitative" data. Visitor characteristics cover socio-demographic characteristics, the type and level of past experience, the knowledge of the wild conditions and regulations, the preferences for the environmental conditions encountered, and management practices and attitudes toward them (Watson et al., 2000). Basic quantitative and qualitative information regarding the visitors of the sample area requires the recreational use in the area to be systematically monitored (Muhar et al., 2002).

Although, in the recent period, high resolution spatio-temporal data collection method has gained importance in determining the spatial distribution regarding the visitor density (Cole, 2005; Skov-Petersen, 2005), in the study, observation, questionnaire,

Table 1. The methods and resources for the collection of visit, visitor, and spatial data.

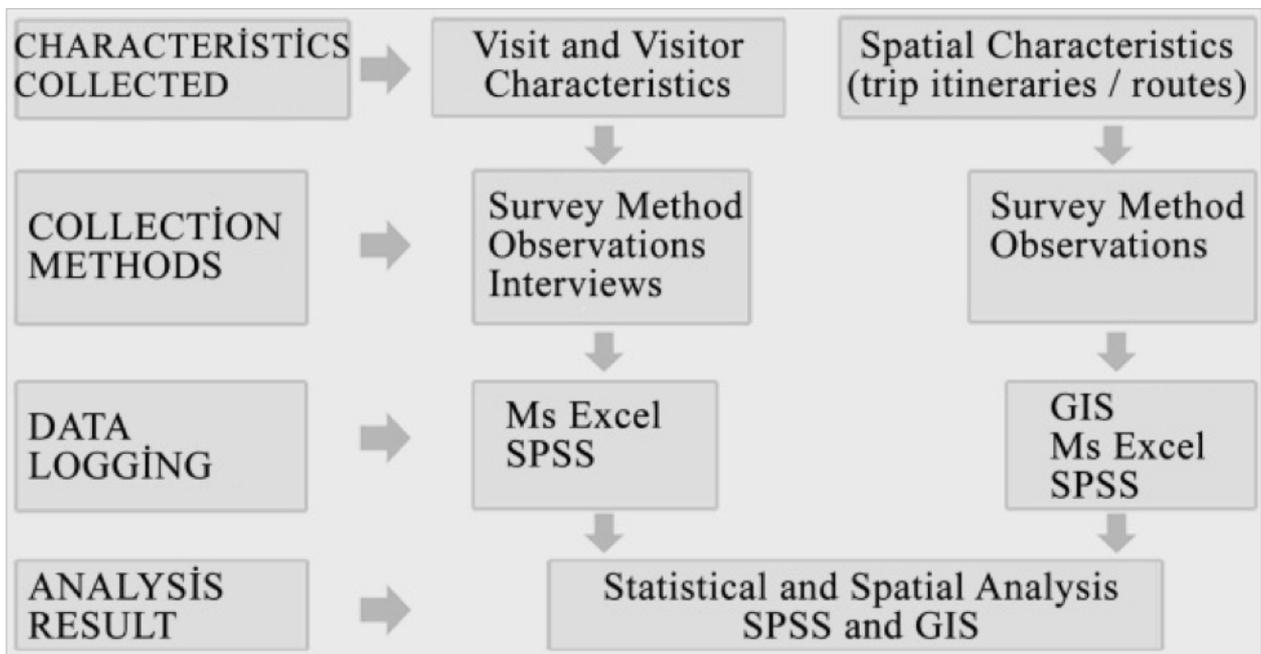| Method	Source	Date	Data type
Interviews	Authorities		Visitor profile and activity, area history, use by month, use during the day, satisfaction, dissatisfaction.
	Visitors		Visitor profile and activity, area history, use by month, use during the day, activities required to be in the area, satisfaction, dissatisfaction, inadequacies.
Observation	Observer	04/26/2015, 04/29/2015 05/13/2015, 05/24/2015	Visitor's group size, count, sex, directions to go, company of children and dogs, whether the dog's leash.
Questionnaire	Visitors	01/24/2015, 01/31/2015 02/03/2015, 02/05/2015 02/06/2015, 02/12/2015 02/18/2015, 02/19/2015 02/20/2015, 02/21/2015 03/17/2015, 03/25/2015 03/26/2015, 04/03/2015 04/04/2015, 04/06/2015 04/12/2015, 04/14/2015 04/16/2015, 04/18/2015 05/05/2015, 05/09/2015 05/18/2015, 05/22/2015	*Visit characteristics:* Visit day-time, arrival time, duration of visit, duration of the trip, group size, company of children/dog, whether the dog's leash, days and months came to the area, purpose of arrival, activities done in the area, the frequency of encounters with other visitors, the reason for choosing a route, trip conditions, walking time to reach your destination in the forest, presence of constructions-buildings, benches and tables, diner-restaurant, shop-buffet, road signs, warning signs-signboard, explanation signboard, presence of limiters that limit passage, destruction of vegetation cover. *Visit characteristics:* Mode of transport, access time, regular come, frequency of visits, satisfaction, dissatisfaction, satisfaction degree, the frequency of doing sports, sports committed, sex, age, education, occupation.

Figure 2. The methods used in the present study

Table 2. General structure of the data entered in the software

Data	Resource	Data type	
Visit characteristics	Questionnaire, observation	Non-spatial data	SPSS, MS Excel
Visitor characteristics	Questionnaire, observation	Non-spatial data	SPSS, MS Excel
Spatial features		Spatial data	ArcGIS/ SPSS
Routes	Questionnaire, observation	Spatial data	ArcGIS/ SPSS

SPSS: Statistical Package for the Social Sciences; MS: Microsoft; ArcGIS: Arc Geographic Information System

and interview methods, which are the most frequently used ones in data acquisition (Erkkonen and Sievänen, 2002; Gimblett and Skov-Petersen, 2008; Taczanowska, K., 2009), were preferred since there was data loss due to peak closure during the use of these technologies in urban forests (Table 1). A total of 864 individuals were observed in the area for 4 days.

A questionnaire form of 31 questions was prepared for the survey method. Questions aim at eliciting the information about visit and visitor characteristics.

In addition, a map was added to the survey for acquisition of the information about the routes visitors use on the area. For the creation of the map, one digital map from KBB and one raster map were provided from İzmit Forest Management Directorate. Those raster maps were digitized in AutoCAD and ArcGIS 10.1 environment. With the overlap of the maps and the checks made in the field, the changes resolved, and a new map was produced. Visitors were asked to mark the route they follow and the points where they pause the activity on the map. Most of the spatial features are based on the route information that the visitors pointed to on the map. The disadvantage of this method is the inability of the visitors to precisely remember the routes that they travel around or the likelihood of marking different locations on the map due to their mistakes in map reading (Daniel, 2002).

A total of 637 individuals selected by simple random method in the urban forest were surveyed (Sandal and Karademir, 2013). A total of 30 pre-evaluation surveys were conducted before the questionnaire study. Surveys were conducted during the two seasonal periods of Winter and Spring; 5-month period covering January, February, March, April, and May for a total of 24 days during weekdays and weekends.

Methods of evaluation
Similar responses to open-ended questions were grouped to facilitate the entry of the data obtained from "Observations and Surveys" into programs.

On the other hand, to facilitate data entry and analysis of "route information," 54 road segments were created by separating the roads in the urban forest from each other at intersection points. The collection of the features belonging to the segments is the basis for spatial features. For this reason, the spatial features of the segments were either obtained from the maps or determined as a result of checks made in the area and entered into base maps prepared through the Geographical Information System (GIS). "Segment lengths," "segment widths," "segment paving materials," "segment slopes," "stand closure," and "land-

scaping structures on the segment," such as signboard, fountain, rain shelter, camellia, picnic table, garbage can, hut, Mescit (prayer room), and restroom, are the properties that belong to segments and that were entered into the GIS database. Visits-, visitors-, and spatial features-related data were transferred to the relevant programs specified in Table 2.

Data were analyzed using Statistical Package for the Social Sciences (SPSS) 22 program (SPSS IBM Corp.; Armonk, NY, USA) for the data entry of the questionnaires and for the statistical analysis of relationship (Kaptanoğlu, 2006). The Kolmogorov–Smirnov test (one sample K–S) was applied for the test of the convenience of the data to the normal distribution.

Percentage distribution was determined by frequency analysis for the evaluation of visit and visitor characteristics. Factor anal-

ysis was applied to group the factors related to visit characteristics, visitor characteristics, and route characteristics.

For the analysis of these, all related variable groups correlation (Pearson correlation) and for two different variable groups, one-way analysis of variance (ANOVA) were performed.

Visitor density on the routes between the function fields and functions in urban forest and whether the road segment features (spatial features), such as segment slope, length, width, paving material, landscape structures existing on it, and its closure, are important or not when the visitors selected those routes were examined by hypothesis tests.

Interrelated relationship between the path segment properties and distribution of the visitors to the path segments was analyz-

Table 3. Frequency percent of visit characteristics

Data	Category	Percentage (%)	Data	Category	Percentage (%)
Admission hours	8.00–10.00	7.4	Group size	Single (1 person)	3.8
	10.00–12.00	18.3		Binary group (2 people)	26.7
	12.00–14.00	44.9		Small group (3–4 people)	29.8
	14.00–16.00	26.1		Middle group (5–10 people)	27.9
	>16.00	3.3		Large group (>10 people)	11.8
Duration of visit	<1 h	20.1	Days came to the area	Weekday	43.3
	1–2 h	40.3		Weekend	20.4
	3–4 h	23.9		Weekday and weekend	36.3
	>4 h	15.7			
Duration of the trip	Did not walk around	17.1	Company of children	Yes	19.9
	5–10 min	5.2		No	80.1
	15–20 min	16.7	Company of dog	Yes	3.8
	30 min	14.3		No	96.2
	Approximately 1 h	24.3			
	>1 h	22.4			
The reason for choosing a route	Interesting	6.1	Months came to the area	January	29.8
	Aesthetic-landscape beauty	10.1		February	38.1
	Naturalness	4.3		March	33
	Unemployment	6.7		April	64.3
	Security	2.6		May	70.4
	Location-accessibility	31		June	57.2
	Suitability of park facilities to function	6.1		July	35.6
	Thermal comfort	0.9		August	30.1
	Goal-oriented	14.8		September	30.1
	Inadequacy of other facilities	2.9		October	24.8
	Failure of other facilities	2		November	20.4
	Random	12.5		December	20.8

ed by the method of correlation, which is one of the hypothesis tests, by regression, by one-way ANOVA, and by independent samples t-test. The significance levels of the relationship in the analysis are as follows: p≤0.05: existence relationship, p≤0.01: strong relationship, and p≤0.001: very strong relationship.

RESULTS

Visit characteristics

The most frequent admission hours to the city forest are 12.00–14.00, whereas the least visited hours are the ones after 16.00 h.

Table 4. Frequency percent of visitor characteristics

Data	Category	Percentage (%)	Data	Category	Percentage (%)
Mode of transport	Public service vehicle	31.4	Access time	1–to 10 min	34.6
	By walking	35.2		11 to 20 min	34.6
	Car/motor	30.3		21 to 40 min	20.1
	Bicycle	0.3		41 to 60 min	6.5
	Other	2.8		>60 min	4.2
Age (year)	<18	9.1	Education	Uneducated	0.2
	18–30	70.3		Primary school	3.9
	31–40	14.6		Secondary school	6.8
	41–50	4.4		High school	67.7
	51–60	4.4		Associate degree	3.1
	>60	1.6		Bachelor's degree	14.6
				Post graduate	3.6
Frequency of visits	Every day	2.8	Satisfaction	Naturalness	50.4
	At least 2 times a week	8.3		Quiet-calmness	17.2
	Once a week	14.1		Aesthetic-landscape beauty	3.3
	Monthly	19.4		Entering motor vehicles	0.5
	At least 2 times a month	8.6		Functionality	2.6
	Quarterly	12.1		Adequate existence of park facilities	23.4
	Semi-annually	11.1		Wellness	1.3
	Annually	11		Entry free	0.9
	One-off	12.5		Location-accessibility	0.4
Occupation	Student	61	Dissatisfaction	Neglect	37.4
	Retired	1.4		Security	13.6
	Civil servant	1.9		Lack of night security	0.8
	Health sector	5.5		Visitor behaviors	7.2
	Education-science-research	4.3		Facility inadequacy	5.3
	Engineering-architecture	3.9		Sports field and playground inadequacy	0.3
	Technician-technician	3.6		Neglected sports field and playground	1.1
	Transportation-services	3.4		Inadequacies	6.9
	Business-economy-trade	2.2		Having unplanned areas	4.2
	Jobs that do not qualify	10.4		Vehicle entry	1.9
	Unemployed	2.4		Pergola and picnic tables neglected	2.2
Sex	Female	50.2		Seating units are close	1.9
	Male	49.8		Thermal comfort	0.6
				The presence of stray animals	16.6

Most of the visitors spent 1–2 h in the area, and minority of the others spent ≥4 h. Visitors stayed on the routes for at most approximately 1 h, at least 5–10 min. The reason for visitors' choosing the route that they visit is location-accessibility the most, and thermal comfort is the least. The urban forest was visited by small groups the most, and by individual visitors the least. Most visitors come to the area on weekdays. Overall, 80.1% of the visitors have children with them, and 3.8% have dogs. May is the time when the visitors come to the area the most, whereas October is the least (Table 3).

Visitor characteristics

Visitors mostly walked to the city forest, and bicycles were the least common mode of transport. Overall, 70.3% of the visitors are at the age range of 18–30 years, 61% are students, 50.2% are females, 49.8% are males, and 67.7% are high school graduates. It takes most of the coming visitors 1–20 min to reach the area. Whereas the visitors are most pleased with the urban forest's naturalness and its ability to meet the facility requirements, they feel discomfort about dilapidation and the presence of stray animals (Table 4).

Relationship between visit and visitor characteristics

There is a positive relationship between group size and duration of the visit. The duration of the visit extends as the group size increases. That is, there is a significant difference in visit times of different sized groups (p=0.000, F=29.238). As the group size increases, the duration of the visit extends. There is a negative relationship between group size and children's presence near the visitors, duration of the trip, age, loiter, and walking. There is a significant difference between the groups of different sizes and children's presence (p=0.000, F=8.402). As the group size decreases, children's presence near the visitors increases. As the group size increases, duration of the trip, visitor's age, loiter, and walking are reduced. There is a negative relationship between children's presence near the visitors and admission hours, duration of visit, and group size; there is a positive relationship between arrival frequency. Visitors with children usually arrive at the area early in the morning; here, they do not spend a long time, and their arrival frequency is higher than the visitors without children. There is a positive relationship between duration of the visit and duration of the trip and duration of arrival. As the duration of the visit increases, the duration of the trip extends;

Table 5. Relationship between visit and visitor characteristics

Properties		Admission hours	Group size	Children's presence	Duration of visit	Duration of the trip	Arrival frequency	Frequency of visits	Age	Hiking, walking
Group size				−0.133	0.367	−0.092			−0.190	−0.184
	Sig. (2-tailed)			0.001	0.000	0.021			0.000	0.001
Children's presence	Pearson cor.	−0.113	−0.113			−0.099		0.132		
	Sig. (2-tailed)	0.002	0.001			0.006		0.00		
Duration of visit	Pearson cor.						0.069	0.191		
	Sig. (2-tailed)						0.041	0.000		
Residence closeness	Pearson cor.		0.091					0.137		
	Sig. (2-tailed)		0.011					0.000		

p=0.00: very strong relationship, p≤0.01: strong relationship, p<0.05: existence of the relationship, −: negative relationship

Table 6. Percentage of visitors coming purposes and correlation of visit duration

Coming aim	Major effect (%)	Moderate effect (%)	Neutral (%)	Minor effect (%)	No effect (%)	Duration of visit
Residence closeness	28.4	10.8	15.2	6.4	39.1	
Sports/movement/health	19.9	14.3	16.6	15.1	34.1	
Nature-landscape passion	20.3	17.4	19	10.4	33	
Visiting the city forest	22.3	14.1	18.7	11.1	33.6	
Recreation (for hobby)	20.6	16.2	19	11	33.3	p=0.033, r=0.073
Blow off steam	48.7	22.3	8.5	4.1	16.5	
Socialness	25.6	22.6	16.6	6	29.2	p=0.002, r=0.117
Being alone in the land	18.8	8.6	12.6	14.3	45.7	p=0.025, r=−0.078
Other	11.8	4.1	6.9	3.1	73.8	

p=0.00: very strong relationship, p≤0.01: strong relationship, p<0.05: existence of the relationship, −: negative relationship
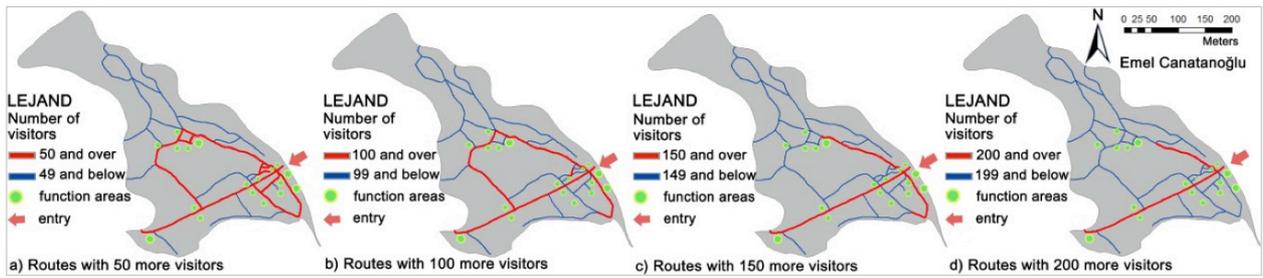
Figure 3. Visitor density of the routes in Kocaeli Urban Forest

Table 7. Percentage of activities made by visitors and correlation of trip duration

Activities	Frequently	Occasionally	None	Duration of the trip
Trip-walking	45.7	39.7	14.5	p=0.000, r=0.174
Brisk walking	10	33.1	56.7	p=0.008, r=0.096
Mountain hiking	12.7	25.4	61.7	p=0.001, r=0.125
Running	9.7	20.6	69.5	
Classic cycling	6.4	14	79.4	
Mountain biking	4.6	6.1	89.2	p=0.010, r=0.093
Mountain biking (for the race)	3.6	3.3	92.9	
Herb-mushroom picking	3.8	12.6	83.6	p=0.029, r=0.075
Picnicking (barbecue)	37.2	30.5	32	
Picnicking (e.g., sandwich)	37.4	33.8	28.6	p=0.027, r=0.077
Taking photos	40.3	31.7	27.8	p=0.004, r=0.106
Bird watching	6.8	14.3	78.7	
Walking dogs	4.1	5.3	90.3	p=0.024, r=0.078
Sledging	14.3	10.7	74.8	p=0.030, r=0.075

p=0.00: very strong relationship, p≤0.01: strong relationship, p<0.05: existence of the relationship, –: negative relationship

Table 8. Correlation between the number of visitors on the routes and road segment features

Factor	Length	Slope	Material	Width	Canopy closure
Visitor number	0	0	0	***	*

***: very strong relationship (p=0.00), **: strong relationship (p≤0.01), *: existence of the relationship (p<0.05), 0: no relationship (p>0.05)

those who come from far places spend longer times in the area. There is a positive relationship between those who arrive because the area is close to their residence, admission hours, and arrival frequency (Table 5).

Visitors mostly come to the urban forest to relieve tension and because of the closeness of the area to their residence. There is a positive relationship between the duration of the visit, socialness, and recreation when the duration of the visit and their purpose of visit are examined (for hobby); there is a negative relationship between being able to be lonely in nature/loneliness (Table 6). Visitors most often went for a walk-hike in the urban forest and took photos. As the number of trips on the routes increases, so does the number of visited segments, and the spatial distribution spreads throughout the area from the entrance. There is a relationship between the duration of the visit on the routes, trips-hikes, mountain hiking, brisk walking, mountain bike riding, taking photos, picking plants-mushrooms, picnicking, walking the dog, and sledging (Table 7).

Relationship between road segment features and distribution of the visitors to the road segments
The reasons why the visitors choose the routes they visit rank in order, from the most to the least as location-accessibility, goal-focused, random, aesthetic-landscape beauty, loneliness, attraction, function suitability of the facility, naturalness, inadequacy of the other facilities, security, dilapidation of the other facilities, and thermal comfort. The visitor density on the routes in the city forest was investigated (Figure 3). The segments where the number of visitors is >50 (a), 100 (b), 150 (c), and 200 (d) were highlighted in red (Figure 4). As the visitors density along the routes increases, the number of heavily used routes decreases and heads back toward the entrance area. The most heavily
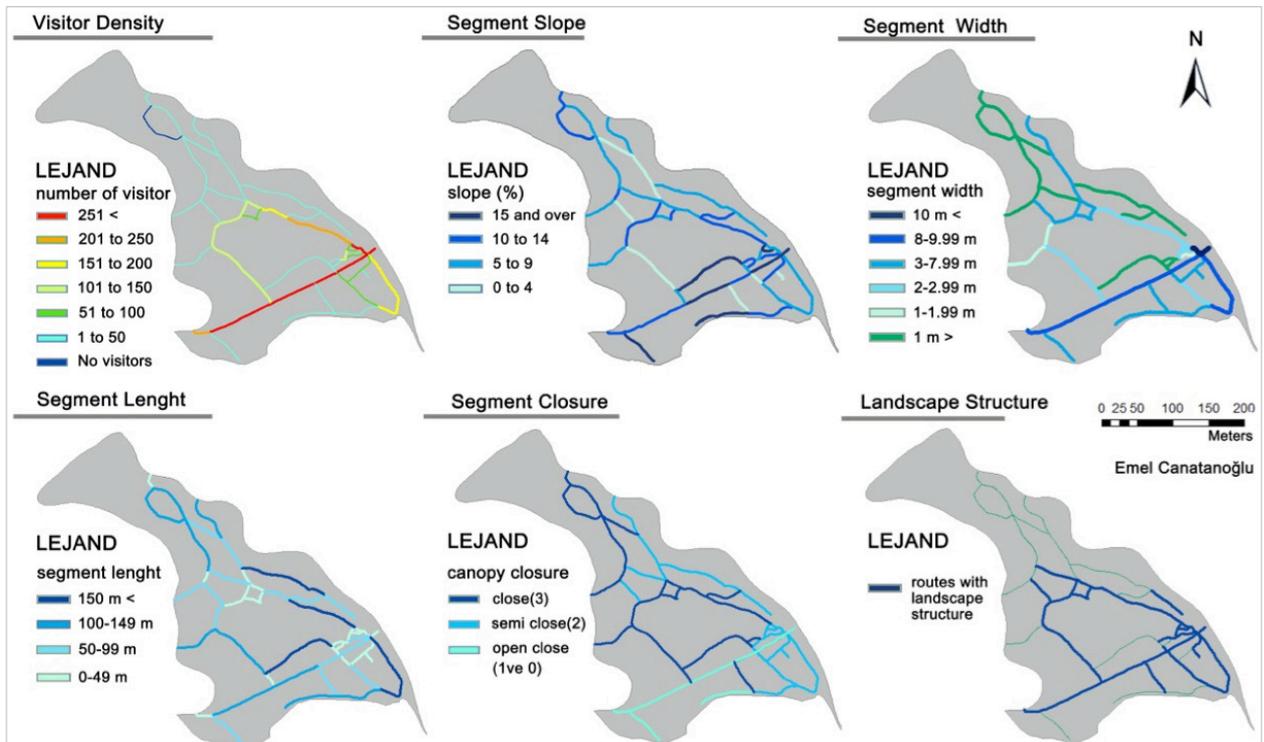
Figure 4. Relationships between road segment features and visitor density in Kocaeli Urban Forest

used segments are the ones that are close to the entrance area (location-accessibility) and the ones that provide access to the function areas (target-orientedness). In this case, there is a relationship between the visitor density along the routes and the reasons for the visitors for choosing those courses. The visitor density along the routes and the route features are shown in Figure 5.

There is a very strong positive relationship according to the analysis of the correlation between the distribution of the visitors to the routes and the route segment width (p=0.00, r=0.815). As the route segment width increases, the number of visitors along the routes also increases. According to the regression analysis, since p=0.00, the segment width affects the number of visitors along the routes positively. Of the variation in visitor density (R^2=0.665), 66% is explained by the change in segment width. Some other variables are effective for the part of the remaining 34%. A 1-unit change in the road segment width causes an average of 40 units (B1=40.649) change in visitor density. There is a positive relationship between the visitor density on the road segments and the segment closures (p=0.023, r=0.309). As the closure on the routes increases, so does the visitor density. There is no relationship between visitor density and slope, road segment length, and road segment paving material on the routes through urban forests (Table 8).

The most visited segments are divided into four zones according to the survey and observation results (Figure 5). Of the four zones, the relationship between visit and visitor characteristics was investigated (Table 9).

There is a strong positive relationship *between the first zone* and the number of visitors in April (p=0.008, q=0.105) and in September (p=0.006, q=0.110) and visitor age (p=0.002, q=0.125), whereas there is a positive relationship between the number of visitors in March (p=0.015, q=0.096). There is a strong positive correlation between duration of stay in the area (p=0.003, q=−0.120), group size (p=0.001, q=−0.136), and picnicking (barbecue) (p=0.002, q=−0.122); there is a very strong negative relationship between picnicking (sandwich) (p=0.000, q=−0.152), whereas there is a negative correlation between the duration of the trip in the area (p=0.031, q=−0.085) and visiting the area for the nature-landscape passion (p=0.043, q=−0.080).

There is a very strong positive relationship between the second zone and admission hours (p=0.000, q=0.165), duration of the trip in the area (p=0.000, q=0.393), pathway conditions (p=0.000, q=0.158), and visitors in January (p=0.000, r=0.194) and in February (p=0.000, q=0.225); there is a strong positive relationship between visiting the area for the purpose of trip and walking (p=0.001, q=0.137), taking photos (p=0.002, q=0.123), and sledging (p=0.004, q=0.113), whereas there is a positive correlation between mountain hiking (p=0.017, q=0.095), the number of visitors in July (p=0.013, q=0.099), and the number of visitors in December (p=0.022, q=0.091). There is a very strong negative correlation between group size (p=0.000, q=−0.152) and the number of visitors in May (p=0.000, q=−0.189), whereas there is a strong negative correlation between arriving for the purpose of residence closeness (p=0.007, q=−0.107). There is also a very strong negative correlation between the first zone and gender (p=0.037, q=0.083). There is a significant differ-
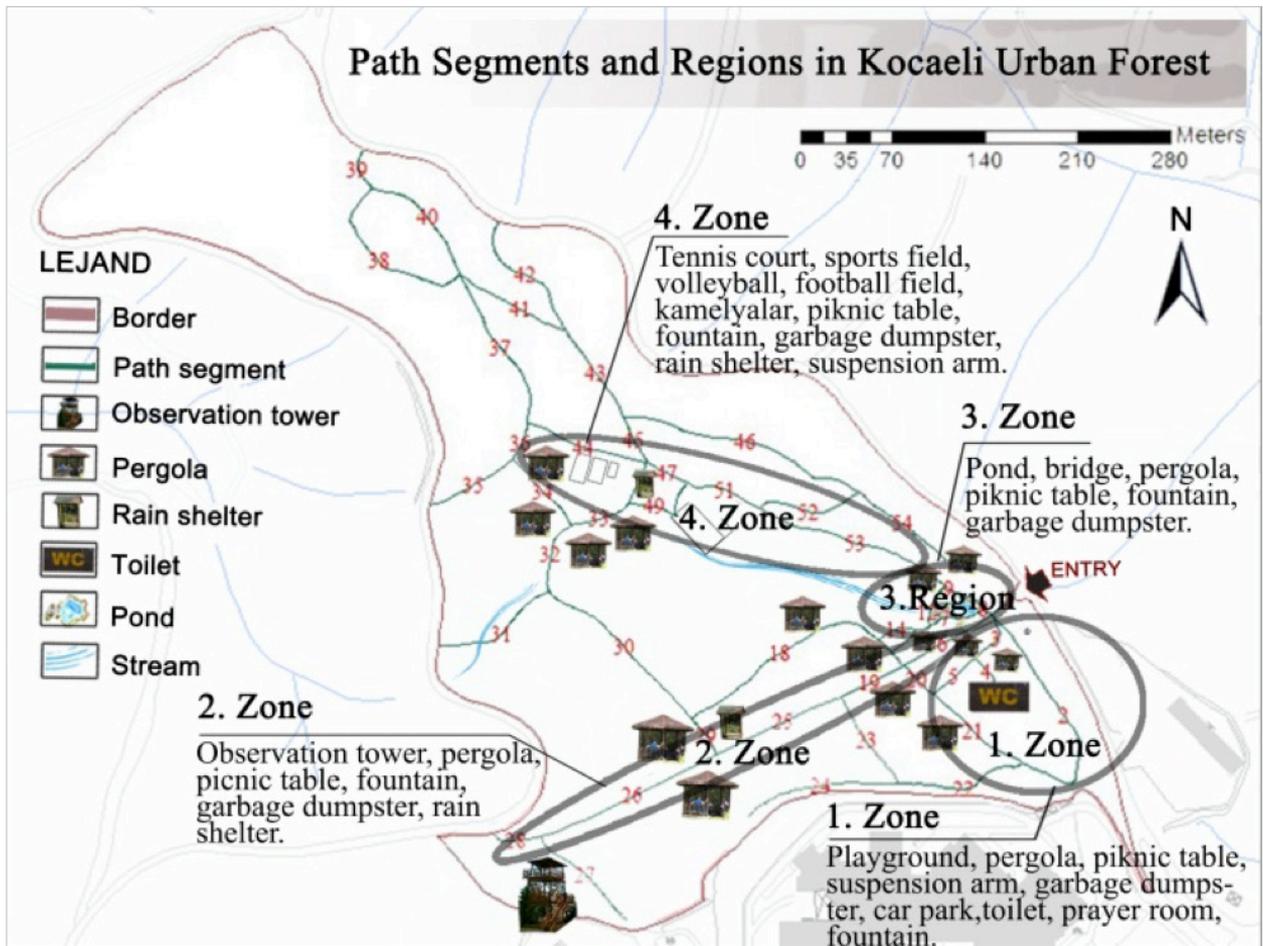
Figure 5. Intensively used road segments and zones in Kocaeli Urban Forest

ence (p=0.037, t=2.089) between the male and female groups according to the independent t-test. Male visitors are more in sight in the second zone.

There is a very strong positive correlation between the third zone and the duration of the stay (p=0.000, q=0.238) and group size (p=0.000, q=0.142); there is a strong positive relationship between the number of visitors in June (p=0.008, q=0.106) and duration of the trip in the area (p=0.001, q=0.131); there is a positive correlation between visits for the purpose of sports-movement-health (p=0.049, q=0.078), visitors in April (p=0.036, q=0.060), and visitors in May (p=0.045, q=0.079). There is a very strong negative correlation between the number of visitors in February (p=0.000, q=−0.153); there is a strong negative correlation between the number of visitors in January (p=0.003, q=−0.117); there is a negative correlation between admission hours (p=0.044, q=−0.080) and age (p=0.026, q=−0.088).

There is a very strong positive correlation between the fourth zone and the duration of the stay (p=0.000, q=0.241), the number of the visitors in April (p=0.000, q=0.145), and the number of the visitors in May (p=0.000, q=0.131); there is a strong positive relationship between the group size (p=0.001, q=0.134) and du-

ration of the trip in the area (p=0.005, q=0.113); there is a positive correlation between visits for the purpose of sports-movement-health (p=0.046, q=0.079), mountain hiking (p=0.032, q=0.085), jogging (p=0.024, q=0.089), and the number of visitors in June (p=0.016, q=0.095). There is a very strong negative correlation between the admission hours (p=0.010, q=−0.102) and the number of visitors in February; there is a negative correlation between the age (p=0.018, q=0.094). There is also a very strong negative correlation (p=0.000, q=−0.151) with gender. There is a significant difference (p=0.000, t=3.682) between the male and female groups according to the independent t-test. Male visitors are more in sight in the fourth zone. There is also a strong negative correlation (p=0.000, q=−0.151) whether visitors have their children with them or not. There is a significant difference (p=0.000, t=3.857) between the groups with and without children according to the independent t-test. Visitors with children are less available in the fourth zone.

Preferences of most of the visitors regarding the road/route/environment conditions are as follows: the pathways in the urban forest should be visited wearing sport shoes; road signs, warning signs, and legend signs must be as many as possible; there must be access restrictions only in important places; perhaps

Table 9. Relationships between visit–visitor characteristics and intensively used zones

Visit/visitor characteristic		1st zone	2nd zone	3rd zone	4th zone
Admission hours			***	_*	_**
Duration of visit		_**		***	***
Group size		_**	_***	***	**
Company of children					_***
Coming aim	Residence closeness		_**		
	Sports/movement/health			*	*
	Nature-landscape passion	_*			
Activities	Trip and walking		**		
	Mountain hiking		*		*
	Running				*
	Picnicking (barbecue)	_**			
	Picnicking (e.g., sandwich)	_***			
	Taking photos		**		
	Sledging		**		
Months	January		***	_**	
	February		***	_***	_**
	March	*			
	April	**		*	***
	May		_***	*	**
	June			**	*
	July		*		
	September	**			
	December		*		
Duration of the trip		_*	***	**	**
Pathway conditions			***		
Sex			*		***
Age		**		_*	_*

: very strong relationship (p=0.00), **: strong relationship (p≤0.01), *: positive relationship (p<0.05), _: very strong negative relationship (p=0.00), _**: extremely negative relationship (p≤0.01), _*: negative relationship (p<0.05)

there must be a couple of diner-restaurant and shop-buffet; human-made structures must be distinctly recognized; walking time to reach the destination in the forest must be 5–10 min; and one must half-hourly encounter other visitors (Table 10).

RESULTS AND DISCUSSION

In the present study, visit and visitor characteristics and spatial features, which are effective in the spatial distribution of the visitors, are presented. According to the findings obtained, the number of groups of an individual in the area is low, and one of its reasons is security concern. The security problem is one major constraint blocking the spatial distribution in the area. Talay et al. (2010) revealed that among the reasons that prevent the adequate use of recreational areas, the lack of security is perceived as an important problem by the visitors. Kurdoğlu and Düzgüneş (2011) also pointed out that the lack of security is the most important constraint. The duration of the visit and those who perform the trip-walk activity increase as the group sizes increase, whereas the duration of the trip of the visitors on the routes, the presence of children near them, and their ages decrease. The visitors with children come to the area earlier than the ones without children, and their visits last shorter and come in smaller groups. Those who come for socialness and recreation spend longer times in the area. Those who come to the area because it is close to their residence are both late and more

Table 10. Visitor preferences about road/environment/route					
Data	Category	%	Data	Category	%
Pathway conditions	Should be visited wearing heeled shoes	5.6	Bench and table	Both the bench and the table	94.6
	Should be visited wearing sport shoes	84.7		Only the bank is enough	3.5
	Should be visited wearing walking boots	9.7		Not a bench and a table	1.9
Walking time to reach the destination	5–10 s	36.6	Encounter other visitors	Continuous	15.9
	15–20 s	34.1		Every 10 min	23.8
	30 s	23.2		Half an hour	33.8
	1 h	3.5		One an hour	14.2
	>1 h	2.6		I do not meet anyone	12.3
Diner-restaurant	It can be as much as possible	19.5	Shop-buffet	It can be as much as possible	31
	Perhaps there must be a couple	47.9		Perhaps there must be a couple	56.7
	Not at all	32.6		Not at all	12.3
Road signs	It can be as much as possible	77	Warning signs	It can be as much as possible	80.9
	Perhaps there must be a couple	17.5		Perhaps there must be a couple	14.7
	Not at all	5.5		Not at all	4.4
Access restrictions	Everywhere	20.2	Legend signs	It can be as much as possible	82.2
	Only in important places	67.2		Perhaps there must be a couple	13.8
	Not to be access restrictions	12.6		Not at all	4
Human-made structures	Apparently noticeable	46.9	Destruction of vegetation cover	Destruction noticed	71.7
	Be slightly noticeable	30.4		Be less noticeable	18.7
	Inconspicuous	22.7		Be noticeable	9.6

frequent. Those whose journey time to the area is longer stay longer in the area. Visitors who stay in the area longer spend more time along the routes. As the number of trips on the routes increases, the number of visited road segments also increases, and the spatial distribution within the area is not limited to the entrance point vicinity but spreads to the whole area. In one of his studies on Vienna Danube National Park, Taczanowska (2009) also observed that there is a meaningful relationship between the duration of the visit and the route length, and that the time spent is related to the length of the path.

Those who perform activities, such as outing-trekking, mountain hiking, mountain biking, taking photos, brisk walking, walking dogs, picnicking, picking up herbs and mushrooms, and sledging, respectively, stayed on the routes longer. The ones who stayed on the routes the longest are the ones who go for outing-hiking. Taczanowska (2009) stated that the stays of >4 h have higher variance than those of 2 h, which is why the majority of the visitors, especially the hikers, take long pauses while performing their activities.

There is no correlation seen between visitor density and slope and segment length on the routes, whereas the number of visitors on the routes increases as the route segment width and the stand closures increase. Taczanowska (2009) found a linear

relationship between the breadth of the road and the number of visitors and preferability. Gül and Kurdoğlu (2002) ascertained that stand closure, living cover, and density and distribution of the trees increase the visual quality on Fırtına Valley. Ribe (1989) reported that the more the closure increases, the less the landscape is perceived. Of those whose stand density is medium according to low-to-high conditions, older trees are more appreciated than younger ones. There is no relationship between the road paving material and the number of visitors because 50 out of the 54 segments in the area are stabilized in the urban forest.

According to the findings obtained from the relationship of the visit and visitor characteristics to the zones in the urban forest, of the visitors who prefer the first zone, the duration of sightseeing trip and visit is shorter. Those who came for the purpose of picnicking and nature-landscape passion preferred that zone less. In that zone, children's playgrounds and sitting areas are nested, and the region is on the roadside. For that reason, visitors who are in search of picnic and nature-landscape do not prefer this region. Sightseeing duration of the visitors who opt for the second zone is longer. More men than women spent time here. In addition, visitors who go for a stroll-walk, who take photos, and who sledge are many. Especially in Winter, the most visited segments are in that zone. Visitors use the fire safety road in the urban forest for sledging on snowy days. Therefore, this region is visited

most during the Winter months. In addition, on snowy days, road segments in other regions not being suitable for transportation increase the intensity in the second region. The duration of sightseeing trip and visit of the visitors who prefer the third zone is longer. There are ponds and recreation areas in this area. Visitors who come for the purpose of sports-movement-health choose that zone. Despite the road segments in the region are narrow and sloping, one of the most important reasons for being one of the most favorite regions is the existence of the water feature. It has been shown in various studies that water feature enhances visual landscape quality (Kıroğlu, 2007; Bulut et al., 2010). Of the visitors who opt for the fourth zone, the duration of sightseeing trip and stay is longer. As the group sizes increase, so does the preference degree of the region. Visitors who mostly perform activities, such as sports-movement-health, mountain hiking, and jogging, more likely prefer that zone because in that zone, there are facilities, such as playfields, playgrounds, picnic sites, recreational areas, and fountains. Many studies put forward that recreational facilities, such as picnic tables, fountains, playgrounds, and bicycle tracks, increase the recreational potential at that place (Kurdoğlu and Düzgüneş, 2011; Ateşoğlu, 2008).

Erkkonen and Sievänen (2002) recommend that visitors be asked about road preparation and increasing or decreasing the amount of service. According to the findings of the questions about the road/environment/route conditions asked for this purpose, the majority of the visitors would like to have as many bench-table and shop-buffet but one or two restaurants in the city forest. Most desire pathway conditions to be suitable for sport shoes. The vast majority of the visitors would like to have road signs, warning signs, legend signs on the roads, and some restrictors, such as pontoons, ropes, and strips, as many as possible. Taczanowska (2009) mentioned that signposts and waymarks increase the motivation of the visitors. However, there is no relationship between the frequency of sightseeing and satisfaction in urban forests.

Knowing the visit–visitor characteristics in revealing the spatial distributions of visits becomes more of an issue, in determining the locations of such areas, in determining the functions to be brought into the area, in guiding the flow of visitors in the area, and in determining the facility characteristics of the routes in the area. Associating spatial features in recreation areas to visit–visitor characteristics will provide convenience in meeting the needs and demands of the visitors and being directed to spatially desired areas. By this means, when recreational areas are being planned, it will be possible to meet the visitors' wishes and demands better, on the one hand, and to keep the visitors away from the areas that need to be protected, on the other hand. Thus, both the maximum benefit from the area will be achieved, and a sustainable recreational area where other creatures can also survive will be created. In conclusion, knowing the spatial attitudes of the visitors in recreational areas and their interactions with the environment will shed light on the studies to be conducted in the future.

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