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Examining the Level of Service in the Context of Recreational Carrying Capacity in the Erzurum Urban Forest, Turkey

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Abstract

Urban forests are confronted with high using pressure because of the increasing demand for recreation and accessibility of these settings. For that purpose, defining and managing recreational carrying capacity is considered as significant in ensuring ecological value's and recreational satisfaction's continuity. The purpose of this paper is to investigate the carrying capacity of Erzurum Urban Forest with respect to Level of Service (LOS) as a new management technique that focuses on service quality and visitor satisfaction. The data were obtained by self-administered questionnaire conducted with 166 visitors on weekends and holidays during summer season of the year 2014. Data were analyzed by dimensions/indicators of recreational satisfaction and socio-demographic characteristics with intent to identify tolerance range of visitors. The contribution and relative importance of each of the indicators to the overall satisfaction were analyzed by using Ordinal Logistic Model (OLM). The results indicated that the four indicators were at the greatest degree; "distance from picnic spot to toilets" and "quantity of children's playground facilities" were decease of overall satisfaction while "distance from picnic spot to parking" and "level of shade at picnic spot" had a positive contribution to the overall satisfaction. The outputs from these analyses were used to calculate LOS. It was revealed that the level of service (0.40) in Erzurum Urban Forest was below the moderate level. Planning and managing strategies for optimizing the LOS were developed and discussed by considering these results.

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Keywords

Recreational Carrying Capacity, Level of Service, Visitor Satisfaction, Recreation Planning and Management, Erzurum Urban Forest

1. Introduction

Outdoor recreations are widely recognized as an important element in people's lives [1] [2]. Today there are large numbers of people using urban forests for their recreation. Urban forests not only provide physical and biological benefits, but also contribute to human well-being in urban environments by offering refuges from hectic city life and the work environment [3]-[5]. At the same time, these parks are confronted with high use pressure because of the increasing demand for recreation and accessibility of urban forest settings [6]. One main challenge for the forests' management is to contend with negative impacts of visitor use on both natural environment and visitors' recreational experience [7] [8]. For that purpose, forest managements strive to balance preservation and use to investigate the acceptable level of recreational use that can be sustained by the environmental resources of the recreational forest area [9]. This effort has often been mentioned as defining and managing recreational carrying capacity [10]. The main purpose of this research is to analyze the carrying capacity of Erzurum Urban Forest with using Level of Service (LOS) as a new management technique that focuses on recreation experience [11]. The study has three goals in the scope of main purpose. The first goal of this study is to identify, on the basis LOS concept, the tolerance range of indicators that are functions components of satisfaction. The second goal is to identify indicators, which are more effective on overall visitor satisfaction in Erzurum Urban Forest and the third goal is to calculate LOS and bring forward a proposal on planning and management.

Carrying Capacity: In its most generic form, carrying capacity refers to the amount of activity or use that can be accommodated in recreational settings before it begins to deteriorate. Another way to describe carrying capacity is determining maximum use level that recreational settings can absorb, before unacceptable impacts occur [12]. It was recorded the first recommendation for applying the concept of carrying capacity to outdoor recreation in the mid-1930's as a park management concept. But the development of recreation carrying capacity concept started with Wagar's (1964) [13] monograph and subsequent paper on the topic, which Wagar indicated as the more recreational use could affect, not only the natural and cultural resources values of the area but also the quality of recreational experience [14]. From this point of view, 4 dimensions (Physical, Social, Ecological and Managerial) of carrying capacity were identified in the process of time. Physical capacity is defined as the maximum number of visitors occupying specific areas, numbers of parties per site and the physical characteristics of sites and percent occupancy for various facilities. Social capacity is the maximum visitor use above which there is a decline in the quality of the recreation experience. This component is concerned with social impacts, such as visitors' perceptions of crowding. Ecological carrying capacity is the maximum level of visitor use, which can be accommodated by an ecosystem before an unacceptable or irreversible decline in natural and cultural values such as the loss of ground cover, impacts on wetlands and riparian communities, observed soil compaction and soil erosion, and observed trash accumulation and sanitary problems. Management capacity is defined as the maximum number of visits that a site can sustain considering the administrative facilities. It can also be defined as the level of use of a site that is required to yield a given financial return and also as the amount of income that local people provide by tourism/ecotourism [2] [9] [15] [16]. Determining carrying capacity is linked with the practical problems involved in difficultness of absolute measurable conditions [12] [17]. The capacity of a park also varies depending on the place, season, time, user behavior, facility design, patterns and levels of management, and the dynamic character of the environmental elements [18]. In spite of these severe challenges, carrying capacity is accepted as a useful concept for determining desirable conditions, unacceptable impacts and use levels that affect conditions [19].

Planning and Management Frameworks: A number of planning and decision-making frameworks were developed by researchers to help planners and managers with address visitor impacts or capacity, including Recreation Opportunity Spectrum (ROS) [20]; Limits of Acceptable Change (LAC) [21]; Visitor Activity Management Process (VAMP) [22]; Carrying Capacity Assessment Process (C-CAP) [15]; Visitor Impact Management (VIM) [23] and Visitor Experience and Resource Protection (VERP) [24]. Although all frameworks differ

from each other in terms of orientation, emphasis, terminology and specific steps are also the common traits [25]. All these frameworks suggest the necessity of measuring indicators to elicit standards of quality for acceptable conditions [26]. Manning *et al.* (1996) [27] identified that indicators of quality were specific, measurable variables that defined the quality of the recreation experience. Standards of quality define the minimum acceptable condition of each indicator variable. Outdoor recreation can be functionally planned, monitored, and managed with defining indicators and standards of quality. Facilities and services for visitors can be planned to ensure that the standards of quality are met [28]. Overall visitor satisfaction is a function of various indicators, which are components of recreational services and facilities, natural and cultural resources and recreational use levels [29]-[34]. In a sense, the visitor satisfaction is a function of the multiple features of the natural, social and managerial environment, and recreational activity [35]-[38]. By defining indicators and standards of quality, recreational areas can be pleasingly planned, monitored, and managed. Also, indicators of quality can be monitored over time, and if appropriate, management action can be taken in a way not to exceed standards of quality [11]-[32]. In an attempt to estimate the total visitor satisfaction of visitors, Fleishman and Feitelson (2003) [11] adapted Level of Service (LOS) to recreation areas as a new management technique. The LOS concept was first developed for transportation system. Since then, this method has been developed for pedestrian flows, bicycle flows, pedestrian walkways and viewing platforms of National Park [39] and also forest based recreation [11]. Overall user satisfaction is an important criterion for determining level of service [40] [41]. It is a function of overall satisfaction from each of the service components according to its relative importance for the visitors [32] [42]. This method is based on measured and monitored indicators, which are used to determine visitor satisfaction. This approach enables to determine the values of each of the indicators and their contribution to the overall satisfaction of visitors, who are involved in a particular recreational activity quantified.

2. Material and Methods

Study Area: Erzurum Urban Forest is located 5 km South West of the city center of Erzurum (**Figure 1**). The park is situated on steep with an area of 717 ha. The forest, surrounded by both planted and natural woodlands, which are mainly Pinussylvestris and Betula pendula and Salix alba. In this urban forest, approximately 1075.5

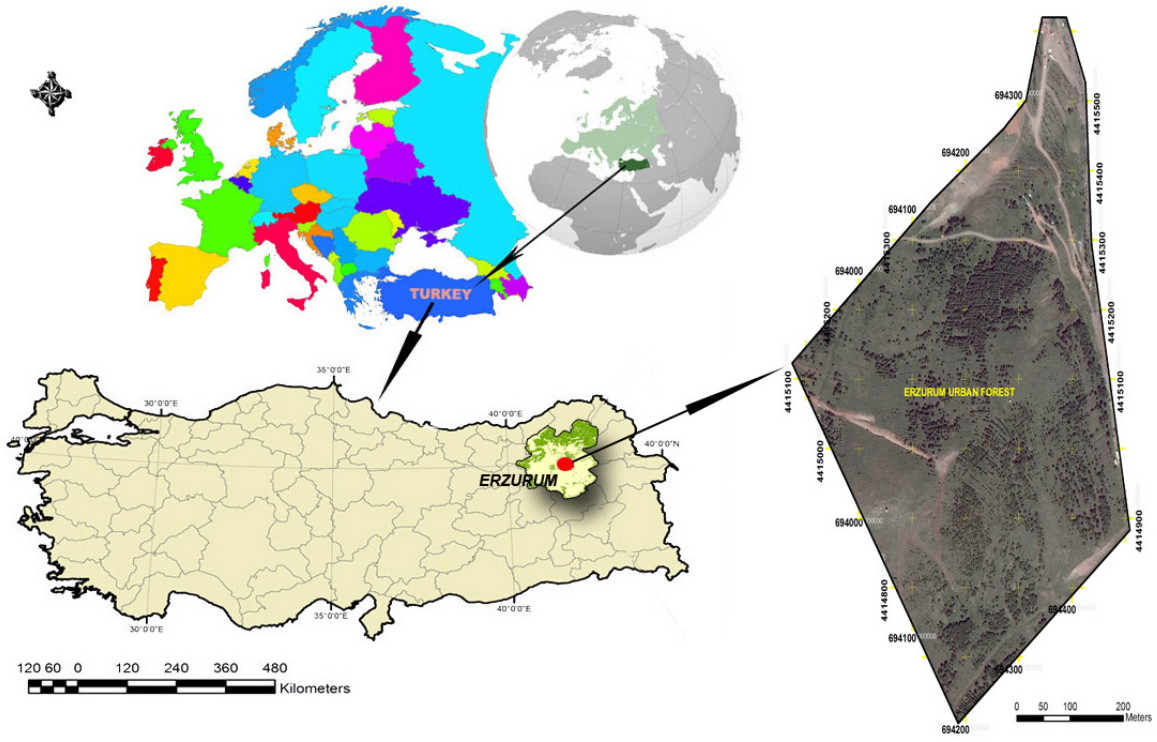

Figure 1. Location of forest.

tons of carbon is stored. This corresponds to 3943.5 tons of carbon dioxide in the atmosphere. The avifauna in the park area includes pigs, foxes, moles, squirrels, rabbits [43].

According to the accounting records, the average of the last 4 years, the annual number of visits to the area is 11000. The major recreational activity in the forest is picnics. Most use occurs during summer, because of the higher and more comfortable daytime temperature. The forest is equipped with recreation facilities, including picnic areas, observation terrace, spring and children's playgrounds (**Figure 2**). There are 2 pergolas, 23 picnic tables, 2 toilet units, 1 playground and 16 rubbish bins. Erzurum Urban Forest managed by Erzurum Regional Directorate of Forestry, The forest primarily serves the local people of Erzurum City in the vicinity of the forest. Through the existing road network, the accessibility to the forest is easy [43].

Methods: The geographical, biological, physical, managerial characteristics and the annual visits of the research area were inquired. Data concerning the demographics and visitor satisfaction levels were collected using a questionnaire survey, administrated on-site on weekends and holidays during summer season of 2014, periods known to be the peak seasons. The onsite survey was conducted among private visitors, usually a group of family members and/or friends. The visitors sampled, over the age 18, were asked to participate in the study and to fill out self-administered questionnaire. 166 were useable questionnaires from the 200 respondents sampled; the response rate was 83%. The carrying capacity was assessed by using Level of Service (LOS) methodology, which was adopted by Fleishman and Feitelson (2009) [11]. This method comprises the following steps.

Identifying sources of satisfaction for a recreational activity: For the purpose of identifying the sources of satisfaction for a recreational activity such as picnics in forests, possible dimensions of satisfaction for picnic recreation in forests were delineated. These dimensions and the indicators, which were used for assessing this each of dimensions, are presented in the following **Table 1**.

Identifying the minimum acceptable level and ideal level of the tolerance range: In order to identify tolerance level it is necessary to identify the minimum acceptable level and the ideal level. Tolerance level represents the range between ideal level and minimum acceptable level. The minimum acceptable level of the tolerance range is a threshold leaving the recreational site earlier or choosing alternative recreational sites. This threshold is a function of visitors' individual traits. The ideal level means average suitable condition level for recreation. In order to identify minimum acceptable level and ideal level of the tolerance range generic method was implemented. This method based upon visitors' opinions on a request to specify the level of each indicator, which might cause displacement, and average suitable condition. Each of indicators' level of services (indicator levels and their scale of measurement) have been defined by Fleishman and Feitelson (2009) [11] according to the picnic activities in the urban forests as in **Table 2**.

Figure 2. Recreational use map.

Table 1. Dimensions and indicators for picnic recreation.

Dimensions	Indicators
Location, capacity and occupancy of the parking lot	Time searching for a parking space.
	Distance from picnic spot to parking.
Location, number and quality of service facilities	Time searching for a picnic spot.
	Number of available picnic tables at picnic site.
	Distance from picnic spot to adjacent group.
	Quality and maintenance level of tables.
Location, number, quality and access to sanitary facilities	Quality and maintenance level of toilets.
	Distance from picnic spot to toilets.
	Distance from picnic spot to water taps.
Number, quality and access to recreational facilities	Quantity of children's playground facilities.
	Quantity of sport facilities.
	Distance from signs to signs.
	Quality and maintenance level of children playground facilities.
	Quality and maintenance level of sport facilities.
Cleanliness and shady vegetation in picnic area	General cleanliness.
	Level of shade at picnic spot.
Level of personal security in the setting	Security level at site.

Table 2. Levels of service by indicators.

Indicators	Levels of service[a]			
	4	3	2	1
Time searching for a parking space	Up to 5 min	5 - 10 min	10 - 15 min	More than 15 min
Time searching for a picnic spot	Up to 5 min	5 - 10 min	10 - 15 min	More than 15 min
Number of available picnic tables at picnic site	More than 2/3	2/3 - 1/3	1/3	Less than a third
Distance from picnic spot to adjacent group	More than 20 m	10 - 20 m	5 - 10 m	Up to 5 m
Distance from picnic spot to parking	Up to 5 m	5 - 15 m	15 - 30 m	More than 30 m
Distance from picnic spot to toilets	20 - 40 m	40 - 60 m	60 - 100 m	More than 100 m
Distance from picnic spot to water taps	Up to 5 m	5 - 10 m	10 - 20 m	More than 20 m
Distance from signs to signs	40 - 60 m	60 - 100 m	100 - 200 m	More than 200 m
Quantity of children's playground facilities	5 - 6 in area	3 - 4 in area	1 - 2 in area	None
Quantity of sport facilities	5 - 6 in area	3 - 4 in area	1 - 2 in area	None
Quality and maintenance level of tables	All tables clean and whole	Most tables clean and whole	Most tables dirty and broken	All tables dirty and broken
Quality and maintenance level of toilets	Flush toilet and clean	Squatting toilet and clean	Flush toilet but dirty	Squatting toilet but dirty
Quality and maintenance level of children playground facilities	All of them clean and whole	Most of them clean and whole	Most of them dirty and broken	All of them dirty and broken
Quality and maintenance level of sport facilities	All of them clean and whole	Most of them clean and whole	Most of them dirty and broken	All of them dirty and broken
Level of shade at picnic spot[b]	4	3	2	1
General cleanliness[c]	4	3	2	1
Security level at site	Full sense of security	Some worry in remote areas	Worry to visit site	No sense of security at all

[a]The numbers delineated levels of service on dimensions match the scores 1-4, where the score 1means "lowest level of service", score 4 means "highest level of service". [b]Level of shade at the site is depicted by means of photographs whose numbers match the scores 1-4, where the score 1 means "low level of shade", score 4 means "high level of shade". [c]Level of general cleanliness at the site is depicted by means of photographs whose numbers match the scores 1-4, where the score 4 means "very clean", the score 1 means "very dirty".

Visitors remarked two different values as the minimum and ideal acceptable level for each one of the indicators. The minimum ideal acceptable service level for each of the indicators was identified according to the degree of consensus among visitors. In other words, values which conform to the largest group of visitors were defined as the minimum acceptable level and ideal acceptable level for each indicator.

Many of these indicators have quantitative characteristics such as "time sent searching for a parking space"; therefore, the levels of them can be measured with a numerical scale. Besides this, two indicators (degree of shading in picnic grounds and cleanliness) have qualitative characteristics. In such cases, computer simulation modelling is used to measure these indicators, which involves using software to manipulate and create visuals [44] [45]. Visuals provide a realistic and cognitively easy assessment of indicators so they provide convenience for respondents to choose conditions that would be like [46] [47]. This technique have widely preferred for describing environmental or social indicator impacts [26] [44] [46] [48]-[51]. Computer simulation modeling was used to prepare two series of photographs which represent two qualitative indicators; shading and cleanliness range. The number and size of thrashes in the images were measured by 4-color-photographs representing level of cleanliness of the site. The number of trashes was detected at four different levels, which increase arithmetically. The cleanliness simulation series were presented in **Figure 3**. The second simulation series, represented the shading indicator levels, were also prepared with the same technique.

Identifying perceived level of service and satisfaction degree of visitors: In order to identify perceived level of service and satisfaction degree of visitors, the site-based method was implemented. The perceived level represents the level, which visitors decided taking into account during their visiting experience. The visitors' degree of satisfaction from each indicator and also overall satisfaction from the visit were measured by the five-point likert-type. In this response scale the lowest level (1) signifies dissatisfaction and the highest level (5) means full satisfaction.

Identifying level of service: This process includes several steps. First, the contribution of the different indicators to the visitor's overall satisfaction from the visit is identified with a statistical analyses based on Ordinal Logistic Model (OLM). This model analyzes the possibility of different levels of overall satisfaction as a function of the satisfaction levels from each one of the indicators. The results of the model reveal the key indicators that influence overall satisfaction to the greatest degree in recreational site. In order to elicit the relative importance of the key indicators influencing overall level of satisfaction, Likelihood-Ratio Chi Square test is carried out. The relations between source Likelihood-Ratio Chi Square and Whole Model Likelihood Chi Square Difference and also standardized coefficient is investigated to answer the question of which of the key indicators have a greater effect on the overall satisfaction in this regression analyze.

Figure 3. Simulation series which is represented shading indicator levels.

Finally, the overall level of service is calculated by the following formula.

$$\mathrm{LOS}_j = \sum_{i=1}^{n} \frac{\alpha_i \left(x_{ij} - x_{il}\right) \Big/ \left(x_{iu} - x_{il}\right)}{n} = \sum_{i=1}^{n} \frac{\alpha_i \mathrm{LOS}_{ij}}{n}$$

where x_{ij} is the perceived level of indictor i, x_{iu} is the ideal level of indicator i and x_{il} is the minimum acceptable level of indicator i. Therefore $(x_{iu} - x_{il})$ is the tolerance range along indicator i. α_i is a coefficient that states the relative importance of indicator i originated in the logistic model and n is the number of indicators that are the most important on the overall satisfaction identified by OLM. Usually LOS value varies from 0 to 1 scale.

3. Results

Demographic profile of respondents: **Table 3** summarizes the demographic profile of the study respondents. Most of the respondents were female (57.8%), 18 - 34 (45.2%) or 35 - 49 (37.3%) age groups, had at least a university degree (58.4%), lived in Erzurum city (85.5), married (73.5), had 1 - 2 children (45.2) and had a household income less than 2000 TL (38.6%) or between 2001 TL and 4000 TL (45.2%).

The minimum acceptable level and the ideal level of the tolerance range: In order to identify a minimum acceptable level and ideal level of the tolerance range, the generic method was implemented. For this purpose, visitors were asked to evaluate alternative four different level of each indicator and they decided on which one was describing the preferred (ideal) level of each indicator and which indicator was describing the conditions that makes it unacceptable to visit that site (minimum acceptable level). At least 40% of the respondents agreed at the same degree of satisfaction from an indicator, which was approved as representative and reasonable. In this study, the general cleanliness indicator and level of shade was measured with four photographs depicting the number and size of thrashes 0 to 15 pieces of thrashes with the number of trashes doubling in each image (*i.e.* 0, 5, 10 and 15) and the size of space covered by shadow doubling in each image (*i.e.* 0% of site, 25% of site, 50% of site, 75% of site).

Table 4 shows the majority of respondents' opinion about the minimum acceptable level and ideal level of the indicators. Most visitors reported that time searching for a parking space and picnic spot for 5 - 10 minute was tolerance threshold, while up to 5 minute was ideal duration, the playground and sport facilities need to be at least 1 - 2 units and preferably 3 - 4 units at the picnic site, proximity of the adjacent group 5 - 10 m was the

Table 3. Description of survey respondents (N = 166).

***"Socio-demographic variables percent* (%)"**			
Gender	**%**	***Family status***	**%**
Female	57.8	Married	73.5
Male	42.2	Bachelor	26.5
Age		***Number of children under* 18**	**%**
18 - 34	45.2	None	34.3
35 - 49	37.3	1 - 2	45.2
50 or above	17.5	3	16.9
Educational level	**%**	>3	3.6
Primary school	10.2	***Household income***	**%**
High school	31.3	Less than 2000 TL (less than 668 €)	38.6
University or above	58.4	2001 TL-4000 TL (669 € - 1336 €)	45.2
Place of residence	**%**	4001 TL-7000 TL (1337 € - 2338 €)	12.7
Erzurum city	85.5	More than 7001 TL (more than 2339 €)	3.6
Another city	14.5		

Table 4. Tolerance range for the Erzurum Urban Forest.

Indicators	Minimum acceptable level			Ideal level		
		Score	%		Score	%
Time searching for a parking space	5 - 10 min	3	51.8	Up to 5 min	4	68.1
Time searching for a picnic spot	5 - 10 min	3	50.6	Up to 5 min	4	47.0
Number of available picnic tables at picnic site	1/3	2	42.8	2/3 - 1/3	3	42.2
Quantity of children's playground facilities	1 - 2	2	47.0	3 - 4	3	53.6
Quantity of sport facilities	1 - 2	2	52.4	3 - 4	3	48.2
Distance from signs to signs	More than 200 m	1	42.2	40 - 60 m	3	48.2
Distance from picnic spot to adjacent group	5 - 10 m	2	44.6	More than 20 m	4	43.4
Distance from picnic spot to parking	15 - 30 m	2	44.0	5 - 15 m	3	42.2
Distance from picnic spot to toilets	60 - 100 m	2	42.2	40 - 60 m	3	44.6
Quality and maintenance level of children playground facilities	Most of them clean and whole	3	50	All of them clean and whole	4	76.5
Quality and maintenance level of sport facilities	Most of them clean and whole	3	50	All of them clean and whole	4	76.5
Level of shade at picnic spot[b]	2	2	48.8	3	3	45.2
Distance from picnic spot to water taps	10 - 20 m	2	42.8	Up to 5 m	4	42.2
Quality and maintenance level of toilets	Squatting toilet and clean	3	54.8	Squatting toilet and clean	3	72.9
Quality and maintenance level of tables	Most of them clean and whole	3	50	All of them clean and whole	4	76.5
Security level at site	Full sense of security	4	51.8	Full sense of security	4	85.5
General cleanliness	3	3	59.6	4	4	94.6

tolerance threshold and more than 20 m was ideal distance, shaded areas at a picnic spot should not be less than 25%, while 50% of the area should ideally was in shade. It is revealed that there was no difference between the minimum acceptable level and the ideal level from two indicators, which were the quality, and maintenance level of toilets and security level at site. Namely, a majority of the visitors did not approve any decrease in the quality of both of indicators. This means that there was no tolerance range for these indicators.

Identifying perceived level of service and satisfaction degree of visitors: In order to identify a perceived level of service by the site-based method, visitors were asked to evaluate alternative four different level of each indicator and decide on the one described the actual level of each indicator according to their recreation experience. Then, visitors were asked to give a value of their satisfaction from each indicator, which was exposed during recreation experience. The visitors' degree of satisfaction from each indicator and also the overall satisfaction from the visit, were measured by the five-point likert-type.

Visitor comments about perceived level of service were exhibited in **Table 5**. Most visitors experienced and predicated that the only five indicators levels were at score 3. According to levels of service by indicators which were shown **Table 2**, the numbers delineated levels of service on dimensions match the scores 1-4, where the score 1 means "lowest level of service", score 4 means "highest level of service". It is inferred that although none of the indicators were experienced at the highest level, the indicators; "time searching for a parking space", "distance from picnic spot to adjacent group", "level of shade at picnic spot", "security level at site" and "general cleanliness" were experienced higher than other indicators. In addition to these, "number of available picnic tables at picnic site", "distance from signs to signs", "distance from picnic spot to toilets" and "quality and maintenance level of toilets" were experienced at the lowest level by respondents.

The conclusions in **Table 6**, expressed that none of the indicators was perceived to be at the "satisfied" or

Table 5. Perceived levels of Erzurum Urban Forest.

Indicators	Perceived levels of service	Score	%
Time searching for a parking space	5 - 10 min	3	42.2
Time searching for a picnic spot	10 - 15 min	2	40.4
Number of available picnic tables at picnic site	Less than a third	1	48.2
Quantity of children's playground facilities	1 - 2 in area	2	66.3
Quantity of sport facilities	1 - 2 in area	2	93.4
Distance from signs to signs	More than 200 m	1	90.4
Distance from picnic spot to adjacent group	10 - 20 m	3	63.3
Distance from picnic spot to parking	15 - 30 m	2	49.4
Distance from picnic spot to toilets	More than 100 m	1	50.6
Quality and maintenance level of children playground facilities	Most of them dirty and broken	2	75.3
Quality and maintenance level of sport facilities	Most of them dirty and broken	2	75.3
Level of shade at picnic spot	3	3	55.4
Distance from picnic spot to water taps	10 - 20 m	2	55.4
Quality and maintenance level of toilets	Squatting toilet but dirty	1	71.1
Quality and maintenance level of tables	Most of them dirty and broken	2	59.0
Security level at site	Some worry in remote areas at site	3	53.0
General cleanliness	3	3	52.4

Table 6. Distribution of visitors according to degree of satisfaction from different indicators.

Indicators	Satisfaction degree[a] (percent)					
	1	2	3	4	5	Aver. score
Time searching for a parking space	10.8	20.5	**40.8**	19.5	8.4	2.95
Time searching for a picnic spot	22.3	24.5	**40.7**	7.7	4.8	2.48
Number of available tables	11.4	**46.4**	27.1	14.5	0.6	2.46
Quantity of children's playground facilities	10.8	**54.2**	22.9	11.4	0.6	2.37
Quantity of sport facilities	31.9	**42.8**	16.9	7.2	1.2	2.03
Quantity of signs	10.8	**46.4**	22.9	18.7	1.2	2.53
Distance from picnic spot to adjacent group	4.2	22.3	**42.8**	27.1	3.6	3.04
Distance from picnic spot to parking	6.6	31.9	**45.8**	13.3	2.4	2.73
Distance from picnic spot to toilets	9.0	**43.4**	33.7	11.4	2.4	2.55
Distance from picnic spot to water taps	6.6	**41.6**	36.1	12.0	3.6	2.64
Distance from picnic spot to garbage cans	13.9	**43.7**	23.9	16.1	2.4	2.49
Quality of tables (clean and whole)	7.2	**52.4**	28.9	10.2	1.2	2.46
Quality and maintenance level of children playground facilities	9.6	**53.6**	27.1	8.4	1.2	2.38
Quality and maintenance level of sport facilities	16.9	**48.8**	25.9	7.8	0.6	2.27
Quality and maintenance level of toilets	24.7	**44.6**	19.9	10.2	0.6	2.17
General cleanliness	5.4	36.1	**42.2**	15.1	1.2	2.70
Security level at site	11.4	31.3	**40.2**	16.5	0.6	2.63
Level of shade at site	2.4	25.9	**49.4**	18.7	3.6	2.95
Crowding perception	11.4	19.5	**40.2**	18.7	10.2	2.97
General satisfaction	3.0	24.7	**51.8**	17.5	3.0	2.93

[a]1 = completely dissatisfied, 2 = dissatisfied, 3 = moderately satisfied, 4 = satisfied and 5 = completely satisfied.

"completely satisfied" degree by visitors. Most of the respondents were "moderately satisfied" from time searching for a parking space (40.8%), time searching for a picnic spot (40.7%), distance from picnic spot to adjacent group (42.8%), distance from picnic spot to parking (45.8%), general cleanliness (42.2%), security level at site (40.2%), level of shade at site (49.4%), crowding perception (40.2%), general satisfaction (51.8%). On the other hand, quality, quantity, maintenance and proximity of most facilities were proved unsatisfactory. Most of the respondents were "dissatisfied" from number of available tables (46.4), quantity of children's playground facilities (54.2), quantity of sport facilities (42.8), quantity of signs (46.4), distance from picnic spot to toilets (43.4), distance from picnic spot to water taps (41.6), distance from picnic spot to garbage cans (43.7), quality of tables (clean and whole) (52.4), quality and maintenance level of children playground facilities (53.6), quality and maintenance level of sport facilities (48.8), quality and maintenance level of toilets (44.6). The findings reveal that only 4 of the all indicators were reported to be at "moderately satisfied" degree. Most of the indicators were dissatisfying for visitors. Correspondingly, it was determined that the average scores of these indicators were closer to the "dissatisfied" degree (2). The average scores were examined, it was shown that the satisfying degree from each of the indicator was between at "dissatisfied" (2) and "moderately dissatisfied" (3) level. The lowest satisfaction averages pertain to quantity of sport facilities (2.03), quality and maintenance level of toilets (2.17) and the highest level of satisfaction averages pertain to distance from picnic spot to adjacent group (3.04) and crowding perception (2.97).

Level of Service: In order to calculate LOS (Level of Service), the probability of different levels of overall satisfaction as a function of the satisfaction levels from each one of the indicators were analyzed by using Ordinal Logistic Model (OLM). Both the dependent and the independent variables, which were at the original five-point survey scale, were used to evaluate visitor satisfaction and they were converted into three values. These three values converted respectively: 1, dissatisfied (converted values 1 "Completely dissatisfied" and 2 "Dissatisfied"); 3, moderately satisfied; 5, satisfied (converted values 4 "Satisfied" and 5 "Completely Satisfied").

All of the indicators, which were designated in **Table 4** were measured with using OLM. The results are indicated that, only four indicators of overall satisfaction were at the greatest degree. These indicators, which are "distance from picnic spot to parking", "distance from picnic spot to toilets", "quantity of children's playground facilities", and "level of shade at picnic spot" are presented in **Table 7**. The effects of intensity on the overall satisfaction (depended variable) were deduced from the size of parameter estimates, while the direction of the effect of independent variables on overall satisfaction level was revealed from the signs of estimates. This means that negative sign of the parameters probably causes the decrease of overall satisfaction. Consequently, the parameters, which are "distance from picnic spot to toilets" and "quantity of children's playground facilities", decrease of overall satisfaction while "distance from picnic spot to parking" and "level of shade at picnic spot" have a positive contribution to the overall satisfaction.

The overall level of service is the average weighted sum of these indicators. The weighting indicates the importance of the indicators, as derived from the Logistic Model. The relation between Likelihood-Ratio Chi Square for each indicator in the model and Whole Model Likelihood Chi Square Difference was regarded to be the convenient measure of the relative importance of the indicator. **Table 8** shows the estimations, which indicate the relative importance of indicators' effect on overall level of visitor satisfaction.

Also, the indicators that were identified as the most important on overall satisfaction were compared with their perceived levels, minimum acceptable levels and ideal levels (**Table 9**). It is shown that only perceived level of "level of shade at picnic spot" is equal to the ideal level, while the other indicators' perceived levels are below the ideal levels.

Table 7. Contribution of different indicators to overall satisfaction from the visit.

Variable	Estimate	Standard error	χ^2 test
Constant = 1	4.088	1.355	9.106[a]
Constant = 2	6.444	1.408	20.942[a]
Distance from picnic spot to parking	−0.551	0.215	6.584[a]
Distance from picnic spot to toilets	−0.390	0.192	4.120[b]
Quantity of children's playground facilities	−0.473	0.229	4.277[b]
Level of shade at picnic spot[b]	0.708	0.200	12.517[b]

N = 166; pseudo-R^2 = 0.360; [a]Significant at $p < 0.05$ level. [b]Significant at $p < 0.01$ level.

Table 8. Relative importance of satisfaction indicators influencing overall level of satisfaction.

Indicators	Likelihood ratio	Relation between source likelihood-ratio chi square and whole model likelihood chisquare difference	Standardized coeff. α_i
Distance from picnic spot to parking	20.191	0.165	1.22
Distance from picnic spot to toilets	2.663	0.022	0.163
Quality and maintenance level of children playground facilities	7.117	0.058	0.430
Level of shade at site	36.338	0.297	2.20
Whole model	122.196		

Table 9. The most important indicators' influence on overall level of satisfaction.

Indicators	Perceived level	Score	Min. accep. level	Score	Ideal level	Score
Distance from picnic spot to parking	15 - 30 m	2	15 - 30 m	2	5 - 15 m	3
Distance from picnic spot to toilets	More than 100 m	1	60 - 100 m	2	40 - 60 m	3
Quality and maintenance level of children playground facilities	Most of them dirty and broken	2	Most of them clean and whole	3	All of them clean and whole	4
Level of shade at site	3	3	2	2	3	3

Finally the overall level of service for the Erzurum Urban Forest was calculated by using LOS formula as follows:

$$\mathrm{LOS}_j = \sum_{i=1}^{n} \frac{\alpha_i \left(x_{ij} - x_{il}\right) / \left(x_{iu} - x_{il}\right)}{n} = \frac{1.22 \times \frac{(2-2)}{(3-2)} + 0.163 \times \frac{(1-2)}{(3-2)} + 0.430 \times \frac{(2-3)}{(4-3)} + 2.20 \times \frac{(3-2)}{(3-2)}}{4} = 0.40$$

where;

x_{ij} = the perceived level of indictor i.

x_{iu} = the ideal level of indicator i.

x_{il} = the minimum acceptable level of indicator i.

Therefore $(x_{iu} - x_{il})$ is the tolerance range along indicator i.

α_i = a coefficient which states the relative importance of indicator i originated in the logistic model.

n = the number of indicators which are the most important on the overall satisfaction identified by OLM.

Usually LOS value varies from 0 to 1 scale. This means that if the value of LOS closer to 1, the level of service should be evaluated as at the high quality. The values, obtained as a result of several statistical analyses, were calculated by LOS formula. The level of service for Erzurum Urban Forest calculated according to the expression was 0.40. It is inferred from this value that the level of service in Erzurum Urban Forest is below the moderate level.

4. Discussion

The aim of this study is to determine recreational level of service of Erzurum Urban Forest, which is located in close proximity to the city center and preferred especially for picnics by the locals.

For this purpose, possible dimensions of satisfaction for picnic recreation and the 17 indicators representing these dimensions were identified. 200 respondents were sampled in the survey and 166 questionnaires were found useable. In order to ensure variety in response and filling in questionnaire without being under the influence, the members of different families conducted the questionnaires and questionnaires were self-administered. The purpose of maximum variety sampling is not to generalize the universe by providing diversity; it is to find the similarities and partnerships between the diverse situations [52]. From these identified indicators the socio-demographic variables of visitors, tolerance range, perceived levels and satisfaction degree were inferred. Computer simulation modeling was used to measure two qualitative indicators that were "shade at picnic spot"

and “general cleanliness”. Each simulation was presented as 20 cm × 15 cm in size and high resolution for an easy comprehension by visitors. The tolerance range between minimum acceptable level and high level of service was identified by the generic method while the perceived level and satisfaction degree were identified by the site based method for those indictors in which the degree of user consensus exceeded 40%.

It was inferred from tolerance range analyze, most visitors reported that time searching for a parking space and picnic spot for 5 - 10 minute was the tolerance threshold, while up to 5 minute was an ideal duration. Indeed, the majority of visitors were observed during the site survey that they carried heavy picnic supplies from parking area to picnic site. It is estimated that the type of visit and usage habits to be effective on visitors’ tolerance range. Most of the visitors notified that the playground and sport facilities need to be at least 1 - 2 units and preferably 3 - 4 units at the picnic site. This result is interpreted with demographic profile of respondents, most of them were 18 - 34 (45.2%) or 35 - 49 (37.3%) age groups and they had 1 - 2 children (45.2). For most visitors proximity of the adjacent group 5 - 10 m was the tolerance threshold and more than 20 m was ideal distance. This finding is not only important for designing in accordance with the physical capacity but also important for managing social capacity of the site. More clearly it is expressed that with the increase of crowding, probably the distance of adjacent picnic spot (picnic table or only a rug brought by visitors) will be shortened.

None of the indicators was perceived to be at “satisfied” or “completely satisfied” levels by visitors, and also except “the shade of site” indicator, the perceived level of any indicator is not equal to their ideal level. In addition to these results, the perceived level of 8 indicators (“Time searching for a picnic spot” “Number of available picnic tables at picnic site”, “Distance from picnic spot to toilets” “Quality and maintenance level of children playground facilities” “Quality and maintenance level of sport facilities” “Quality and maintenance level of toilets” “Quality and maintenance level of tables” “Security level at site”) were determined to be below minimum acceptable level. According to these results, it can be stated that the quality and the number of recreational facilities, service facilities and sanitary facilities from the identified dimensions of satisfaction of the site were insufficient in terms of the quality of recreation experience. It was determined that the consensus for perceived levels of related with “time searching” and “distance” indicators is lower than the others. This divergence is suspected that the visitors may have stayed different locations of site and may have reached different times of a day. The questionnaires were conducted with 1 individual from each family to ensure diversity of survey and to increase the reliability.

It was inferred from satisfaction degree analyze that; The average scores of indicators, correlated with perceived level analyze results, revealed that the satisfying degree from each of the indicator was between at “dissatisfied” and “moderately dissatisfied” level. It can be seen clearly that the service quality is lower than the standards of determined indicators and this physical deficiency does not only restrict the physical capacity but also reduces the level of satisfaction of the visitors, which affects the social capacity.

Ordinal Logistic Model (OLM) was used to identify the contribution of all indicators to the visitor’s overall satisfaction; Likelihood-Ratio Chi Square test, Relation between source Likelihood-Ratio Chi Square and Whole Model Likelihood Chi Square Difference was used to identify the relative importance of the key indicators. By standardized coefficient in this regression analyze, which indicators have a greater effect on the overall satisfaction were identified.

The four indicators are important on the overall visitor satisfaction. One of these indicators “the distance from picnic spot to parking” and “level of shade at picnic spot” have positive effect, while “the distance from picnic spot to toilets” and “quantity of children’s playground facilities”, have negative effect on the overall satisfaction. It was observed that the some visitors prefer to park their cars on the road on the side of the picnic area rather than the parking area. On “The distance from picnic spot to parking” indicator, it was considered that this behavior was likely to be reflected as a positive effect. Also, the climatic condition of Erzurum City is estimated to contribute to these results. The continental (cold and temperate) climate is dominant, the altitude is over 2000 meters, during the summer months low and moderate winds are blowing in Erzurum City. For this reason, climatic comfort can be provided without the need for intensive shade in the picnic spots. As a result of these analyses it is clear that the distance from picnic spot to toilets is longer than preferred distance and the quantity of children’s playground facilities is less than preferred. It is recommended to increase the satisfaction of visitors, increase the level of service by constructing another toilet introduce regular cleaning. In addition to these, redesign playground in the site and supplying maintenance were suggested.

LOS, ranging from 0 to 1 scale, was calculated as 0.40 for Erzurum Urban Forest. It is inferred from this value that the level of service in Erzurum Urban Forest is below the moderate level. This result also means that the

physical and managing conditions are insufficient for optimum satisfaction level of visitors and recreational experience quality. Although it is not actually recreational use above the social capacity in the area, the social capacity is affected by the way of physical inadequacy and managerial inability. In fact, several authors have noted that crowding is not the only factor that affects the social capacity of the recreation experience, but there are also other factors that affect the quality of the recreation experience [53] [54]. However, previous studies was emphasized that each factor also does not have the same degree of impact on the quality of the recreation experience [11] [32].

Besides this, Fleishman and Feitelson, 2009 [11] applied the recreation level of service approach to forests in Israel. The results of the study, different from our study, reveal that four indicators; "time searching for a parking space", "number of available picnic tables at picnic site", "quality and maintenance of tables" and "shade intensity at picnic spot" found significant effect on the overall satisfaction. Both studies are compared with each other; it is observed that the significant indicators are different. This discrepancy is thought to result from the demographic characteristics of the visitors. Indeed, Sayan and Karagüzel (2010) [55] analyzed the effect of visitors' demographics on the perceptions and Sayan *et al.* (2013) [56] analyzed the cultural influence on crowding norms in outdoor recreation. In both studies, significant differences between the satisfaction levels of different visitor groups were found.

5. Conclusion

Although the basis of LOS method constitutes the most important factors on the overall satisfaction of visitors, it should be noted that the other indicators have an impact on satisfaction. Consequently, it is thought to be the proper approach to enhance the great effected indicators on the overall satisfaction first and then to develop other indicators during the planning of visitor management.

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