Black Sea Journal of Engineering and Science
doi: 10.34248/bsengineering.1254464

Open Access Journal
e-ISSN: 2619 – 8991

Research Article
Volume 6 - Issue 3: 219-228 / July 2023

# DETERMINATION OF ENCOUNTER NORMS AND SOCIAL CARRYING CAPACITY OF YOZGAT ÇAMLIK NATIONAL PARK USING SIMULATION MODELING TECHNIQUE

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**Abstract:** National parks are at the forefront where city people can satisfy their longing for nature. While the increase in the demands for green and soul has caused some questions for these areas, it has also prepared the ground for local governments to take protective-preventive measures. Yozgat Çamlık National Park has the title of being the first national park of Türkiye and is characterized as a rare piece of nature. This study calculated the carrying capacities of the scenic cruise route and picnic roads, the most intensive-use areas of Yozgat Çamlık National Park. To make the calculations, the National Park was visited frequently between January and December 2021-2022, and the most intense usage points were determined. Photographs of the determined points were taken, and six simulation images were created. The visitors using the National Park were asked to score between 1-6 on the simulation images that they felt comfortable and uncomfortable within the simulation images created by a survey study. The National Park's Social Carrying Capacity and Social Norm levels were calculated according to the scoring status. When the findings are evaluated, the Social carrying capacity of the Picnic area is 524 people, the Social Norms level is nine people, the Social Capacity is 84 people on the Scenic cruise route, and the Social Norms level is determined as ten people.

**Keywords:** Social norm, Social carrying capacity, Yozgat çamlik national park, Recreation

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**Received:** February21, 2023
**Accepted:** June 06, 2023
**Published:** July 01, 2023

**Cite as:** Rüzgar A, Demir M. 2023. Determination of encounter norms and social carrying capacity of yozgat çamlik national park using simulation modeling technique. BSJ Eng Sci, 6(3): 219-228.

## 1. Introduction

Recently, with the expansion of ecotourism activities, there has been an increase in air pollution, deformation in natural landscapes, and decline in ecosystems on a global scale, such as the endangerment of flora and fauna species. (Marsiglio, 2017; Agyeman, Yeboah and Ashie, 2019; Demir, 2019; Sobhani et al., 2022).

To supply the housing needs of the rapidly growing urban population, natural areas open to social use and forested areas near the city are destroyed. This situation causes the decrease and disappearance of the sites where urban people will provide their recreation needs (Onat, 1998; Demir, et al., 2017; Başaran et al., 2020).

National Parks are at the forefront of the areas where people will satisfy their longing for nature in the city. National parks are areas where people can relax, spend time with their families, view atural landscapes, and provide educational purposes. The increase in interest in national parks has paved the way for protective-preventive measures to be taken by the authorities. Priority has been given to protecting the current potential of these areas, considering sustainable values, and transferring them to future generations. International Union for Conservation of Nature (IUCN,2011) When defining National Parks, "Parts of nature (land/sea) reserved for preserving the ecological integrity of one or more ecosystems for present and future generations, preventing the invasion and exploitation of natural environments, and optimizing science, education, recreational and visitor activities in harmony with the natural environment." defines it as (Şahbaz and Altınay, 2015; Demir and Özer, 2014; Koday and Kaymaz, 2017). National Park studies in Türkiye National Park areas were examined and determined within the forest law's scope dated 1956 and numbered 6831. For the first time in Türkiye, on 05.02.1958, Yozgat Çamlık National Park was given the status of Türkiye's first National Park. (Doğru and Aydın, 2020). Most of the National Parks in Türkiye have been defined as National Parks to protect their recreational resource values as well as their resource values (Sever, 1998).

National Parks are areas with vast recreational opportunities according to their unique landscape beauties, scientific qualities, national historical values, and other features. Mountaineering, camping, hiking, bird

watching, etc. These areas are deemed necessary for people to provide a healthy and happy life with these factors. These opportunities differ according to the characteristics of national parks and the cultural level of the countries (Sözen, 1974; Sever, 1998).

The frequent use of parks and natural areas has caused sustainability problems and new problems in managing these areas (Dias et al., 2004). In recent, the increased time allocated for leisure and entertainment has made carrying capacity a central research topic. (Grafe et al., 1984, Shelby and Heberlein, 1984, Stankey and Mccool, 1984; Pereira Da Silva, 2002, Jurado et al., 2009).

Carrying capacity has been the subject of some differences in terms of concept and definition (Lindberg et al., 1997; Brown et al., 1997; Buckley, 1998; Papageorgiou and Brotherton, 1999; Saveriades, 2000; Simon et al., 2004; Ünlüönen and Tokmak, 2009). Although its conceptual meaning is intriguing, the information in the definitions and explanations cannot fully explain the subject and its meaning. Difficulties arising from both the definition and the fact of the concept make it challenging to determine the carrying capacity at a standard level. (Lindberg et al., 1997). For this reason, researchers have developed a capacity calculation method and planning strategies to manage the densities that push the capacity limit and optimize the effects caused by the negativity. (Ünlüönen and Tokmak, 2009).

Carrying capacity in nature areas was used for the first time in the literature by Hadwen and Palmer (1922) in rangeland management. The concept of carrying capacity was mentioned in this area as recreation and tourism areas. (Clarke, 2002; McCool and Lime, 2001; Göktuğ et al., 2013). On the other hand, Recreational carrying capacity determines the number of visitors and the types of recreational buildings determined for the use of the general area, which causes unacceptable picture deterioration on the physical, biological, and cultural resource values of any recreation view (McCool and Lime, 2001; Clarke 2002; Göktuğ et al., 2013; Caner and Demir, 2020).

It is possible to identify more than one behavior in a carrying capacity for a region. When determining the utilization capacity based on literature (Ceballos and Lascurain, 1996; Maldonado and Montagnini, 2005; Sayan et al., 2005; Sayan and Ortaçesme, 2005; Sayan and Atık, 2011; Göktuğ, 2011; Zacarias et al., 2011; Queiroz et al., 2014; de Sousa et al., 2014; Göktuğ and Arpa, 2016; Soylu and Özkök, 2016; Göktuğ, et al., 2017; Erdemir, 2018; Kara et al., 2020; Göksu, 2022), the researchers have achieved effective results with the relevant work they have carried out.

The Computer Simulation Modeling Technique was developed to predict the magnitude of recreation groups according to the meeting places and types, and the model first came to the fore in Smith and Headly's (1975) "Wilderness Travel Simulation Model (WTSM) study. To give effective results in the computer architecture structure, a face-to-face survey study was tried with the users of the area to calculate the carrying capacity.

The concepts of encounter, crowd, and norm have received significant attention in the literature. Perceived broad is an overly hypothetical and negative evaluation of a certain number of encounters (Shelby and Heberlein, 1984; Manning et al., 2002; Vaske and Shelby, 2008). Reported encounters are other people or the estimated number of times a person remembers a warning (Vaske and Donnelly, 2002). In measuring intensity, encounter norms typically consume as standards for consumption to restrict individuals from accepting more encounters with other people or objects (Manning, 2007; Shelby et al., 1996).

As a result of the increasing number of ecotourism destinations, it is subject to extensive negative impacts. With these potentials and physical properties, the calculation of bearing capacities should be emphasized so that the protection is not exposed to a load above the existing limits. The aim of this study; It will be able to give Social Carrying Capacity to determine the values of human encounters on the route of a picnic area and Landscape viewing points, which are the most intensive use areas of Yozgat Çamlık National Park. This study is a base for sustainable ecotourism planning, protection of cultural structure, human communities, decision-makers, and planners to make the right decisions.

## 2. Materials and Methods

Yozgat Çamlık National Park is located between 34º 48' 30,77''- 34º 49' 24.35'' east longitudes and 39º47'54.31''-39º48'52.54'' north latitudes. The National Park is an area in the southern region of Yozgat province, which stands out with its black pine species and has the title of Türkiye's first national park. (Yozgat Çamlık National Park Development Plans, 2021), (Figure 1).


**Figure 1.** Location of the study area.

To determine the social carrying capacity in the areas most frequently used by the participants, separate simulation series was created for picnic areas and viewing points. The reason for choosing these areas is that the participants spend most of their time in these areas, and it is seen that there is a visitor density above

their current capacity (Figure 2).

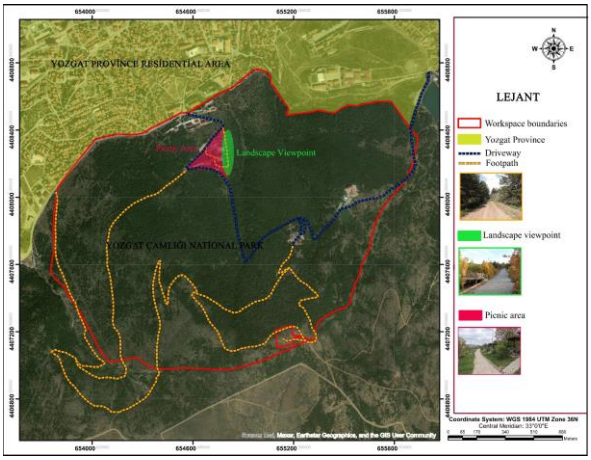


**Figure 2.** Yozgat Çamlık National Park.

The route length in the photo frame for the picnic area (Figure 3) is 23 meters, and the length of the viewpoints in the photo frame (Figure 4) is 70 meters. In creating each simulation image, the area in the photo frame is linearly increased by five people. In these simulation images, the tolerance levels of the participants participating in the survey were measured.


**Figure 3.** Simulation Images of the Picnic Area Prepared to Calculate the Social Carrying Capacity of the National Park.


**Figure 4.** Landscape viewing points Simulation Images Prepared to Calculate the Social Carrying Capacity of the National Park.

In order to measure the Social Carrying capacity, a face-to-face survey was conducted for the person using the National Park. The target audience of the survey is the people living in Yozgat Province. The expressions used by Özdamar (2003) were used to determine the sample size. The number of universe units was determined as 418,500 according to the 2021 population regulations announced by the Turkish Statistical Institute (TURKSTAT, 2021).
When the formula is examined (equation 1);

$$n = \frac{Npq(Z)^2}{(N-1)(d)^2} \quad (1)$$

N: Universe Unit number
n: Sample size
p: Observation rate of X in the universe
q (1-P): X's non-observation rate
$Z_\alpha$: $\alpha$= 0.05 for 1.96
D: sampling error

The Cronbach Alpha's test in the SPSS 20 program determined the scale's reliability. According to the result obtained from the formula developed by Özdamar (2003), the number of questionnaires to be applied to the participants was 384, with a margin of error of ±5 in the 95% confidence interval. According to the test result, Cronbach Alpha's scale value is 0.83. The fact that this value is more significant than 0.70 indicates that the reliability of the scale level is sufficient.
For the simulation images created by the questionnaire

applied to the participants, the participants were requested to score the simulation images created at the picnic area and scenic viewing points according to their acceptability levels. The participants in the survey asked the prepared simulation images three questions. In the first question, they were asked to score between 1-6 (1 unacceptable, 6 acceptable) according to their tolerance levels. In the second question, they were asked to give points to the image they felt most comfortable with in the simulation image prepared. Finally, they were asked to rate the photo frame they felt most uncomfortable with among the simulation images posed in the third question.
The 'Bearing Capacity Estimation Method in Protected Areas' developed by Göktuğ (2011) was used for digitizing the obtained simulation images. This method is expressed with a numerical formula, and the formula is given below (equation 2).

$$SCC = A\left(\frac{Z}{a}\right)Rf \quad (2)$$

A: Area of the Field
Z/a: Acceptable number of visitors in the photo*/ Size of the area in the photo
(*Preferred level represents the best level of participants' use of space).
Rf: Time the site is open daily/ average duration of a visit

It is aimed to use the resulting social relative norm. The social norm can be analyzed according to various characteristics, such as the minimum level of acceptability. The minimum acceptability level is the size of the point where the norming curve intersects with the neutral line to the value defined on the y-axis. Most of the investigated bring the minimum acceptability standard as the quality level of the obtained indicator. (Shelby and Heberlein, 1984; Vaske et al., 1993; Manning, 1999; Needham and Rollins 2005; Caner, 2018).
When Göktuğ (2011) examined the steps in the order of operation of the model;

- The peak usage level and hours of the examined locations are determined by making on-site observations at different locations in the national park
- A series of simulations with separate viewing angles and area sizes are created, in which the intensity level of the areas in the captured photos increases and decreases linearly.
- Simulation images created to determine whether these places are crowded according to their visitors and their satisfaction level are asked as questions to the participants participating in the survey.
- It is desired to determine the ideal image (person/vehicle/group size) among the obtained simulation images.
- It is requested to determine the maximum usage level (maximum person/vehicle/group size) that can be tolerated from the simulation.
- It is requested to score between 6 (most acceptable) and 1 (Most unacceptable) according to the acceptability levels of the simulation images in a view frame. The scored survey data is plotted, and the 0 (zero) point (Neutral) is the optimum acceptability level.

The relationship between the area size seen in the obtained photo frames and the visitor preferences (ideal level, tolerance level, and optimum level) is interpreted.
The Normative Approach is a graphical representation that shows the averages of social norms (Figure 5). This chart is called the "social norm movement."

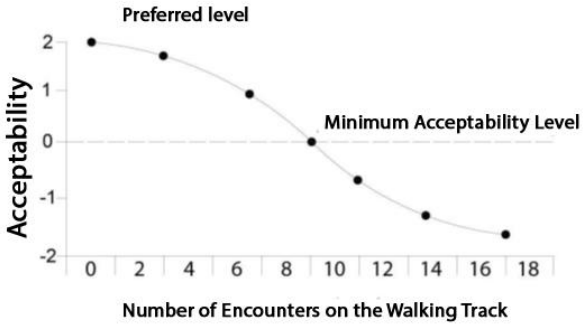


**Figure 5.** Social Norm Curve Graph (Manning et al., 1999; Caner, 2018).

The Computer Simulation Modeling Technique was developed to predict the size of recreation groups according to the meeting places and types. (Wang and Manning, 1999; Manning, 2002; Lawson et al., 2003a; Lawson et al., 2003b; Manning et al., 2005; Moore and Polley, 2007; Valliere and Manning, 2008; Jurado et al., 2009; Zacarias et al., 2011; Göktuğ, 2011; Ceurvorst and Needham, 2012; Silva and Ferreira, 2013; Caner, 2018) has been successfully implemented by.

## 3. Results

An essential criterion in determining the social carrying capacity is visitors' time in the area. "How Many Hours Do You Spend in Yozgat Çamlık National Park?" The data obtained when the question was asked; 5.2% in 1 hour, 18% in 2 hours, 20.3% in 3 hours, 25% in 4 hours, 22.1% in 5 hours, 4.9% in 6 hours, 1% of them stated that they spent 7 hours, 1.3% of them 8 hours, and 2.1% of them spent 9 hours or more in the National Park. When the average of these values was taken, it was determined to be 3.78. It will be used to calculate the average social carrying capacity obtained (Table 1).

**Table 1.** The time spent by the participants using the Yozgat Çamlık National Park

| How Many Hours Do You Spend in Yozgat Çamlık National Park?" | Person (N) | Percent (%) |
|---|---|---|
| 1 hour | 20 | 5.2 |
| 2 hours | 69 | 18.0 |
| 3 hours | 78 | 20.3 |
| 4 hours | 96 | 25.0 |
| 5 hours | 85 | 22.1 |
| 6 hours | 19 | 4.9 |
| 7 hours | 4 | 1.0 |
| 8 hours | 5 | 1.3 |
| 9 hours or more | 8 | 2.1 |

When the scores given for the picnic area according to the acceptability levels of the participants in the survey are examined, 1. Simulation image (42.4%), 2. Simulation image (12.2%), 3. Simulation image (17.4%), 4. Simulation image (8.6%), 5. Simulation image (5.2%) and finally 6, Simulation image (14.1%) results were obtained (Table 2). In other words, when the most acceptable images are ranked from the indecent images, 1. Simulation- 3. Simulation- 6. Simulation- 2. Simulation- 4. Simulation-5. It is in the form of a simulation.

The participants were asked which simulation images they would feel most comfortable with. It was determined that the most comfortable simulation image was the 1st simulation image, with 29.2% (Table 3). When the standard views of the individuals participating in the survey were examined, it was determined that the average of the section they felt most comfortable with was 2.96. This value corresponded to 3 people in the simulation images.

**Table 2.** Determination of Acceptability Levels of Simulation Images, Picnic area

| Acceptability Variables | 1 Points | | 2 Points | | 3 Points | | 4 Points | | 5 Points | | 6 Points | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | (%) | N | (%) | N | (%) | N | (%) | N | (%) | N | (%) |
| 1. Simulation Image | 93 | 24.2 | 34 | 8.9 | 25 | 6.5 | 28 | 7.3 | 41 | 10.7 | 163 | 42.4 |
| 2. Simulation Image | 12 | 3.1 | 85 | 22.1 | 23 | 6.0 | 40 | 10.4 | 177 | 46.1 | 47 | 12.2 |
| 3. Simulation Image | 8 | 2.1 | 8 | 2.1 | 75 | 19.5 | 187 | 48.7 | 39 | 10.2 | 67 | 17.4 |
| 4. Simulation Image | 2 | 0.5 | 11 | 2.9 | 213 | 55.5 | 85 | 22.1 | 40 | 10.4 | 33 | 8.6 |
| 5. Simulation Image | 18 | 4.7 | 22 | 57.3 | 34 | 8.9 | 26 | 6.8 | 66 | 17.2 | 20 | 5.2 |
| 6. Simulation Image | 250 | 65.1 | 27 | 7.0 | 14 | 3.6 | 18 | 4.7 | 21 | 5.5 | 54 | 14.1 |

**Table 3.** Determining in which simulation image the participants feel comfortable

| Which simulation image do you feel comfortable with? | Person (N) | Percent (%) |
|---|---|---|
| 1. Simulation Image | 112 | 29.2 |
| 2. Simulation Image | 73 | 19.0 |
| 3. Simulation Image | 77 | 20.1 |
| 4. Simulation Image | 31 | 8.1 |
| 5. Simulation Image | 22 | 5.7 |
| 6. Simulation Image | 69 | 18.0 |

Among the simulation images created, the participants were asked, "If You Were Inside These Simulation Images, In Which One Would You Feel Uncomfortable." It was determined that the simulation image they felt most uncomfortable with was the 6th simulation image, with 56.5% (Table 4). When the everyday opinions of the individuals participating in the survey were examined, it was determined that the average of the part they felt uncomfortable with was 4.11. This value corresponded to 15 people in the simulation images.

The minimum acceptability level was determined after the scoring of the participants on the simulation images was analyzed. It was determined by calculating the average of the photo frame they felt most comfortable with from the simulation images created to determine the minimum acceptability level and the standard of the simulation image they felt most uncomfortable accompanied by. The middle of the photos the participants felt most comfortable with was 2.96, and the average of the ideas they felt most uncomfortable with was 4.11. The standard of these simulation images;

(2.96+4.11) /2: 3.53 has been determined. On a per-person basis; (3+15) / 2: 9 in a person.

When the social norm graph of Yozgat Çamlık National Park was created, it was determined that the minimum acceptable number of people was three people, the average was nine people, and the maximum was 15 people. (Figure 6).

**Table 4.** Determining in which simulation image the participants felt uncomfortable

| In which simulation image do you feel uncomfortable? | Person (N) | Percent (%) |
|---|---|---|
| 1. Simulation Image | 126 | 32.8 |
| 2. Simulation Image | 11 | 2.9 |
| 3. Simulation Image | 8 | 2.1 |
| 4. Simulation Image | 5 | 1.3 |
| 5. Simulation Image | 17 | 4.4 |
| 6. Simulation Image | 217 | 56.5 |

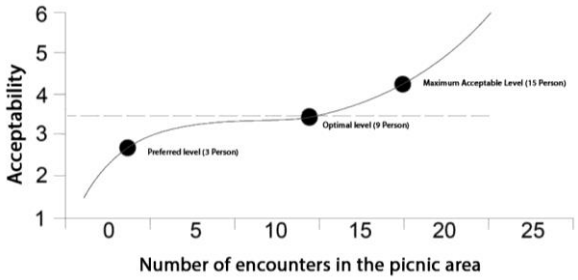


**Figure 6.** Social Norm Curve Graph for picnic areas.

When the social carrying capacity values of Yozgat Çamlık National Park are calculated (Table 5). The intensity and impact of visitors' encounters with each other were measured. The results determined the social carrying capacity for the National Park picnic area as 262 people. Since there are two circulation times in the area, it is calculated to be 524 people.

When the carrying capacity of the study area at the scenic viewpoints is calculated; When the points given to the acceptability levels of the participants participating in the survey are examined (Table 6), The highest scores are respectively 1. Simulation (45.8%), 2. Simulation (6.5%), 3. Simulation (16.9%), 4. Simulation (8.3%), 5. Simulation (4,7%) and 6. Simulation (17.7%). In other words, when the most acceptable images are ranked from the inappropriate images, 1. Simulation- 6. Simulation- 3. Simulation- 4. Simulation- 2. Simulation-5. It is in the form of a simulation.

**Table 5.** Determination of Social Carrying Capacity (SCC) of Yozgat Çamlık National Park Picnic Area

| Social Features | Yozgat Çamlık National Park |
|---|---|
| $g_s$: The daily time that the National Park is open to visitors (Hours) | 12 |
| A: Length of Field (m) | 634 m |
| $z_s$: Average Visit Time at the Picnic Area (Hours) | 3.78 |
| Z/a: Acceptable number of visitors in the picture/ Size of the area in the picture | (3/23m) |

SCC: 634x (3/23) x (12/3.78) = 262 person

**Table 6.** Determination of Social Carrying Capacity of Yozgat Çamlık National Park, landscape viewpoints

| Acceptability Variables | 1 Points | | 2 Points | | 3 Points | | 4 Points | | 5 Points | | 6 Points | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | (%) | N | (%) | N | (%) | N | (%) | N | (%) | N | (%) |
| 1. Simulation Image | 99 | 25.8 | 32 | 8.3 | 19 | 4.9 | 30 | 7.8 | 28 | 7.3 | 176 | 45.8 |
| 2. Simulation Image | 7 | 1.8 | 86 | 22.4 | 23 | 6.0 | 45 | 11.7 | 198 | 51.6 | 25 | 6.5 |
| 3. Simulation Image | 6 | 1.6 | 5 | 1.3 | 82 | 21.4 | 196 | 51.0 | 30 | 7.8 | 65 | 16.9 |
| 4. Simulation Image | 4 | 1.0 | 11 | 2.9 | 217 | 56.5 | 84 | 21.9 | 36 | 9.4 | 32 | 8.3 |
| 5. Simulation Image | 14 | 3.6 | 228 | 59.4 | 31 | 8.1 | 14 | 3.6 | 79 | 20.6 | 18 | 4.7 |
| 6. Simulation Image | 254 | 66.1 | 24 | 6.3 | 12 | 3.1 | 14 | 3.6 | 12 | 3.1 | 68 | 17.7 |

The participants were asked which of the simulation images created for the scenic viewpoints they would feel most comfortable with. Participants stated that they had the first simulation image with 33.9% (Table 7). When the standard views of the participants were examined, It was determined that the average of the section where they felt most comfortable was 2.88 for the scenic viewpoints. This value corresponds to 3 people in the simulation image.

Among the simulation images created for the viewpoints, the participants were asked, "If You Were in These Simulation Images, In Which One Would You Feel Uncomfortable"? It was determined that the simulation image they felt most uncomfortable with was the sixth simulation image, with 59.5% (Table 8). When the everyday opinions of the individuals participating in the survey were examined, it was determined that the average of the part they felt uncomfortable with was 4.29. This value corresponded to 17 people in the simulation images.

**Table 7.** Determining in which simulation image the participants feel comfortable

| Which simulation image do you feel comfortable with? | Person (N) | Percent (%) |
|---|---|---|
| 1. Simulation Image | 130 | 33.9 |
| 2. Simulation Image | 64 | 16.7 |
| 3. Simulation Image | 71 | 18.5 |
| 4. Simulation Image | 31 | 8.5 |
| 5. Simulation Image | 15 | 3.9 |
| 6. Simulation Image | 73 | 19.0 |

**Table 8.** Determining in which simulation image the participants felt uncomfortable

| In which simulation image do you feel uncomfortable? | Person (N) | Percent (%) |
|---|---|---|
| 1. Simulation Image | 111 | 28.9 |
| 2. Simulation Image | 11 | 2.9 |
| 3. Simulation Image | 6 | 1.6 |
| 4. Simulation Image | 12 | 3.1 |
| 5. Simulation Image | 15 | 3.9 |
| 6. Simulation Image | 229 | 59.6 |

The minimum acceptability level was determined after the scoring of the survey participants on the simulation images created for the Landscape viewing points was analyzed. The average of the images the participants felt most comfortable with was 2.88, and the average of the images they felt most uncomfortable with was 4.29. The average of these simulation images
(2.88+4.29) /2: 3.58 has been determined. On a per-person basis, (3+17) / 2: 10 in a person.
When the social norm graph of Yozgat Çamlık National Park was created, it was determined that the minimum acceptable number of people was three, the average was ten, and the maximum was 17 (Figure 7).

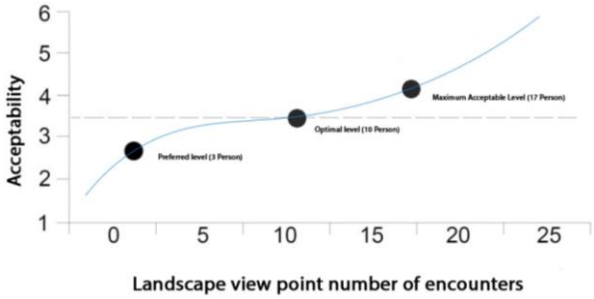


**Figure 7.** Social Norm Curve Graph for the Landscape viewing points route.

When the social carrying capacity values are calculated for the scenic viewing points of Yozgat Çamlık National Park (Table 9). The intensity and impact of the visitors' encounters with each other were measured. According to the results obtained, the social carrying capacity of the scenic viewpoints route of the National Park was determined as 42 people. It has been calculated that there are 84 people since there is circulation in the area twice.

**Table 9.** Social Carrying Capacity (SCC) of Landscape Viewing Points Route

| Social Features | Yozgat Çamlık National Park |
|---|---|
| $g_s$: The daily time that the National Park is open to visitors (Hours) | 12 |
| A: Length of Field (m) | 307 m |
| $z_s$: Average Visit Time at the Picnic Area (Hours) | 3.78 |
| Z/a: Acceptable number of visitors in the picture/ Size of the area in the picture | (3/70m) |

SCC: 307x (3/70) x (12/3.78) = 42 Person.

## 4. Discussion and Conclusion

The increase in the demand for green areas to relax and find peace in the face of the difficulties brought by the urban life of the people causes pressure on these areas and overcapacity. In this context, carrying capacity has become an increasingly important issue. Carrying capacity calculation methods determine the maximum, minimum, and optimal load that any area can handle. The carrying capacity should be calculated for the participants who visit the National Park to continue their

recreational activities in the area without interruption.

In determining the social carrying capacity, the carrying capacity was calculated on the route of the picnic areas and scenic viewing points in the National Park. For the computer simulation modeling technique used in the calculation, a simulation image was created from 6 serial photo frames. The participants' crowd perceptions and tolerance levels were measured with these photo frames.

When the scores given by the participants to the simulation images were examined, it was determined that the image that made them feel most comfortable in the picnic area was the 1st Simulation image, with 29.2%. When the average of this value is taken, it is calculated that this number is 2.96, and the equivalent in the simulation image corresponds to 3 people. It was determined that the image they felt most uncomfortable with was the sixth simulation image, with 56.5%. When the average of this section was taken, it was 4.11, and the equivalent in the simulation image was 15 people ((3+15) /3= 9 personal optimal level).

According to the data obtained in the simulation images created in the picnic areas, it was determined that the preferred number of people on the same route is three people, this capacity will not cause a decrease in the recreational experience, and when it reaches 15 people, the users will feel uncomfortable and want to leave the area.

The 15 people obtained are the crowd tolerance level of the participants on the same route. This value is valid for 23 meters length in simulation images. When the intensity and impact of the participants' encounters with each other are measured, the social carrying capacity of the picnic areas in Yozgat Çamlık National Park is 262 people. When evaluated daily, this value was calculated as 524 visitors/day.

When the social capacity was calculated on the scenic viewpoint route, it was determined that the image in which the participants felt most comfortable was the first simulation image, with 33.9%. The average of this value corresponded to 2.88 and 3 people. They feel most uncomfortable with the 6th Simulation image, with 59.5%. The average of this value was 4.29, which corresponds to 17 people on a person-to-person basis ((3+17) /2=10 personal optimal level).

According to these data, it has been determined that the number of people who preferred the same route on the scenic viewpoint route is 3. If this value reaches 17 people, the participants will want to leave the area uncomfortably.

The values obtained are generally seventeen people on the same route, which is the tolerance level for the crowd. This value is valid for the 70 m long view. The total social carrying capacity of the area is 42 people. When evaluated daily, this value was determined as 84 visitors/day. It is aimed that the area in the National Park, especially on weekdays with intensive use, exceeds this capacity.

**Author Contributions**

The percentage of the author(s) contributions is present below. All authors reviewed and approved final version of the manuscript.

| | A.R. | M.D. |
|---|---|---|
| C | 50 | 50 |
| D | 50 | 50 |
| S | 50 | 50 |
| DCP | 50 | 50 |
| DAI | 50 | 50 |
| L | 50 | 50 |
| W | 50 | 50 |
| CR | 50 | 50 |
| SR | 50 | 50 |
| PM | 50 | 50 |

C=Concept, D= design, S= supervision, DCP= data collection and/or processing, DAI= data analysis and/or interpretation, L= literature search, W= writing, CR= critical review, SR= submission and revision, PM= project management.

**Conflict of Interest**

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

**Ethical Consideration**

Study ethics committee decision; Atatürk University, Institute of Science and Technology (approval date: June 24, 2022, protocol code: E-60665420-000-2200188830, Session Number: 8, Decision No: 21).

## References


Agyeman YB, Yeboah AO, Ashie E. 2019. Protected areas and poverty reduction: the role of ecotourism livelihood in local communities in Ghana. Commun Develop, 50: 73–91.

Başaran MA, Demir M, Ayhan Y, Ağyürek C, Okutucu MA, Öksüz S. 2020. Orman içi dinlenme yerlerini kullanan ziyaretçilerin talep ve beklentilerinin belirlenmesi: Erzurum örneği. Turk J Biod, 3(1): 32-42.

Brown K, Turner RK, Hameed H, Bateman I. 1997. Environal carrying capacity and tourism development in the Maldives and Nepal. Environ Conser, 24(4): 316-325.

Buckley R. 1998. Toolsand indicators for managing tourism in parks. Annals Tour Res, 25(4): 208-210.

Caner AM. 2018. Erzincan Girlevik Şelalesinin fiziksel ve sosyal taşıma kapasitesinin belirlenmesi. Yüksek Lisans Tezi, Atatürk Üniversitesi, Fen Bilimleri Enstitüsü, Erzurum, Türkiye, ss: 140.

Caner, AM, Demir M. 2020. Erzincan Girlevik Şelalesi ve yakın çevresinin fiziksel taşıma kapasitesinin belirlenmesi. Kent Akad, 13(41): 22-36.

Ceballos-Lascurain H. 1996. Tourism, ecotourism, and protected areas: the state of nature-based tourism around the world and guidelines for its development. World Conservation Union, New York, USA, Gland: IUCN, pp: 301.

Ceurvorst RL, Needham MD. 2012. Is Acceptable really acceptable? Comparing two scales for measuring normative evaluations in outdoor recreation. Leisure Sci, 34(3): 272-279.

Clarke AL. 2002. Assessing the carrying capacity of Florida

keys. Popul Environ, 23(4): 405-418.

de Sousa RC, Pereira LC, da Costa RM, Jiménez JA. 2014. Tourism carrying capacity on estuarine beaches in the Brazilian Amazon Region. J Coastal Res, 70(1): 545-550.

Demir M, Özer S. 2014. Evaluation of the Tortum Waterfall according to the criteria used in the selection of protected areas in Turkey. Polish J Environ Stud, 23(5): 1230-1235.

Demir M, Toy S, Göktuğ TH. 2017. Planning process of recreational areas based on the use of forest sources for recreational purpose. In: Öztürk M, Efe R, editors. Contemporary Studies in Environment and Tourism. Cambridge Scholars Publishing, London, UK, pp: 507-520.

Demir M. 2019. Characteristics of air pollution in the city of Erzurum. Fresen Environ Bullet, 28: 3586-3593.

Dias E, Beinat E, Scholten HJ. 2004. Effects of mobile information sharing in natural parks. In Enviro Info, 2: 11-25.

Doğru E, Aydin F. 2020. Yerel halkın milli parklara ilişkin görüşleri: İğneada Longoz Ormanları Milli Parkı Örneği. Inter J Geograp Geograp Edu, 42: 328-355

Erdemir B. 2018. Sürdürülebilir turizm kapsamında destinasyonların fiziksel ve psikolojik taşıma kapasitesi analizi: Pamukkale Hierapolis ören yeri örneği. Yüksek Lisans Tezi, Balıkesir Üniversitesi, Sosyal Bilimler Enstitüsü, Balıkesir, Türkiye, ss: 140.

Göksu U. 2022. Korunan alanlarda taşıma kapasitesi ve ziyaretçi memnuniyetinin belirlenmesi: Karagöl-Sahra Milli Parkı örneği. Yüksek Lisans Tezi, Artvin Çoruh Üniversitesi, Lisansüstü Eğitim Enstitüsü, Orman Mühendisliği Anabilim Dalı, Artvin, Türkiye, ss: 56.

Göktuğ TH. 2011. Dilek Yarımadası Büyük Menderes Deltası Milli Parkı'nın rekreasyonel taşıma kapasitesinin belirlenmesi üzerine bir araştırma. Doktora Tezi, Atatürk Üniversitesi, Fen Bilimleri Enstitüsü, Erzurum, ss: 261.

Göktuğ TH, Yıldız DN, Demir M, Bulut Y. 2013. Taşıma kapasitesi kuramının milli parklarda oluşum- gelişim ve modellenme süreci. Atatürk Üniv Zir Fak Derg, 44(2): 195-206.

Göktuğ TH, Arpa NY. 2016. A method approach for determining recreational carrying capacity in the scope of boat tours: Sample of Beyşehir Lake National Park. Kahramanmaraş Sütçü İmam Üniv Doğa Bilim Derg, 19(1): 5-27.

Göktuğ TH, İçemer GT, Göktürk RS, Deniz B, Aslan EŞO, Arpa NY. 2017. Beydağları sahil milli parkı'nda taşıma kapasitesi boyutlarının (fiziksel, gerçek, etkin, sosyal, ekolojik) analizleri tabanlı ziyaretçi yönetim modelinin geliştirilmesi: Faselis ve Çıralı koyları örneği. TÜBİTAK, Kesin Sonuç Raporu, Proje no: 114O344, Ankara, Türkiye, ss: 231.

Grafe AR, Vaske JJ, Kuss FR. 1984. Social carrying capacity: An Integration and synthesis of twenty years of research. Leisure Sci, (6)4: 395-431.

Hadwen S, Palmer LJ. 1922. Reindeer in Alaska. Alaska, USA, Department of Agriculture, No: 1089, pp: 273.

IUCN, (2011). What is a protected area. URL: http://www.iucn.org (accesed date: May 20, 2015).

Jurado E, Dantas AG, Silva CPD. 2009. Coastal zone management: Tools for establishing a set of indicators to assess beach carrying capacity (Costa del Sol—Spain). J Coastal Res, 1125-1129.

Kara VM, Celep M, Kanıgür S. 2020. Aşırı turizm kapsamında salda gölü'nün fiziksel taşıma kapasitesinin belirlenmesi. J Tour Gastron Stud, 4: 79-92.

Koday Z, Kaymaz ÇK. 2017. Çevre, Eğitim ve milli parkların önemi. 15. Uluslararası Türk Dünyası Sosyal Bilimler Kongresi, 11-12 Eylül 2017, Komrat, Moldova, ss: 21-32.

Lawson SR, Manning RE, Valliere WA, Wang B. 2003b. Proactive monitoring and adaptive management of social carrying capacity arches national park: An application of computer simulation modelling. J Environal Manage, 68(3): 305-313.

Lawson S, Kiely AM, Manning RE. 2003a. Computer simulation as a tool for developing alternatives for managing crowding at wilderness campsites on isle royale. Northeastern Recreation Research Symposium Proceedings, Pensilvanya, USA, pp: 18.

Lindberg K, Mccool S, Stankey G. 1997. Research notes: Rethinking carrying capacity (sustainable tourism). Annals Tourism Res, 24(2): 461-465.

Maldonado E, Montagnini F. 2005. Carrying capacity of la tigra national park, Honduras. J Sustainable Forestry, 19(4): 29-48.

Manning R. 1999. Crowding and carrying capacity in outdoor recreation: From normative standards to standards of quality. In Jackson E, Burton T, editors. Leisure Studies: Prospects for the Twenty-First Century, State College. Venture Publishing, Pensilvanya, USA, pp: 323–34.

Manning RE. 2002. How much is too much? carrying capacity of national parks and protected areas. In Monitoring and Management of Visitor Flows in Recreational and Protected Areas, Conference Proceedings, August 16-19, Norway, pp: 306-313.

Manning R, Leung YF, Budruk M. 2005. Research to support management of visitor carrying capacity of Boston Harbor Islands. Northeastern Naturalist, 12(sp3): 201-220.

Manning R, Valliere W, Wan, B, Lawson S, Newman P. 2002. Estimating day use social carrying capacity in Yosemite national park. J Canadian Assoc Leisure Stud, 27(1-2): 77-102.

Manning R. 2007. Impacts of recreation on riparian soils and vegetation. Jawra J American Water Resources Assoc, 15(1): 78022.

Marsiglio S. 2017. On the carrying capacity & the optimal number of visitors in tourism destinations. Tour Econ, 23: 632–646.

McCool SF, Lime DW. 2001. Tourism carrying capacity: Tempting fantasy or useful reality? J Sustainable Tourism, 9(5): 372–88.

Moore SA, Polley A, 2007. Defining indicators and standards for tourism impacts in protected areas: Cape Range National Park, Australia. Environal Management 39(3): 291-300.

Needham MD, Rollins RB, 2005. Interest group standards for recreation and tourism impacts at ski areas in the summer. Tourism Manage, 26 (1): 1-13.

Onat F. 1998. Yeşil alan kullanıcılarının memnuniyet derecelerinin değerlendirilmesi: Beşiktaş ilçesi örneği. Yüksek Lisans Tezi, İstanbul Teknik Üniversitesi, İstanbul, Türkiye, ss: 147.

Özdamar K. 2003. Modern bilimsel araştırma yöntemleri. Kaan Kitabevi, Eskişehir, Türkiye, ss: 228.

Papageorgiou K, Brotherton I. 1999. A management planning framework based on ecological, perceptual, and economic carrying capacity: The case study of Vikos-Aoos National Park, Greece. J Environal Manage, 56: 271-284.

Pereira da Silva C. (2002). Beach Carrying Capacity Assessment. How important is it? J Coastal Res, 36: 190-197.

Queiroz RE, Ventura MA, Guerreiro JA, Cunha RTD. 2014. Carrying capacity of hiking trails in natura 2000 sites: A case study from North Atlantic Islands (Azores, Portugal), Revista de Gestão Costeira Integrada, 14(2): 233-242.

Şahbaz RP, Altınay M. 2015. Türkiye'deki milli parkların rekreasyon faaliyetleri açısından değerlendirilmesi. J Tourism Gastron Stud, 3(3): 125-135.

Saveriades A. 2000. Establishing the social tourism carrying

capacity for the tourist resorts of the east coast of the Republic of Cyprus. Tourism Manage, 21: 147-156.

Sayan MS, Atık M, 2011. Recreation carrying capacity estimates for protected areas: A sudy of termessos national park. Ekol, 78: 66-74.

Sayan MS, Ortaçeşme V, Karagüzel O, Atik M, Şahin T, Yıldırım E, Avcı Ü. 2005. Termessos (Güllükdağ) milli parkı'nda rekreasyonel taşıma kapasitesinin belirlenmesi. TÜBİTAK, Kesin Sonuç Raporu, Proje no: TOGTAG- 3197, Antalya, Türkiye, ss: 63.

Sayan MS. Ortaçeşme V. 2005. Rekreasyonel taşıma kapasitesi kavramı ve korunan doğal alanlarda taşıma kapasitesinin belirlenmesi. Korunan Doğal Alanlar Sempozyumu, 8-10 Eylül, Isparta, Türkiye, pp: 495-503.

Sever S. 1998. Yozgat Çamlığı Milli Parkı'nın koruma kullanım ve geliştirme ilkeleri üzerine bir araştırma. Yüksek Lisans Tezi, Ankara Üniversitesi, Fen Bilimleri Enstitüsü, Peyzaj Mimarlığı Anabilim Dalı, Ankara, Türkiye, ss: 229.

Shelby B, Heberlein T. 1984. A Conceptual framework for carrying capacity determination. Leisure Sci, 6: 433-451.

Shelby MD, Newbold RR, Tully DB, Chae K, Davis VL. 1996. Assessing Environal chemicals for estrogenicity using a combination of in vitro and in vivo assays. Environal Health Perspect, 104(12): 1296-1300.

Silva SF, Ferreira JC. 2013. Beach carrying capacity: The physical and social analysis at Costa de Caparica, Portugal. J Coastal Res, 1039-1044.

Simon FJG, Narangajavana Y, Marques DP. 2004. Carrying capacity in the tourism industry: A case study of Hengistbury head. Tourism Manage, 25: 275-283.

Smith K, Headly R. 1975. The use of computer simulation models in wilderness management. In: Ladany S, editor. Management science applications to leisure time. National Recreation and Parks Association, North Holland, Holland, pp: 273.

Sobhani P, Esmaeilzadeh H, Sadeghi SMM, Marcu MV. 2022. Estimation of Ecotourism Carrying Capacity for Sustainable Development of Protected Areas is Iran. Int J Environ Res Pub Health, 19: 1059.

Soylu Y, Özkök F. 2016. Turistik destinasyonlarda taşıma kapasitesi: Çanakkale Savaşları Gelibolu tarihi alanı örneği. Balıkesir Univ J Soc Sci Instit, 19: 36-41.

Sözen N. 1974. Ülkemizde milli parklar. Peyzaj Mimarlığı Derg, 1974: 2.

Stankey GH, Mcool, S. 1984. Carrying capacity in recreational settings: evolution, appraisal, and application. Leisure Sci, 6(4): 453-473.

TURKSTAT. 2021. Turkish Statistical Institute. URL: https://www.tuik.gov.tr/ (accessed date: 11 March 2022).

Ünlüönen K, Tokmak C. 2009. Topkapı Sarayı'nda çalışanlar ve ziyaretçilerin sosyal taşıma kapasitesine yönelik değerlendirmeleri. İşletme Araş Derg, 1(2009): 17-30.

Valliere W, Manning R. 2008. Research to support analysis and management of carrying capacity at lake Umbagog National Wildlife Refuge, New Hampshire and Maine. Proceedings of the Northeastern Recreation Research Symposium, Pensilvanya, USA, pp: 314-323.

Vaske JJ, Donnelly MP. 2002. Generalizing the encounter--norm--crowding relationship. Leisure Sci, 24(3-4): 255-269.

Vaske JJ, Shelby LB. 2008. Crowding as a descriptive indicator and an evaluative standard: Results from 30 years of research. Leisure Sci, 30(2): 111-126.

Vaske JJ, Shelby B, Graefe AR, Heberlein TA. 1986. Backcountry encounter norms: Theory, method and empirical evidence. J Leisure Res, 18(3): 137-153.

Vaske JJ, Donnelly MP, Shelby B. 1993. Establishing management standards: Seleceted examples of the normative approach. Environal Manage, 17 (1): 629-636.

Wang B, Manning RE. 1999. Computer simulation modeling for recreation management: A Study on carriage road use in Acadia National Park, USA. Environal Manage, 23(2): 193-203.

Zacarias DA, Williams AT, Newton A. 2011. Recreation carrying capacity estimations to support beach management at Praia de Faro, Portugal. Applied Geograp, 31(3): 1075- 1081.