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DETERMINATION AND EVALUATION OF THE RECREATIONAL CARRYING CAPACITY OF BORÇKA-KARAGÖL NATURE PARK IN ARTVİN PROVINCE

ARTVİN İLİ İÇERİSİNDE BULUNAN BORÇKA-KARAGÖL TABİAT PARKI'NIN REKREASYONEL TAŞIMA KAPASİTESİNİN BELİRLENMESİ VE DEĞERLENDİRİLMESİ

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Abstract

The increasing number of recreational activities have become a problem in natural and cultural areas. It is a necessity to impose certain restrictions on the intended use. In this sense, the concept of carrying capacity has gained importance. The carrying capacity of the simplest form is the highest acceptable population level of an ecosystem. In other words, protecting the loss of natural and cultural resources in protected areas, which are sensitive areas, and paying attention to the use order is an important compilation planning tool preferred in the operation of tourism. For this purpose, in this study, the carrying capacity of Borçka-Karagöl Nature Park, which is utilized within the scope of recreational activities in Artvin province and used as a protected area, was determined between 2017-2021. As a result, recommendations have been developed to overcome the current situation. The number of visitors obtained by the Artvin General Directorate of Nature Conservation and National Parks (GDNCNP) in 2017-2021 was used. As a result of the evaluations made, it has been determined that there is an excess of approximately 6.5 times in the rate of utilization of only Borçka-Karagöl Nature Park for tourism purposes in Artvin province even between the years mentioned. Therefore, in parallel with the increase in people's demand for natural resources, it will pave the way for an increase in environmental destruction. For this reason, it is concluded that the relevant associations and organizations should focus on raising awareness of the people with planned studies and support.

Keywords: Protected Areas, Carrying Capacity, Recreational Carrying Capacity, Borçka-Karagöl Nature Park, Artvin

Özet

Her geçen gün korunan alanlar üzerinde artan rekreasyonel faaliyetlerde artış ve bu artışa bağlı olarak doğal ve kültürel alanlarda oluşan tahribatlar bir sorun haline gelmiştir. Bu amaçla bu alanların kullanımına belli sınırlamalar getirilmesi gerekliliği ile taşıma kapasitesi kavramı gündemde yer almaya başlamıştır. En basit haliyle taşıma kapasitesi, bir ekosistemin en yüksek düzeyde kabul edebileceği popülasyon düzeyidir. Diğer bir deyişle, hassas alan olan korunan alanlarda doğal ve kültürel kaynaklara zarar vermeden koruma-kullanma dengesine dikkat edilerek turizm faaliyetlerinin yapılabilmesinde tercih edilen önemli bir stratejik planlama aracıdır. Bu amaçla, bu çalışmada Artvin ilindeki rekreasyon faaliyetleri kapsamında istifade edilen ve korunan alan olarak kullanılan Borçka-Karagöl Tabiat Parkı'nın 2017-2021 yılları arasındaki taşıma kapasitesi belirlenmiştir. Sonucunda, günümüzdeki mevcut durumların aşılmasına yönelik öneriler geliştirilmiştir. Bu kapsamda 2017-2021 yıllarında Artvin Doğa Koruma ve Milli Parklar Müdürlüğü (DKMP) tarafından elde edilen ziyaretçi sayılarından istifade edilmiştir. Yapılan değerlendirmeler sonucunda belirtilen yıllar arasında dahi Artvin ilinden sadece Borçka-Karagöl Tabiat Parkı'ndan turizm amaçlı istifade etme oranında yaklaşık 6.5 kat kadarlık bir fazlalık olduğu tespit edilmiştir. Dolayısıyla, kişilerin doğal kaynaklara olan talebinin artması paralelinde çevresel tahribatlarda da artışın yaşanmasına zemin hazırlamaktadır. Bu nedenle, ilgili kurum ve kuruluşların planlı çalışmaları ve desteğiyle kişilerin bilinçlendirilmesi çalışmalarına ağırlık vermesi gerektiği sonucuna varılmıştır.

Anahtar Kelimeler: Korunan Alanlar, Taşıma Kapasitesi, Rekreasyonel Taşıma Kapasitesi, Borçka Tabiat Parkı, Artvin

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1. Introduction

The negative impact of ecological, economic and socio-cultural reasons on existing natural and cultural resources from the past to the present has made it necessary to attach importance to nature conservation efforts (Tarrant & English, 1996, p.156). With this necessity, the concept of protected areas emerged and many places were declared as protected areas. According to the definition by the IUCN, protected areas are areas with defined boundaries and subject to specific rules for human activities, established to protect natural and cultural values (URL-1).

Thanks to protected areas, there has been a significant increase in the intensity of activities such as hiking, camping, and photography, along with a rapid rise in interest in areas rich in natural and cultural resources. As recreational activities increase, wildlife is disturbed, vegetation is damaged, and environmental problems such as waste issues arise. Furthermore, this intensity has the potential to negatively affect visitors' experiences, gradually diminishing the area's appeal and ultimately causing the local population to suffer negative cultural or economic consequences (Aydın, Öztürk, & Demirci, 2017, p.74; Risteski, Kocevski, & Arnaudov, 2012, p.25).

Protected areas are extremely vulnerable ecological systems that are sensitive to the presence of tourists. They are also a factor that can accelerate or reinforce environmental degradation through inappropriate management practices. This is likely to cause a decline in the quality of life of local communities living around protected areas (Pavón, Baca, Arcos, & Garcia, 2017, p.165). The existence of these negative situations has also brought new approaches to the agenda to ensure the sustainability of protected areas.

Various studies have also found that when certain threshold values for visitor satisfaction in protected areas are exceeded, the quality of the natural environment declines, existing facilities become inadequate, and visitor experience quality also declines due to overcrowding (Borrie, Freimund, & Davenport, 2002, p.45; Killen, 2023, p.38; Leung, Spenceley, Huenegaard, & Buckley, 2018, p.28). In this sense, it is essential to monitor visitor flows and satisfaction levels and impose restrictions to prevent negative factors in such areas.

Although tourism activities in protected areas have led to increases in the income levels of local communities and entrepreneurs, communication gaps among relevant stakeholders, differences in the roles and responsibilities of institutions and organizational phase issues

threaten the sustainability of these areas. Therefore, the concept of carrying capacity is of great importance, especially for effective planning and management (Risteski, Kocevski, & Arnaudov, 2012, p.26). To ensure sustainable management and planning in such destinations, planning and management must be carried out considering the carrying capacity of protected areas.

According to the World Tourism Organization, carrying capacity is defined as "the number or level of users that an area can tolerate" (Buckley, 1999, p.706). Carrying capacity is a particularly important issue in terms of preventing problems arising from visitor density, determining the maximum number of visitors that can visit the area, and limiting the use of the area according to this requirement. These limits aim to ensure the sustainable use of the area by preserving both its natural structure and the visitor experience (Sayan & Ortaçeşme, 2005, p.495).

Moreover, Article 14 of the National Parks Law stipulates that "The natural and ecological balance and natural ecosystem value cannot be disturbed, wildlife cannot be destroyed, any interventions that cause or may cause the loss or change of the characteristics of these areas, and works and operations that will create soil, water and air pollution and similar environmental problems cannot be carried out (Official Gazette, 2024). In this context, a proper planning and management approach is necessary to ensure the sustainability and continuity of natural resources and cultural values in tourism activities carried out in protected areas.

In fact, studies on the concept of carrying capacity (environmental carrying capacity) date back to the 1960s. In 1964, American scientist Wagar first proposed the concept of environmental carrying capacity in tourism (Long, Lu, Chang, Zhu, & Chen, 2022, p.2). In 1971, Lim and Stankey proposed that tourism environmental capacity consists of four different components: biophysical, sociocultural, psychological, and managerial (Ceballos Lascurain, 1996, p.10; Huang & Wang, 2020, p.5). Later, the World Tourism Organization adopted the concept of tourism environmental carrying capacity in its 1978–1979 general work plan report (Chen, 2014, p. 116). In these components, it is stated that there should be a threshold value in visitor activities, if this threshold value is not taken into consideration, the local people will be negatively affected by this situation in terms of socio-cultural impact, and for this reason, quality should always be given importance, but this can only be possible with successful management (Işık, Ersöz, & Ersoy, 2022, p.402).

For example, in a study conducted in Wuyishan National Park, although tourism had positive effects, findings showed that environmental degradation occurred in the long term due to increased use of the area, and as a result, the area's carrying capacity weakened over time (Xiao, 2024, p.657).

To ensure that visits to particularly sensitive areas are balanced and that service quality is not compromised, it is essential to impose a limit on the maximum number of visitors allowed to visit the area. Recreational carrying capacity analyses are used to determine this limit (Göktuğ, Yıldız, Demir, & Bulut, 2013, p.196).

Recreational carrying capacity, which has ecological, physical, social and management dimensions, is the carrying capacity that reveals the right number of visitors in natural areas, protected natural areas, national parks or similar areas open to human use. By definition, it can be defined as "the maximum number of people who can use a recreation area without permanent degradation of its physical environment, biological and cultural resources, and without reducing the quality of visitors' recreational experience" (Sayan & Ortaçeşme, 2005, p.495). As can be seen, the concept of carrying capacity is a complex concept associated with many factors. For this purpose, while determining the carrying capacity of a protected area, in addition to these components, recreational carrying capacity analysis should also be carried out and the threshold value of the visitor number limit should be specifically determined accordingly (Göktuğ & Arpa, 2016, p.18).

According to Manning and Lawson (2002), in the definition of recreational carrying capacity, there should be no irreversible damage to the natural and cultural values of a recreation area and the number of visitors considered reasonable for the area should be considered. In various studies on recreational carrying capacity classifications, distinctions such as physical, ecological, social and economic capacity (Jenkins & Pigram, 2005, p.40); biological, perceptual and economic carrying capacity (Papageorgiou & Brotherton, 1999, p.271) and physical, real and effective carrying capacity (Cifuentes, 1992, p.18) are made. Ho wever, the more effective and generally accepted method is the one developed by IUCN, which determines the level of recreational carrying capacity based on physical carrying capacity, actual carrying capacity and effective carrying capacity.

In recent years, there has been an increasing trend toward the recreational use of forest resources (Pak & Türker, 2004, p.60). This study highlights the importance of recreational activities in Artvin province, which is a location with high potential for nature tourism due

to its various tourist attractions, the presence of protected areas, and its status as a border city, and whose value is increasing day by day. The failure to determine the carrying capacity of protected areas increases the negative impact of tourism activities on the ecological balance of these areas. This research aims to reveal why carrying capacity is critical in terms of sustainable protection and use. In particular, the fact that the carrying capacity problem has become apparent in protected areas in Artvin province due to the increase in visitor numbers over time highlights the general situation of this problem. It is therefore important to determine the path and strategy to be followed in nature tourism activities to be carried out in specific areas.

This study selected Borçka-Karagöl Nature Park, located within the borders of Artvin Province, as its research area. The park is an important site for recreational activities and has seen an increase in tourist numbers every day. The physical carrying capacity, actual carrying capacity, and effective carrying capacity of this park were calculated with the aim of revealing the possible effects on the park if it carrying capacity limits are exceeded. Recommendations to contribute to the sustainable management of the park have also been developed. For this purpose, the number of visitors to the park during the 5-year period between 2017 and 2021 has been taken as a basis.

1.1. Carrying Capacity Determination Methods

Many methods have been developed in the last two decades to determine recreational carrying capacities in national parks and protected natural areas. While the "Carrying Capacity Estimation Method in Protected Areas" developed by the World Union for Conservation of Nature (IUCN) (1996) addresses the recreational dimension of carrying capacity, the "Carrying Capacity Assessment Process" (CCAP) model developed by Shelby & Heberlein (1984) estimates the social dimension of carrying capacity.

Carrying Capacity Estimation Method in Protected Areas

The method basically enables the determination of physical, real and effective carrying capacities by using physical, ecological, climatic or management factors that restrict visitation in a formula. In this method developed by IUCN, three levels of recreational carrying capacity are defined. These are "Physical Carrying Capacity", "Actual Carrying Capacity" and "Effective Carrying Capacity".

Physical Carrying Capacity (PCC)

By definition, it is the maximum number of visitors that an area can accommodate without damaging the infrastructure and superstructure, in order to see the natural and historical richness of the area. In short, it refers to the maximum number of people that can physically fit within a defined area at a given time. In this context, it is necessary to ensure good management in order to increase the safety and comfort of visitors and thus the quality of the service (Alagöz & Güneş, 2019, p.361; Caner, 2018, p.5; Ceballos Lascurain, 1996, p.10; Erdemir, 2018, p.3). The number of people required for PCC is shown in Formula (1) (Ceballos Lascurain, 1996, p.10):

PCC= A x Z/a x Rf (1)
In the Formula;
A: Area (Area or path available for visitor use
Z/a: Visitor/area (Area or path length per visitor)
(in area: 1 visitor/m^2; on path: 1 visitor/m)
Rf: Rotation factor (The number of daily visits that can be allowed in an area in terms of working hours and is calculated by the following Formula (2):
Rf = Time the site is open per day / average duration of a visit (2)

Actual Carrying Capacity (ACC)

In the calculation of this capacity, the maximum number of visits allowed to an area is obtained by mathematically subtracting the correction factors obtained from certain negative characteristics of the area from the PCC. In other words, the variables affecting the area and the correction factor, which is the numerical equivalent of the variable values, are also taken into account in the physical carrying capacity calculation. For example, the number of sunny/rainy/snowy days, erosion, accessibility, wildlife disturbance, etc. are used as correction factors (Ceballos Lascurain, 1996, p.12) Formula (3):

ACC = PCC – Df1 – Df2 -..... – Dfn (3) Df = Ds/Dt x 100
Df1, Df2,..... Dfn Correction factors calculated for each variable
In the Formula;
Df: Correction factor (%)
Ds: Limiting value of the variable
Dt: Total value of the variable

According to the Formula, in order to find the ACC, the relationship between the limiting value and the total value of the factors that prevent or restrict visitation must first be calculated by interpolation method, then all correction factors valid for the area are determined and the determined values are mathematically deduced from the PCC. In this case, Formula (4) (Ceballos Lascurain, 1996, p.12);

$$ACC = PCC \times (100\ Df1/100) \times (100\ Df2/100) \times \ldots\ldots\ldots \times (100\ Dfn/100) \quad (4)$$

This type of capacity represents the maximum number of visitors an area can handle according to its current management capacity. This capacity is calculated by using the actual carrying capacity calculation and including the management capacity in the calculation (Ceballos Lascurain, 1996, p.12). Formula (5):

$$ECC = ACC \times MC \quad (5)$$

MC (Management Capacity) in the Formula; It means the total of the conditions required for the persons providing the protected storage management to carry out their duties and objectives. In other words, there is an administratively manageable area and more than one visitor. However, it is not easy to measure this capacity because it is affected by many variables such as legislation, infrastructure, superstructure, equipment, etc. related to the administrative area.

2. Materials and Methods

2.1. Introduction of the Research Area

In Artvin province; Hatila Valley National Park, Karagöl-Sahara National Park, Altıparmak Nature Park, Balıklı and Güneşli Waterfalls Nature Park, Borçka Karagöl Nature Park, Tavşan Tepesi Nature Park and Cehennem Deresi Nature Park are protected areas. However, Borçka-Karagöl Nature Park, which attracts more visitors, has more touristic attractions and has an inventory record, was included in the study.

Borçka Karagöl Nature Park was declared as a nature park in 2002. The size of the lake area is approximately 5 ha and has a total area of 368 ha. The lake is a landslide lake and was formed in the early 19th century when a hill near today's “Klaskur (December) Plateau” blocked the Klaskur (December) Stream because of a landslide. It is 57 km to Artvin city center and 25 km to Borçka district center. Karagöl and its immediate surroundings have a unique biodiversity and landscape character with its flora, fauna, superior landscape features and geological features. There are local red scaled trout in the lake. Since the region is located on the migration route of birds of prey, dozens of bird

species, especially birds of prey, can be observed. Access to the Nature Park is mostly provided by asphalt roads and 6 km of natural stone paved roads. It is one of the areas most flocked by visitors with its rich vegetation (URL-2, URL-3).

Borçka-Karagöl Nature Park is in high demand especially in the fall months. In Borçka-Karagöl, visitors come 3 months of the year (September, October, November) to see the diversity of natural resources. Visitors to the area have picnic areas for daily use. The facilities in the area operate at full occupancy during these months, are utilized as a camping area and visitors daily come from nearby provinces (Table 1).

Table 1: Annual Visitor Numbers of Borçka-Karagöl Nature Park

Years	**Seasons**				***Total***
	Spring (March-May)	**Summer (June-August)**	**Autumn (September-November)**	**Winter (December-February)**	
2017	15.400	67.302	6.398	--	***89.100***
2018	12.150	70.700	16.415	300	***99.565***
2019	5.658	89.579	26.200	630	***122.067***
2020	--	76.596	41.118	2.586	***120.300***
2021	3.812	85.979	18.297	540	***108.628***
Total	***37.020***	***390.156***	***108.428***	***4.056***	***539.660***

Source: Artvin GDNCNP datas.

2.2. Material

Due to the lack of inventory data for earlier years, the fact that the years 2020-2021 were affected by the COVID-19 pandemic in terms of tourism, environmental use, and human mobility, and the fact that this study is based on data from a project, only data from the 2017-2021 period has been used. Data was obtained from the Artvin DKMP Branch Directorate, based on protected areas and visitor numbers. In addition, while examining the literature on protected areas and carrying capacity concepts, domestic and foreign articles, graduate theses, projects, activity reports of various institutions and organizations, regulations and other documents were used.

2.3.Method

In determining the recreational carrying capacity for the protected areas of Borçka-Karagöl Nature Park, which are intensively used for recreational purposes in Artvin province, it was decided to make physical carrying capacity, actual carrying capacity and effective carrying capacity calculations.

3. Results And Discussion

3.1. Physical Carrying Capacity

Based on the necessity to walk on the paths open to visitors in Borçka-Karagöl Nature Park, necessary calculations were made considering the path lengths of the relevant area. In the calculations, the rotation factor (Rf) was calculated first. As a result of the calculations, it was concluded that the maximum number of people who can visit the area in one day is 250.000 people (Figure 1).

3.2. Actual Carrying Capacity

While determining the actual carrying capacity of Borçka-Karagöl Nature Park, meteorological data from 1989-2018 (39 years) were used. In addition to the physical carrying capacity calculation, the number of days when the area was snowy, the average number of rainy, stormy and foggy days during the year were taken into account in the correction factor. Calculations were made according to these values. As a result of the calculations, it was calculated that the maximum number of visitors allowed in the area is 96.611 people (Figure 1).

3.3. Effective Carrying Capacity

To determine the effective carrying capacity, the Management Capacity (MC) of Borçka-Karagöl Nature Park was determined. For this purpose, calculations were made according to the current number of personnel working in natural and cultural areas in Borçka-Karagöl Nature Park. In these calculations, it was determined that the number of personnel working in the GDNCNP of Artvin province was 17 and according to this determination, it was calculated that the MC value of Borçka Karagöl Nature Park was 85%. Afterwards, it was seen that the effective carrying capacity (the maximum number of people that the existing management capacity can accommodate) calculated based on this value would be 82,119 people (Figure 1). Moreover, according to GDNCNP data, although the projected number of personnel that should be in the area is 20, activities are carried out with 17 personnel. Therefore, this leads to a decrease in management capacity

and consequently to deficiencies in management services.ctive Carrying Capacity

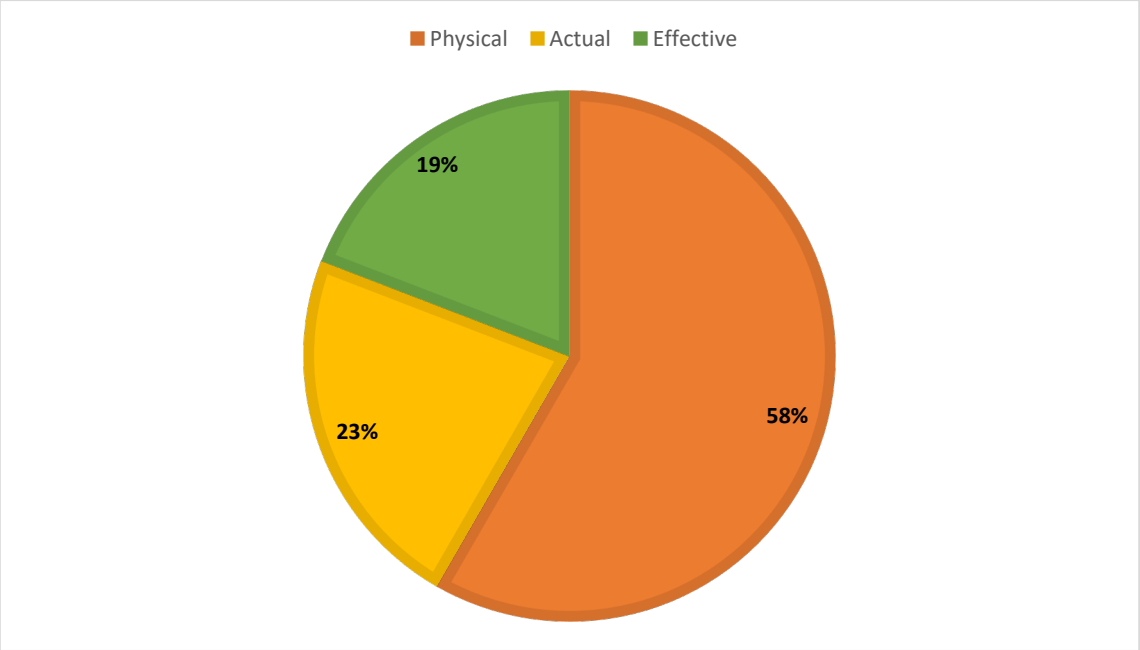

Figure 1. Percentage distribution of carrying capacity data for Borçka-Karagöl Nature Park

4. Conclusions and Recommendations

According to the results of the analysis, the number of people who can physically fit in Borçka-Karagöl Nature Park in Artvin province is 250.000 people. When the factors that restrict or prevent visitation are taken into consideration, the actual carrying capacity drops to 96.611 people. In addition, considering the insufficient number of personnel in the area, the effective carrying capacity of Borçka-Karagöl Nature Park decreases to 82.119 people. Based on these values, the maximum number of visitors that Artvin province can accept in a year is 29.973 people (82.119 visitors/day x 365 = 29.973 visitors/year). However, it should not be ignored that these values are not exact figures, since the problem of not having a complete inventory record of visitors to protected areas in our country is also valid for Artvin province.

According to the GDNCNP data, the number of visitors to Artvin Province's Borçka-Karagöl Nature Park between 2017 and 2021 totaled 906,496 people. However, the maximum number of visitors that Artvin-Borçka Karagöl Nature Park can accommodate in a single year is 29.973, and the maximum number of visitors it can accommodate over a five-year period is 149.865. As a result of this figure, Borçka-Karagöl Nature Park has been visited by 6.5 times more people than its capacity. Moreover, the fact that our

country has been affected by COVID-19 has also contributed to the numbers being lower than expected. It is possible that this number will increase day by day in the present and in the coming years. The rich biological diversity, the availability of areas suitable for most types of tourism, and the increasing recognition through social media day by day will make this increase possible. However, over time, it is clear that Artvin province, specifically Borçka-Karagöl Nature Park, will not be able to support such a high volume of visitors, will be extremely strained, and will soon pave the way for the province to suffer extensive environmental damage.

First of all, ecological sensitivity should be taken into account in protected areas, and care should be taken to open these areas for use in a controlled manner and to regulate the number of visitors and activity intensity within the specified limits. In addition, local communities and regional entrepreneurs should be encouraged to participate in awareness-raising meetings on the sustainable use of these areas. In this way, benefits will be achieved in increasing both economic development and the level of social adoption.

In additional, the implementation of ecotourism activities in these protected areas will also be important for the continued sustainability of the relevant areas. It is again necessary to determine the intensity of use of the relevant areas, to record visitor entries and exits, to check visitor numbers at regular intervals, to limit vehicle traffic to the area, to have specific entry and exit points to the area, to establish alternative routes, and to provide awareness training to increase visitors' environmental awareness.

Even though long-term development plans and management plans include information on carrying capacity in protected areas, they generally lack detailed studies on how this capacity is calculated. Moreover, determining the carrying capacity of protected areas is crucial for ensuring the continuity and sustainability of these areas. In this sense, before a protected area is opened to visitors, the limits of its carrying capacity must be clearly defined during the planning stage, relevant laws and regulations must be established to ensure compliance with these limits, and it must be stated that sanctions will be imposed if the rules are not followed in practice.

In visitor management, visitor behavior should be regulated within certain rules, and visitors should be provided with necessary information about the area. Nowadays, in the rapidly developing technological age, visitors can be provided with information about

environmental protection, route suggestions, and warnings through mobile applications. Strategies should be developed in the context of maintaining service quality and resource values in the area. Weekly or seasonal visitor quotas should be set and periodically updated based on visitor density. Visitors arriving at the site via mobile applications should be registered, and surveys should be conducted with them. Improvements should be made to the site's management policy based on the feedback obtained.

In Artvin province specifically, it has been observed that visitors park their vehicles wherever they find space in all protected areas, not just Borçka-Karagöl Nature Park, as increased recognition has led to a rise in demand. Not only visitor density but also vehicle density (especially motor vehicle density) causes a decline in visitor experience quality, erosion, air and soil pollution, and heavy metal accumulation on plants. For this purpose, it is necessary to either restrict the entry and exit of motorized and passenger vehicles to the area by applying a time slot system (permitting access to the area at specific times of the day) or, especially in priority areas, to strictly limit visitor capacity and construct a well-equipped parking area.

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Ethics Committee Approval

No ethics committee approval was obtained for this study because the data was obtained from the institution where the second author works. However, the study was conducted in accordance with ethical principles.

Collaboration Rate

1st Author: 50%

2nd Author: 50%

Conflicts of Interest

There is no conflict of interest among the authors or any institution or organization involved in the study.