

# An integrative approach to recreational trail planning in mountain protected areas: a case study of Kaçkar Mountains National Park, Turkey

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**Keywords:** Trail planning, protected areas, nature-based tourism

## Abstract

Economic, social and technological changes, as well as a global epidemic, have altered people's needs and influenced travel cultures, shifting tourism from mass forms to alternative, nature-based ones, thereby stimulating economic development. The growing popularity of outdoor recreation activities highlights the need to balance conservation and use in protected areas. This study focuses on trail planning in the Kaçkar Mountains National Park, an area ideal for outdoor activities but threatened by excessive and unplanned use. The Park aims to guide visitors safely along appropriate routes, ensuring access to nature while maintaining a balance between resource use and protection. The research for this study included the selection of 10 trails, expert interviews, field studies, digitization of inventory and routes, assessment of difficulty using AHP, theming of routes, and development of management strategies. Using the AHP method to grade trail difficulty resulted in four low-, four medium- and two high-difficulty paths, which were divided into four themes (Glacial Age, Wild, Victory Climbing, Cloud Sea). Safety problems and management deficiencies of the routes were identified, route maps were prepared, and suggestions for the management of the routes were developed.

## Profile

Protected area

Kaçkar Mountains

National Park

Mountain range

Pontic Mountains

Country

Turkey

## Introduction

According to the World Tourism Organisation, the recent increase in people's desire to experience nature, natural areas and local culture (Silva et al. 2021), and the COVID-19 crisis, which has led to a change in people's expectations and demands, have increased interest in and experience of nature tourism (Smith et al. 2023). But these dynamics have also created problems, such as uncontrolled over-capacity and illegal construction in natural areas (Altun et al. 2021). The main purposes of protected areas (PAs) and national parks, which are the most attractive areas for outdoor and nature-based tourism (Çağlayan 2019) due to their natural and cultural richness (Birinçi 2018), are to protect the natural environment from degradation while providing recreational opportunities (Dudley 2008). The continued attractiveness of these areas can only be achieved by keeping the impacts of their use to a minimum (Akten & Gül 2014). The increasing demand for PAs and national parks has highlighted the need for their controlled use, making the planning, construction and maintenance of trails a key task for park managers (Tomczyk & Ewertowski 2013). Hiking is the most important recreational activity in PAs (Pomfret 2006; Chhetri et al. 2004; Fredman & Tyrväinen 2010) and has considerable potential to generate income for local communities (Wöran & Arnberger 2012; Molokáč et al. 2022). Trail networks enable activities like hiking, cycling, photography and wildlife observation, facilitating movement within PAs (Hugo 1999; Weston & Mota 2012; Santarém et al.

2015). The creation and improvement of recreational trails have increased to prevent uncontrolled use that damages the values of PAs, and to help manage visitors (Marion & Leung 2001; Marion & Leung 2004; Cole 2004; Ballantyne & Pickering 2015), reducing their environmental impacts. Rather than restricting users, this approach assesses the intensity and type of use and tailors trail development accordingly, helping to control environmental damage even under heavy use (Marion 2023), thus enhancing trail sustainability.

Ancient trails, historically used for travel and trade, have gained popularity as recreational paths for activities such as watching wildlife, visiting natural and cultural sites, and educational experiences (Godtman Kling et al. 2017). In nature-based tourism, trails enhance visitor experience and wellbeing through access to nature, and help manage crowds. They provide access to natural areas, and prevent visitors from getting lost while protecting them from potential dangers; they also help to avoid damage to sensitive areas (Lekies & Whitworth 2011).

Determining difficulty levels as part of trail planning is essential for safety, user experience, sustainability and visitor management. This classification helps hikers choose appropriate trails, reducing accidents and increasing satisfaction. It also assists PA managers in resource allocation and maintenance, balancing visitor flows, minimizing environmental impact and supporting conservation.

National and regional mountaineering organizations use different systems to classify trails. In North America, the Yosemite decimal system has five lev-

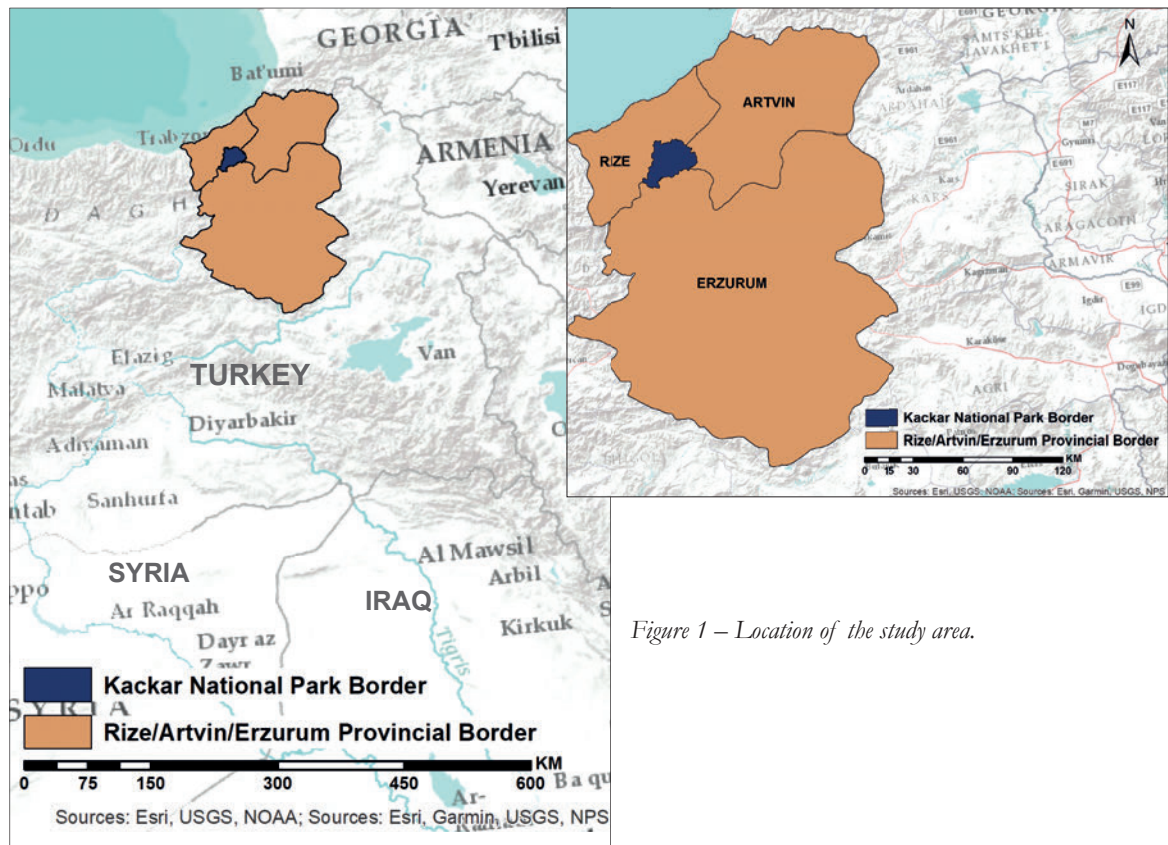


Figure 1 – Location of the study area.

els, from non-technical to expert. The International Mountaineering and Climbing Federation uses six Roman numerals, and in Europe the French Alpine Grades system ranges from F (easiest) to ABO (most difficult). The Swiss Alpine Club classifies trails from T1 (easy, no special equipment needed) to T6 (demanding and technical) (Molokáč et al. 2022; UIAA 2024). Trail classification studies exist, but the classifications they propose are not standardized, varying regionally and often lacking objective measures like elevation and average duration. Based on subjective individual experience, they also often lack sufficient detail for managers to improve the hiking experience (Calbimonte et al. 2021). Krevs et al. (2023) introduced Experimental Trail Classification (ETC), which uses GIS and other analytical tools to provide more objective assessments. ETC helps to plan and manage hiking activities, ensure visitor safety, enhance the experience and promote sustainable use of PAs.

This study addresses the lack of standardized difficulty criteria and the gap in the use of multi-criteria decision making and GIS in trail classification, aiming to standardize the classification on an international scale, and to improve reliability and hiking experience by introducing objective GIS-based methods in Kaçkar Mountains National Park (KMNP), Turkey. The research will help to answer the following questions:

- Which physical and environmental factors play the most critical role in determining difficulty?

- How can difficulty be modelled using multi-criteria decision support systems?
- How can difficulty be mapped and visualized using GIS?
- How can natural and cultural inventories be used to classify trails?

## Material and method

### Study Area

KMNP, which was declared a national park in 1994, was chosen as the study area. The Park has an area of 52,970 ha and includes the fourth highest peak (3,932 m) in Turkey (Figure 1), in an area just 40 km from the coast where peaks reach 3,492 m (Bayrakdar & Özdemir 2010). The area is subject to erosion by streams and freeze-thaw action at higher altitudes, resulting in topography characterized by steep slopes of impermeable igneous rock. The terrain is forested up to 2,200 m and gives way to alpine meadows above this altitude (Figure 2). The impermeability of the rocks hinders the replenishment of underground water resources, resulting in extensive river networks with high flow rates (Ülker 1992).

The Kaçkar Mountains in the eastern Black Sea region is the second most diverse area in Turkey in terms of glacial morphology, with four glacial valleys, multiple moraine types, and glacial lakes, some of which cover an area of 750 m<sup>2</sup> (Doğu et al. 1993; Çiner 2003; Gürgen 2016). The study area, situated in the Colchis

section of the European-Siberian floristic region, features forests with deciduous and evergreen trees, endemic and relict species, and is dominated by subalpine and alpine vegetation with high mountain meadows (Acar et. al. 2006). The Kaçkar Mountains, rich in fauna due to their diverse vegetation, river networks and varied topography, straddle humid and semi-arid climates. Kurdoğlu's (2002) study recorded 30 species of mammals. Recognized as an Important Bird Area, the Eastern Black Sea Mountains, part of the Kaçkar, support dense forest and alpine vegetation (Magnin & Yazar 1997). These mountains are crucial for migrating diurnal birds of prey in the Western Palearctic. The region is home to the Mountain Rooster (*Tetrao mlokosiewiczii*), the presence of which qualifies the area as one of the world's 217 Priority Areas of Conservation for endemism. KMNP includes ancient caravan and local trails, historically used for trade and grazing, which now attract tourists for scenic walks.

## Method

The study aimed to classify trails in the KMNP using measurable criteria, in two stages. The first involved trail selection, inventory, surveys, observational data and experimental walks. Environmental, physical, cultural and climatic features were inventoried using geographic data platforms and field observations. The authors carried out walks to assess walking difficulties, technical trail requirements and safety measures. In the second stage, the Analytical Hierarchy Process (AHP) was used to select and weight criteria, dividing complex problems into hierarchical levels and determining the relative weight of variables (slope, altitude

etc.). Surveys and interviews with walkers were used to incorporate user and expert experience into the planning process. Quantitative criteria weights from the literature review were used to calculate and visualize data using GIS.

## Selection of trails and taking inventory

Due to its purpose and the limitations of the study (in terms of finance and of the individual effort required), it was decided to select just 10 of the total of 64 trails to analyse. To identify appropriate trails appropriate, personal interviews were conducted with 19 individuals, including experienced regional guides (5), local residents (4), tourism sector workers (5), and members of the Kaçkar Mountaineering Rafting and Ski Sports Specialization Club (KMRSC) (5). Participants were chosen based on their trekking experience and diversity of background in terms of age, physical characteristics and profession. The trails were chosen to form a network that would encompass many natural and cultural assets from the south to the north of KMNP. The information gathered during the field surveys was recorded using the Maps3D application and transferred to a computer environment.

## Selection and weighting of criteria

Since the criteria used in trail classification studies vary depending on the geographical features of the region and the visitors' characteristics, the criteria for this study were based on a literature review (Kiper & Arslan 2007; Kiracioğlu et al. 2013; Vías-Martínez & Ocaña-Ocaña 2014; Vías et al. 2018; Ayhan et. al. 2020; Ha & Yang 2020; Turgut et al. 2021), input from members of the KMRSC and hiking guides, and the knowledge of the local people. Sub-criteria were also based on those found in the literature. These were re-scored for the present study in the ArcGIS environment, using the Reclassify tool, in the range of 0–100. The criteria selected for the degree of difficulty and the scores prepared for the subsequent eligibility analysis are shown in Table 1.

### Slope

Slope criteria for trail suitability were classified according to Vías-Martínez & Ocaña-Ocaña (2014). The USGS SRTM Digital Elevation Model (USGS 2021) and 1/25,000 scale national maps were used for slope analysis. As the USGS and Ordnance Survey maps are derived from different databases and cover different years, there were some discrepancies. To address this, contours from both data systems were compared, differences were updated and resolved, and 1m x 1m resolution DEM data were generated. The ArcGIS Add Surface Information tool was used to calculate the average slope of the trails.

### Altitude

Ha & Yang (2020) note that as altitude increases, temperature and air pressure decrease while wind in-

Table 1 – Classification of criteria.

| Criterion              | Sub-Criterion Class     | Score | References                         |
|------------------------|-------------------------|-------|------------------------------------|
| Slope (%)              | 0–5                     | 100   | Vías-Martínez & Ocaña-Ocaña (2014) |
|                        | 5–15                    | 75    |                                    |
|                        | 15–30                   | 50    |                                    |
|                        | 30–45                   | 25    |                                    |
|                        | >45                     | 1     |                                    |
| Surface                | Grassy ground           | 4     | Vías-Martínez & Ocaña-Ocaña (2014) |
|                        | Rock                    | 12    |                                    |
|                        | Grass over stony ground | 1     |                                    |
| Altitude (m a.s.l.)    | 0–1,800                 | 100   | Ha & Yang (2020)                   |
|                        | 1,800–2,300             | 75    |                                    |
|                        | 2,300–2,800             | 50    |                                    |
|                        | 2,800–3,300             | 25    |                                    |
| Length (km)            | 0.25                    | 100   | Normalization                      |
|                        | 0.50                    | 75    |                                    |
|                        | 0.75                    | 50    |                                    |
|                        | 1                       | 25    |                                    |
| Average duration (min) | 0–180                   | 100   | Vías et al. (2018)                 |
|                        | 180–360                 | 75    |                                    |
|                        | 360–540                 | 50    |                                    |
|                        | >540                    | 25    |                                    |

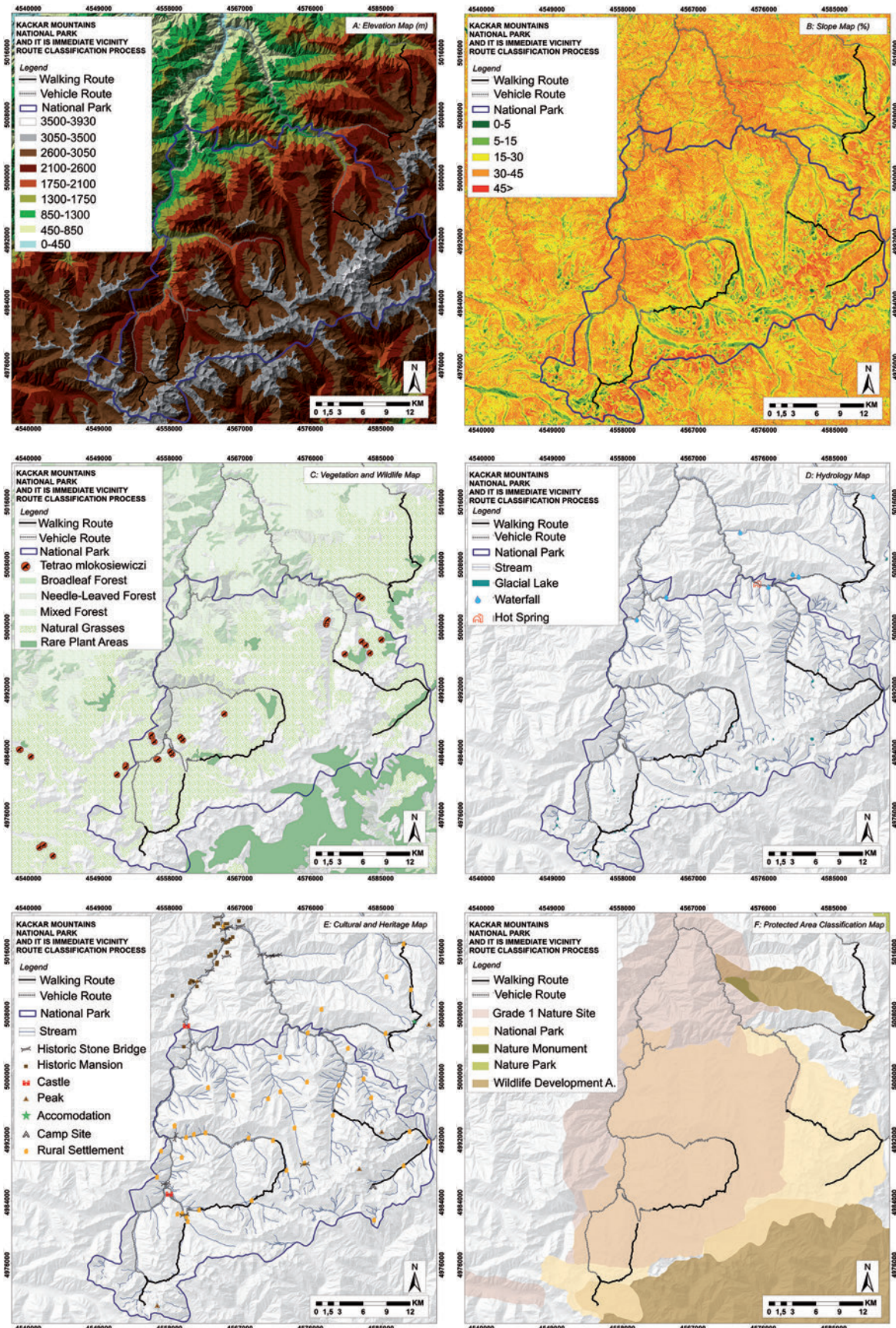


Figure 2 – Inventory of the study area (A: Elevation; B: Slope; C: Vegetation and Wildlife; D: Hydrology; E: Cultural Heritage; F: Protected Area Classification). Source: Authors' figure, Data sources: USGS; Corine Land Cover 2018; General Directorate of Forestry 2021; Isfendiyaroglu 2007; Esri.

Table 2 – Criterion weights.

| Criterion            | Slope | Surface | Elevation difference | Length | Average time | Weight |
|----------------------|-------|---------|----------------------|--------|--------------|--------|
| Slope                | 1     | 1       | 4                    | 5      | 5            | 0.366  |
| Surface              | 1     | 1       | 3                    | 6      | 5            | 0.356  |
| Elevation difference | 1/4   | 1/3     | 1                    | 3      | 3            | 0.141  |
| Length               | 1/5   | 1/6     | 1/3                  | 1      | 3            | 0.083  |
| Average time         | 1/5   | 1/5     | 1/3                  | 1/3    | 1            | 0.054  |

Table 3 – Classification of hiking-trail difficulty levels.

| Difficulty Level | Score Range                                                       | Difficulty Class Points |
|------------------|-------------------------------------------------------------------|-------------------------|
| Low (L)          | $[(\bar{x} + \frac{1}{2}\sigma) - \text{Maximum}]$                | [45–61]                 |
| Medium (M)       | $[(\bar{x} - \frac{1}{2}\sigma) - (\bar{x} + \frac{1}{2}\sigma)]$ | [35–45]                 |
| High (H)         | $[\text{Minimum} - (\bar{x} - \frac{1}{2}\sigma)]$                | [10–35]                 |

$\bar{x}$ : Arithmetic mean,  $\sigma$ : Standard deviation

tensity increases, challenging an individual's physical fitness. Following Ha & Yang (2020), we categorized altitude into five classes. Altitude data were derived from the Z\_Mean table calculated using the tool for the slope criterion analysis.

#### Length

The data for path length came from GPS records, with path lengths in the study area ranging from 2.16 km to 13.09 km. Based on the perception that *shorter distances are easier* derived from interviews, lengths were categorized into four classes.

#### Average Duration

Walking times vary according to the individual's physical condition and physique. In most walking time calculation studies, the Naismith-Langmuir rule and Tobler's walking function are used (Márquez Pérez et al. 2017; Irmischer & Clarke 2018; Kim & Park 2019). Our study used the Tobler walking function, which takes into account the slope of the terrain. The Python module prepared by Alexandre Neto (Neto 2014) was loaded into QGIS, and walking times were calculated using DEM and trail data. In the Tobler function, the walking speed is accepted as 5 km/h, although the actual speeds will be different for flat and sloping ter-

rain. Therefore, in this study, to calculate the duration the walking speed was considered to be 4 km/h.

#### Surface

In order to obtain the surface types of the trails, the CORINE land cover data for 2018 were used. The CORINE data for each trail section were then processed using the ArcGIS Extract by Mask tool. Surface types were checked against field observations and discrepancies were resolved. Reclassifications were based on the work of Vías-Martínez & Ocaña-Ocaña (2014).

Once the criteria had been identified, a survey of 14 experienced hikers was conducted. They were asked to rank the importance of each criterion using the pairwise comparison method developed by Saaty in 1980. This calculates the weight of each effect in the decision-making process (Table 2).

A consistency ratio is used to determine the acceptable accuracy of judgements in the pairwise comparison matrix. According to Saaty, a ratio below 0.10 indicates consistent judgements, allowing evaluations to proceed. Ratios above 0.10 indicate inconsistencies that require reassessment. The following equations are used to calculate the consistency ratio (Öztürk & Batuk 2010).

$$CI = (\lambda - n) / (n - 1) \text{ and } CR = CI / RI \quad (1)$$

CI – Consistency index of the pairwise comparison matrix

CR – Consistency Ratio

RI – Random Consistency Index

## Results

### Results from the field studies

The results of the field studies are presented in Table 4 for the trail experience as defined by Sport Ireland Outdoors (2020) (length, ascent/descent, level of difficulty, etc.), with the addition of duration. The plateaus at the start of the trail and along its length are used by local people for grazing in spring and summer. Field research has shown that most buildings in these areas are single-storey stone structures, a choice influenced by the ready availability of wood and stone.

Table 4 – Findings for trail experience.

| Trail                                  |      | Elevation (m) |       | Length (km) | Elevation Diff. (m) |         | Time (min.) |        | Diff. Level |
|----------------------------------------|------|---------------|-------|-------------|---------------------|---------|-------------|--------|-------------|
| Name                                   | Abb. | Start         | End   |             | Ascent              | Descent | Maps3D      | Tobler |             |
| Vercenik Plateau-Kapılı Lakes          | T1   | 2,606         | 2,975 | 3.84        | 376                 | -       | 127         | 108    | L           |
| Vercenik Plateau-Tatos Lakes           | T2   | 2,610         | 2,941 | 3.27        | 464                 | 132     | 165         | 267    | M           |
| Tatos Lakes-Orta Sirt Plateau          | T3   | 2,941         | 2,243 | 6.36        | 7                   | 705     | 193         | 170    | L           |
| Baş Plateau-Hacıvanak Plateau          | T4   | 2,481         | 2,446 | 6.62        | 511                 | 410     | 277         | 204    | M           |
| Hacıvanak Plateau-Trovit Plateau       | T5   | 2,792         | 2,446 | 9.62        | 616                 | 769     | 369         | 286    | M           |
| Yukarı Kavron Plateau-Olgunlar Village | T6   | 2,260         | 2,110 | 13.09       | 1,066               | 1,209   | 533         | 505    | H           |
| Olgunlar Village-Dilberdüzü Campground | T7   | 2,110         | 2,860 | 7.5         | 746                 | -       | 250         | 272    | L           |
| Komatı Plateau-Topluca Plateau         | T8   | 1,498         | 2,387 | 5.76        | 902                 | 14      | 340         | 361    | M           |
| Topluca Plateau-Avusor Plateau         | T9   | 2,387         | 2,379 | 8.53        | 735                 | 745     | 337         | 327    | H           |
| Avusor Plateau-Büyük Lake              | T10  | 2,370         | 2,675 | 2.16        | 301                 | -       | 58          | 92     | L           |

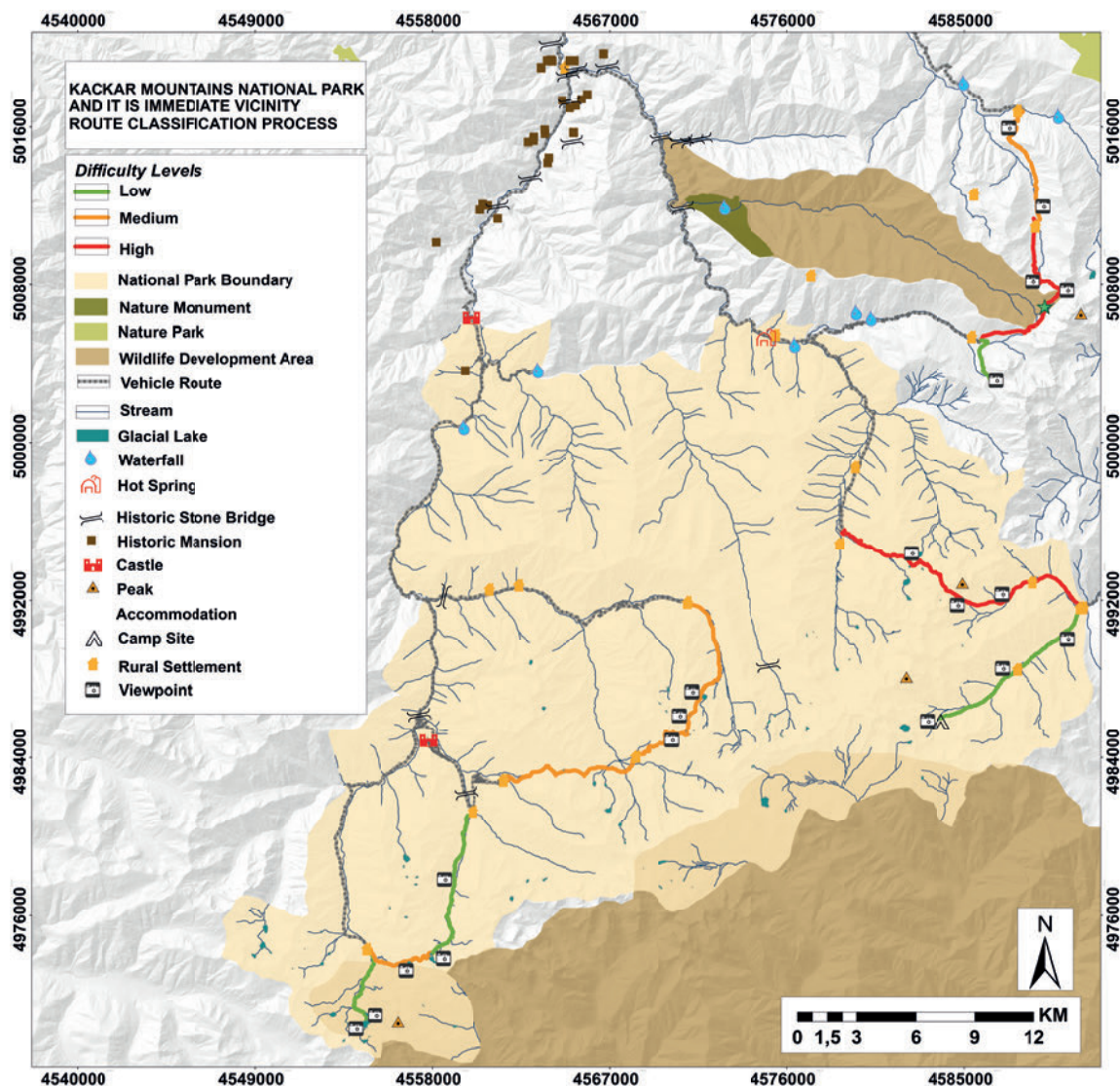


Figure 3 – Hiking-trail difficulty levels. Source: Authors' figure. Data sources: USGS; Corine Land Cover 2018; General Directorate of Forestry 2021; Isfendiyaroglu 2007; Esri.

The trail areas also have abundant surface water and numerous glacial lakes.

### Results regarding trail difficulty levels

When looking at the average of the scores given by the experts, it was found that the slope and surface weights were quite close to the parameter weights used in the pairwise comparison matrix. The two most important parameters were slope followed by surface, then difference in elevation, length and average time (Table 2). The consistency ratio of the matrix created was calculated to be 0.0569, meaning that the matrix fell in the consistent and usable range ( $0.0569 < 0.10$ ).

The scores of the sub-criteria were re-scored taking into account the studies in the literature. Adding the criterion weights and sub-criterion scores resulted in a score range of 10 to 61, where low scores indicate greater difficulty and high scores indicate lower difficulty. The difficulty of the trails is divided into three classes: low, medium and high. The score ranges of

the classification were determined by calculating the standard deviation (Table 3), which has the advantage of revealing the variations specific to the variables in the study area. Each trail's level of difficulty was determined by calculating the weighted average of its range of scores (Figure 3). Looking at the results (Table 4), trails T6 and T9 are of high difficulty; T2, T4, T5 and T8 are of medium difficulty, and T1, T3, T7 and T10 are of low difficulty.

This table is based on the information deemed necessary by Sport Ireland Outdoors (2020) in relation to assessing overall trail experience.

### Results regarding the determination of themes

Thematic classification and grouping of trails allow for the identity of an area to be revealed, interpreted and promoted. The trails in KMNP were classified according to their natural, cultural, historical and social characteristics (Figure 4).

|                                                                                                                                                        |                                                                                          |                                                                                                                                                               |                                                                                                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| <b>Name:</b> Glacial Age<br><b>Content:</b> Glacial valleys, Moraine wall, cirque lakes, plant diversity, Kale-i Bala castle<br><b>Trail:</b> T1-T2-T3 | <b>Name:</b> Wild<br><b>Content:</b> Observing wildlife, desolate<br><b>Trail:</b> T4-T5 | <b>Name:</b> Victory Climb<br><b>Content:</b> Naletleme gateway, Kaçkar Pick, observing geological formations, vernacular architecture<br><b>Trail:</b> T6-T7 | <b>Name:</b> Cloud Sea<br><b>Content:</b> Experiencing traditional highland life, experiencing cloud sea<br><b>Trail:</b> T8-T9-T10 |
|                                                                       |         |                                                                             |                                                  |
|                                                                       |         |                                                                             |                                                  |
|                                                                      |        |                                                                            |                                                 |

Figure 4 – Photographs illustrating theme features. © Pinar Ozge Parlak

## Discussion

Roads in natural areas, used for centuries for traditional needs (transportation, migration, etc.), have become important tourism and recreation resources in the last fifty years (Walker 1996). Today, trails and their management help to conserve nature and culture, improve quality of life, create local jobs and provide enjoyable activity areas (Timothy & Boyd 2015); typically, residents are involved in decision making. The sustainability of recreational activities in areas rich in natural and cultural resources depends on the protection of ecosystems, biodiversity and cultural heritage (Kurdoğlu 2001). Sustainable use in resource-rich areas therefore requires management plans to ensure that access provides quality recreation while balancing protection and use (California State Parks 2020).

Detailed planning and accurate information are essential for a quality walking experience. Classifying trails based on their characteristics helps visitors choose trails that best suit their needs. Without proper planning, visitors may face physical challenges and disappointment, leading to dissatisfaction (Chhetri 2015). Trail mapping studies (e.g. Gavilanes Montoya et al. 2021) which underline the importance of the management and organization of a geographical area are under-used in visitor research. GIS more broadly can also facilitate management and organisation, and needs to be exploited more fully. No planning study

has been made on how recreational activities will be carried out in the KMNP, the conditions for visitor participation or organization, and follow-up of activities (Yüksek et al. 2012). The lack of trail signage, a dedicated management committee and accessible trail information highlight the need for trail mapping.

The fact that all routes in the study area are closed to transport in winter may lead to increased visitor density in the summer months, thus endangering or damaging natural areas. The aim should be sustainable tourism by ensuring a balanced distribution of the number of visitors, taking seasonal density into account. Weather conditions affect visitor experience and satisfaction directly. Sudden changes in weather conditions (such as fog or blizzards) are very common in KMNP, and may make hiking difficult, while visitors may miss out on natural and cultural values. Park managers should advise visitors of seasonal conditions and encourage walking at appropriate times to avoid overcrowding.

The criteria determined in the literature for trail suitability and difficulty on the one hand, and the findings presented in this study that rely in part on expert opinion support each other (Vías-Martínez & Ocaña-Ocaña 2014; Turgut et al. 2021). Slope and elevation were found to be important factors influencing difficulty. Trails with an elevation difference of 700 m and a minimum length of 6 km emerged as being more difficult, while trails of the same length but with an

elevation difference of up to 300 m are classified as easy, demonstrating that the most important factor in walking difficulty is the slope.

Trail T5 was reported by Bektaş (2010) as being less well known and less frequented than other trails due to its altitude, as was also revealed by our own field studies. This situation allows the observation of wildlife – in our case of brown bears and birds of prey. Studies (Boulanger et al. 2012; Muntiferi et al. 2021) indicate that wildlife often flees from trails frequented by tourists, suggesting that increased human activity could reduce wildlife sightings and cause and lead to visitor dissatisfaction. It is therefore advisable to limit the number of visitors on trails and to educate them in the need to be quiet and careful when observing wildlife.

Permanent snow in the Naletleme Pass and frequent heavy fog and hail in the northern pass on T6, which has been the most popular trail since 1980 with the development of the Yukarı Kavron Plateau, make this the most challenging trail (Clow & Gardner 2014). These weather conditions, which were also encountered during fieldwork, highlight the need to inform visitors in advance so that they can take necessary precautions.

This study aims to improve management and visitor satisfaction in PAs by standardizing levels of walking difficulty. It uses a participatory approach, objective criteria weighting and GIS-based methods to improve the objectivity of classification studies and support the development of a globally applicable system. User, expert and local surveys, together with observational data collection and actual experience of walking the trails improve the accuracy and reliability of the data. AHP in combination with GIS technology allow for more objective and reproducible spatial data analysis. However, the scope of this study is limited to ten trails due to time constraints, individual effort and lack of funding, making generalisation difficult, while the complexity of applying AHP and the process of ensuring consistency are methodological difficulties of the study. The fact that characteristics such as an individual walker's age, health and general physical condition cannot be assessed is a further limitation.

Nevertheless, this study aims to help park managers develop more effective planning and management policies, develop sustainable tourism, and increase user satisfaction and safety. It supports the participation of local communities in the planning process and draws attention to the benefits of such participation. It also draws attention to the need to balance conservation and use, and provides an important foundation in the scientific literature for future research and educational activities.

### Management implications

The study can be applied by park managers for trail classifications and themes. Strategies such as simple and useful maps, promotional brochures, clear sig-

nage, litter monitoring/collection, and management programmes that look into human impact should be developed for trail management and maintenance. An online database with websites, mobile applications, pocket information cards introducing plants and animals, and informative signs (e.g. warning of special areas and hazards) should be prepared to guide visitors. Ecological sensitivity should be analysed and risk analyses should be carried out to help ensure the sustainability of resources and recreational activities within the conservation/use balance; a seasonal calendar of trails should be established; trail monitoring and control should be carried out, and trails should be temporarily closed when necessary.

### Conclusions

Tourism in national parks is seen as an alternative to mass tourism. If properly managed, it allows people to develop rewarding relationships with nature, protect the environment and strengthen communities (Ghazvini et al. 2020). On the other hand, when an area within a PA is transformed into a tourism destination, the first group to be affected are the people who live there. For tourism to be sustainable, local people should be involved through a participatory planning approach (Han et al. 2023). Establishing a national park policy is essential to protect nature and balance the interests of both tourists and locals (Sriarkarın & Lee 2018).

Footpaths are ideal for exploring a region or heritage site. This study assessed the difficulty of selected trails in KMNP, examined their natural and cultural values, and presented findings in line with international standards. Identifying and classifying trails in PAs promotes sustainable tourism by improving hiker safety and satisfaction. As a result of the analysis, trail difficulty was divided into three levels (low, medium and high), which helped hikers to make more informed choices when selecting trails.

The thematic classification of the trails highlights the natural and cultural richness of the area and informs visitors about these values. The results were consistent with similar studies in the international literature and contribute to the protection of natural and cultural values, increased visitor safety and satisfaction, the sustainability of tourism, and local economic development.

The objective consideration of difficulty levels and the creation of themes enables park managers to make strategic plans. This approach guides visitors to make choices while supporting the conservation and sustainable use of natural resources. As a result, this study makes a valuable contribution to the planning and management of walking trails and has the potential to be an important tool in achieving the goal of protecting ecosystems and cultural heritage. Further research into the ecological sensitivity and risks of the trails would further improve resource sustainability and visitor sa-

tisfaction. In this context, the implementation by park managers of recommended strategies will ensure the long-term sustainable use of the park by establishing a balance between conservation and use.

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