

# The main determinants influencing the spending of mountaineering in Spain's Protected Natural Areas: the significance of crowding perception

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## Abstract

Protected Natural Areas (PNAs) play a crucial role in driving rural and local development within their regions. Certain PNAs feature iconic mountain peaks that serve as major attractions for mountaineering tourism. While economic impact stands as a fundamental component within the triad of sustainable tourism, and mountaineering significantly propels economic growth in destination areas, a noteworthy gap exists in the available data concerning the impact and determinants of spending within this context. This study, conducted among mountaineering visitors in PNAs, aims to analyse the distribution of spending overall and by mountain peak and to identify the determinants influencing direct spending. The research involved a sample of 562 mountaineers who ascended five Spanish peaks during the summer of 2020. The investigation revealed an average expenditure of approximately €10.62 per mountaineer. Logistics regression identified a total of six variables influencing spending. Remarkably, the research revealed *overcrowding* as a substantial predictor of mountaineering expenditure; specifically, the perception of overcrowding correlated with decreased spending. Understanding how visitors perceive and react to crowded environments is crucial for devising strategies that foster local economies and protect the natural environment of these destinations. The study's findings are relevant to mountaineering economic management in PNAs.

## Introduction

Tourism is one of the fastest growing economic sectors in the world (UNWTO 2020). This includes nature tourism, defined as *tourism whose main motivation is to carry out recreational, leisure, interpretation, knowledge or sporting activities in the natural environment* (Royal Decree 416/2014) frequently in Protected Natural Areas (PNAs). Emblematic mountain peaks are among the main attractions of these areas, drawing large numbers of mountaineering enthusiasts due to their uniqueness (Apollo & Wengel 2021; Dorado et al. 2022; Farías-Torbidoni et al. 2022a; González et al. 2021; Leung et al. 2019; Rogowski 2025).

In addition to their biodiversity conservation function, PNAs act as economic generators of rural and local development in the regions where they are located (Gupta et al. 2023; Hammer et al. 2012; Kandel et al. 2022; Leung et al. 2019; Mayer et al. 2010; Naidoo et al. 2019; Sánchez-Sánchez & Sánchez-Sánchez 2022). In this context, a significant challenge in managing PNAs is to foster sustainable tourism. Sustainable tourism is characterized by considering the comprehensive array of present and future economic, social and environmental impacts, as well as addressing the needs of the environment, the local population and visitors alike (UNWTO & UNEP 2005). Regarding economic aspects, different methodologies have been used to assess the monetary value generated through visits to PNAs. Globally, it is estimated that PNA visits generate an annual spending of approximately €543 billion (Balmford et al. 2015). In Europe, specifically in national parks, the economic impact generated by visits is €14.5 billion per year (Schägnier et al. 2017).

Promoting sustainable tourism in PNAs necessitates the skilful management of a delicate balance among economic, social and environmental factors. Economic impact studies can be classified into two main groups: i) those dealing with direct spending; ii) those that examine the economic impact generated. Direct spending refers to the amount spent by non-local visitors on specific services (for example hiring guides) or products in the PNA and its surrounding area. Economic impact generated, on the other hand, is broader, defined as the net changes in the economic base of a region that can be imputed to the new money brought in by non-local visitors thanks to the very existence of the PNA and its management (Cullinane et al. 2014). Among the first group, several studies have estimated the impact of the spending of visitors to PNAs on: protection of the natural area (Carlsen & Wood 2004; Cini & Saayman 2014; Gupta et al. 2023; Job 2008; Kruger et al. 2012; Mayer et al. 2010); the activity carried out (Farías-Torbidoni & Barić 2020; Fredman 2008; Mehmetoglu 2007; Raya et al. 2017; Schirpke et al. 2018); psychosocial factors (Lima et al. 2012; Veisten et al. 2014); products related to the PNA (Knaus et al. 2017). It is worth highlighting the studies of Cini and Saayman (2014), Fredman (2008), Kruger et al. (2012), Lima et al. (2012), Mehmetoglu (2007), Raya et al. (2017), Veisten et al. (2014), Farías-Torbidoni and Barić (2020) and Seguí-Urbaneja et al. (2025) which, in addition to calculating direct visitor spending in the PNAs concerned, went a step further by identifying the determinants of this spending. Where the second group of articles is concerned (those that examine or calculate the economic impact generated), various methodologies are used, all of them with their strengths and weaknesses, which can be adapted ac-

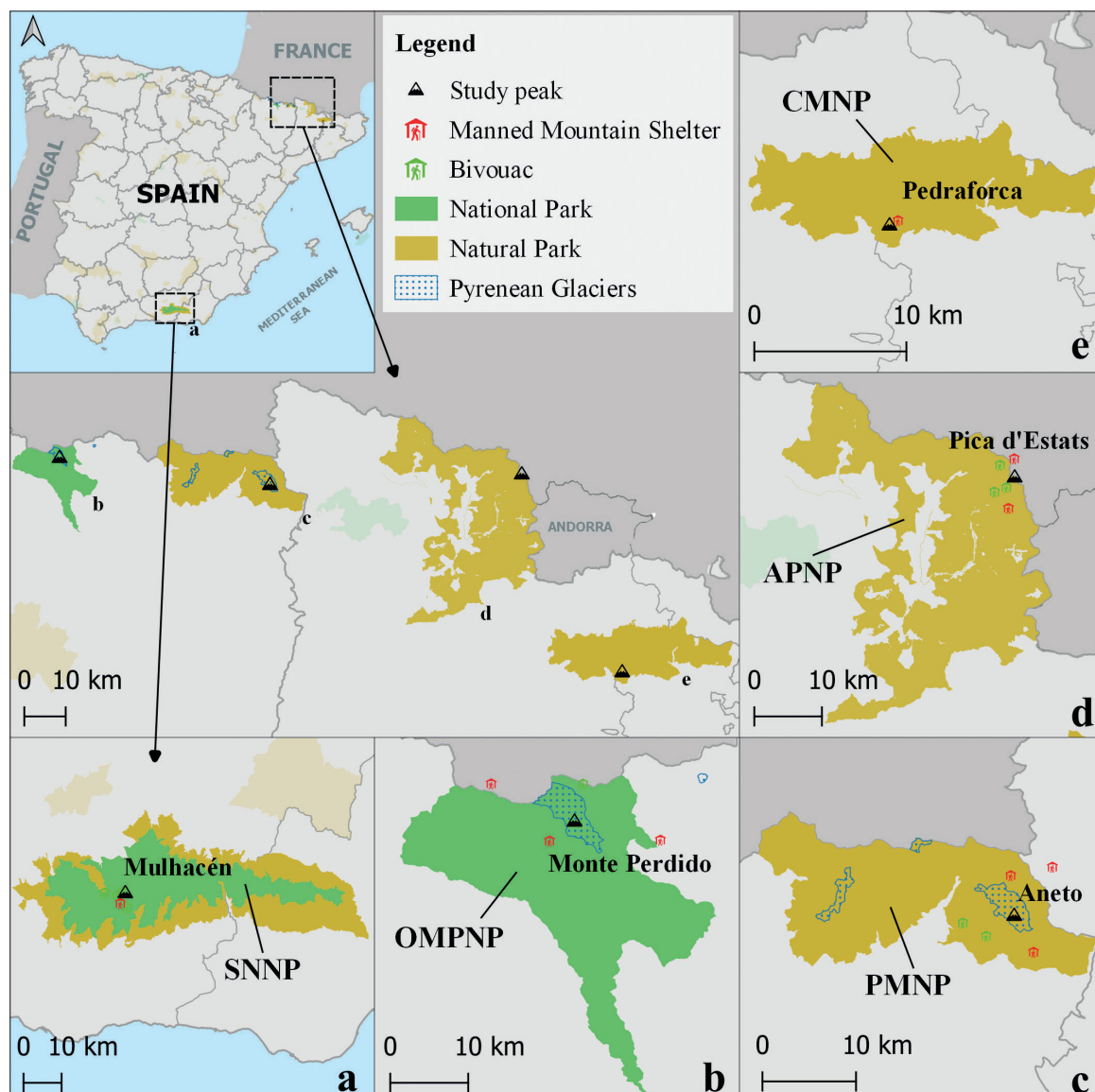


Figure 1 – Geographical location of the study peaks and their protection categories. Study Areas: a) Mulhacén: SNNP = Sierra Nevada National Park; b) Monte Perdido: OMPNP = Ordesa and Monte Perdido National Park; c) Aneto: PMNP = Posets-Maladeta Natural Park; d) Pica d'Estats: APNP = Alt Pirineu Natural Park; e) Pedraforca: CMNP = Cadí-Moixeró Natural Park.

cording to the data available in the area to be studied. Our study focused on direct spending (the first group).

At the national and international level, previous research has reported notable differences in direct visitor spending across PNAs reflecting variation in activity type, local infrastructure and environmental characteristics. For example at the national level, Raya et al. (2017) reported €20.30 for hiking-focused visitors in Berguedà, located in the pre-Pyrenean region. In the eastern Pyrenees, the Capçaleres del Ter i del Freser Natural Park recorded an average of €25.66 per visitor (Fariás-Torbidoni et al. 2022b). In the Alt Pirineu Natural Park, average daily spending has been estimated at €31.70 (Fariás-Torbidoni & Barić 2020), while in the Cadí-Moixeró Natural Park, located in the pre-Pyrenean region too, average spending reached €39.45 (Seguí-Urbaneja et al. 2025). In contrast, a

higher average of €67.50 was found in the Ordesa and Monte Perdido National Park (Fernández et al. 2020). At the international level, the trend is similar. Schirpke et al. (2018) reported an average daily expenditure of €48.56 per visitor across 10 Natura 2000 sites in Italy, including hiking, cycling and food-related tourism. In Germany, Job et al. (2008) estimated €43.90 and €57.50 per day in the Müritzer National Parks and Berchtesgaden respectively.

While most studies on visitor spending have focused on socio-demographic or trip-related variables, some authors have argued that socio-economic impact studies should go beyond purely economic measures. In this sense, Saayman and Saayman (2010) emphasized that such analyses should also consider the contribution of tourism to people's quality of life and other social dimensions, even when these are not di-

Table 1 – Main characteristics of the study peaks.

| Variable                                       | Peak                                                                                                                                   |                                                                                                                                                                                                               |                                                                                                                                                                                           |                                                                                                                                                                                              |                                                                                                                                                                                      |
|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                | Mulhacén                                                                                                                               | Monte Perdido                                                                                                                                                                                                 | Aneto                                                                                                                                                                                     | Pica d'Estats                                                                                                                                                                                | Pedraforca                                                                                                                                                                           |
| <b>General characteristics</b>                 |                                                                                                                                        |                                                                                                                                                                                                               |                                                                                                                                                                                           |                                                                                                                                                                                              |                                                                                                                                                                                      |
| Location <sup>a</sup>                          | 30N 472300<br>4100841                                                                                                                  | 31N 256998<br>4729051                                                                                                                                                                                         | 31N 307853<br>4722508                                                                                                                                                                     | 31N 368712<br>4725071                                                                                                                                                                        | 31N 392983<br>4677231                                                                                                                                                                |
| Region                                         | Andalucía                                                                                                                              | Aragón                                                                                                                                                                                                        | Aragón                                                                                                                                                                                    | Catalunya                                                                                                                                                                                    | Catalunya                                                                                                                                                                            |
| Distance form biggest cities (km) <sup>b</sup> | Granada: 43<br>Málaga: 170                                                                                                             | Huesca: 87<br>Zaragoza: 158                                                                                                                                                                                   | Huesca: 152<br>Lleida: 162                                                                                                                                                                | Barcelona: 265<br>Lleida: 170                                                                                                                                                                | Barcelona: 145<br>Lleida: 195                                                                                                                                                        |
| Mountain shelter                               | Manned                                                                                                                                 | 1                                                                                                                                                                                                             | 3                                                                                                                                                                                         | 2                                                                                                                                                                                            | 1                                                                                                                                                                                    |
|                                                | Bivouac (free)                                                                                                                         | 4                                                                                                                                                                                                             | 1                                                                                                                                                                                         | 3                                                                                                                                                                                            | 0                                                                                                                                                                                    |
| <b>Characteristics of management</b>           |                                                                                                                                        |                                                                                                                                                                                                               |                                                                                                                                                                                           |                                                                                                                                                                                              |                                                                                                                                                                                      |
| Protection level                               | Natura 2000                                                                                                                            | Natura 2000                                                                                                                                                                                                   | Natura 2000                                                                                                                                                                               | Natura 2000                                                                                                                                                                                  | Natura 2000                                                                                                                                                                          |
| IUCN Management Category                       | II                                                                                                                                     | II                                                                                                                                                                                                            | V                                                                                                                                                                                         | V                                                                                                                                                                                            | V                                                                                                                                                                                    |
| <b>Physical characteristics</b>                |                                                                                                                                        |                                                                                                                                                                                                               |                                                                                                                                                                                           |                                                                                                                                                                                              |                                                                                                                                                                                      |
| Altitude m asl                                 | 3,479                                                                                                                                  | 3,355                                                                                                                                                                                                         | 3,404                                                                                                                                                                                     | 3,143                                                                                                                                                                                        | 2,506                                                                                                                                                                                |
| Number of access routes                        | 5                                                                                                                                      | 3                                                                                                                                                                                                             | 2                                                                                                                                                                                         | 3                                                                                                                                                                                            | 3                                                                                                                                                                                    |
| Length of most popular track (km)              | 16.5                                                                                                                                   | 31.1                                                                                                                                                                                                          | 14.8                                                                                                                                                                                      | 18.4                                                                                                                                                                                         | 7.6                                                                                                                                                                                  |
| Positive elevation (m)                         | 1,255                                                                                                                                  | 2,889                                                                                                                                                                                                         | 1,499                                                                                                                                                                                     | 1,582                                                                                                                                                                                        | 1,059                                                                                                                                                                                |
| Physical particularities                       | Rocky ground                                                                                                                           | Glacier and Rocky ground instability                                                                                                                                                                          | Glacier                                                                                                                                                                                   | Rocky ground                                                                                                                                                                                 | Rocky scrambling                                                                                                                                                                     |
| Difficulty (Sendif scale) <sup>c</sup>         | 1,894                                                                                                                                  | 4,629                                                                                                                                                                                                         | 2,076                                                                                                                                                                                     | 2,336                                                                                                                                                                                        | 1,435                                                                                                                                                                                |
| Access regulation                              | No regulation                                                                                                                          | Temporary parking regulation                                                                                                                                                                                  | Temporary parking regulation                                                                                                                                                              | No regulation                                                                                                                                                                                | No regulation                                                                                                                                                                        |
| Accessibility                                  | The length of the route, the physical characteristics of the terrain and the low positive elevation make this peak the most accessible | The length of the ascent routes and the high positive elevation mean that most mountaineers have to stay overnight on the mountain in order to climb Monte Perdido; accessibility is considered to be limited | The need for crampons and ice axes to overcome the glacier and the Mahoma pass to reach the peak make Aneto the least accessible. Alternative routes require technical climbing knowledge | The physical characteristics of the routes (rocky ground) and the high positive elevation limit the access to the peak, requiring a high percentage of mountaineers to overnight in the park | Despite the high positive elevation, the shortness of the ascent routes makes this peak the second most accessible. Alternative routes make it possible to avoid the scrambling pass |
| <b>Social characteristics</b>                  |                                                                                                                                        |                                                                                                                                                                                                               |                                                                                                                                                                                           |                                                                                                                                                                                              |                                                                                                                                                                                      |
| Number of park visitors 2020                   | 418,734                                                                                                                                | 422,570                                                                                                                                                                                                       | No data                                                                                                                                                                                   | 367,713                                                                                                                                                                                      | 363,370                                                                                                                                                                              |
| Number of peak visitors 2020                   | 19,609                                                                                                                                 | 17,002                                                                                                                                                                                                        | 9,912                                                                                                                                                                                     | 7,713                                                                                                                                                                                        | 27,678                                                                                                                                                                               |
| % Mountaineering in the park                   | 4.7                                                                                                                                    | 4.0                                                                                                                                                                                                           | No data                                                                                                                                                                                   | 2.1                                                                                                                                                                                          | 7.6                                                                                                                                                                                  |
| Length of stay in days. Mean (SD) <sup>d</sup> | 1.8 (1.5)                                                                                                                              | 2.1 (1.0)                                                                                                                                                                                                     | 2.7 (3.2)                                                                                                                                                                                 | 2.2 (1.7)                                                                                                                                                                                    | 1.3 (0.5)                                                                                                                                                                            |

<sup>a</sup> The ETRS89/UTM coordinate reference system was used.

<sup>b</sup> Google Maps was used for the calculation (distance).

<sup>c</sup> Sendif is a method to determine the difficulty of walking routes developed by the Institute for the Development and Promotion of the Alt Pirineu and Aran. It distinguishes five levels of difficulty: Very Easy (<135), corresponding to routes up to 6 km with a maximum ascent of 50 m and suitable for all users, including families and seniors; Easy (135–400), up to 13 km or 225 m ascent, appropriate for users with basic fitness; Moderate (401–860), up to 20 km or 575 m ascent, requiring average physical condition and up to four hours of walking; Demanding (861–1,200), involving ascents of around 800 m and suitable for regular mountain walkers; and Very Demanding (>1,200), corresponding to high-mountain routes exceeding 900 m ascent, suitable only for experienced bikers (IDAPA 2018).

<sup>d</sup> Number of days spent in the area of influence of the PNAs where the peak is located, usually limited to neighbouring municipalities; SD – Standard deviation.

rectly monetizable. Following this rationale, our study incorporates perceived crowding (a subjective yet policy-relevant social factor) as a potential determinant of visitor spending. To our knowledge, this is the first study to explore this relationship in the specific context of mountaineering on high mountain peaks within PNAs.

Despite the fact that economic impact is one of the three pillars of sustainable tourism and mountaineering is a key driver of economic growth in destinations

where it is practised (González et al. 2021; Leung et al. 2019), there is a lack of data on the determinants of spending in this context. To address this gap, this study focuses on five emblematic Spanish mountain peaks to examine:

- the profile of spending and non-spending mountaineers;
- the distribution of spending overall and by mountain peak;
- the determinants of direct spending.

By doing so, we aim to gain a better understanding of the economic contributions of mountaineering and provide insights for sustainable tourism planning and management in these destinations.

## Methods

### Study area

The study was carried out on five mountain peaks in Spain: Mulhacén, Monte Perdido, Aneto, Pica d'Estats and Pedraforca (Figure 1).

The peaks are situated in two distinct mountain ranges: i) the Béticas range within the Sierra Nevada National Park, home to Mulhacén, the highest peak of the Iberian Peninsula; ii) the Pyrenees, housing notable peaks such as Monte Perdido in the Ordesa and Monte Perdido National Park; Aneto (the highest Pyrenean peak) protected by the Posets-Maladeta Natural Park; Pica d'Estats (Catalonia's highest peak) in the Alt Pirineu Natural Park (the region's largest); and Pedraforca in the Pre-Pyrenees within the Cadí-Moixeró Natural Park – an iconic peak in Catalonia that garnered the highest number of visits in 2020. Detailed descriptions of the main characteristics of these peaks are provided in the Table 1.

### Data collection

Simple random sampling was used to select participants in our survey, choosing the first or second person in the group (>16 years old) alternately, whether male or female, who were visiting the peak. The data collection period was from 31 July 2020 to 5 September 2020, with a total of 30 fieldwork days carried out from 8:00 to 16:00. The survey took approximately 15 minutes to complete. The total sample comprised 578 visitors, of whom 562 were considered suitable (10 local visitors were excluded, and six were eliminated due to lack of data on the number of people in the group or length of stay). Finally, the margin of error for the total sample was set at  $\pm 5$  calculated for a 95% confidence level (see Table 2).

### Survey instrument

The survey included 37 questions structured in six dimensions. It was written in Spanish and translated into Catalan, English, French and German. Data was collected on sociodemographic characteristics (gender, age, level of education, occupation, region of residence, environmental knowledge), the visit characteristics (frequency of PNA visits, type of access, frequency of peak visit, number of visitors in group, length of stay, overnight stay in the area), sports habits (mountaineering experience; member (or not) of a mountaineering federation), expenses (accommodation, catering, shopping, services), motivations to visit (e.g. drawn by mountain peak) and perceived carrying capacity (e.g. crowding). Information on spending was asked per person per day for each of the variables and was recorded in euros.

Table 2 – Distribution of fieldwork days and valid surveys by peak.

| Peak          | Fieldwork | Number of valid surveys |
|---------------|-----------|-------------------------|
| Mulhacén      | 6         | 113                     |
| Monte Perdido | 6         | 115                     |
| Aneto         | 7         | 109                     |
| Pica d'Estats | 6         | 111                     |
| Pedraforca    | 5         | 114                     |

The survey and research project received the approval of the Clinical Research Ethics Committee (CEIC) of the Catalan Sports Administration, with the number 16/CEICGC/2020. All the people who participated in the study did so voluntarily, were informed about and accepted the confidential treatment of their answers, subject to the guarantees of Organic Law 3/2018, of 5 December, on Personal Data Protection and the guarantee of digital rights.

### Data analysis – structured in four steps

#### Step 1

In this step, the profiles of spending and non-spending visitors were assessed by analysing the distributions of variables. The resulting categorical data were then tested using the Chi-square goodness-of-fit tests and the Mann-Whitney U test. For quantitative variables, since the data did not follow a normal distribution, the non-parametric Mann-Whitney U test was applied. In addition, the effect size index was calculated using the Phi and Cramer's V test ( $\Phi$ ) and by Pearson's  $r$ . Interpretation of the former was based on the following criteria:  $\Phi < .30$  = small effect,  $\Phi \approx .50$  = medium effect, and  $\Phi > .80$  high effect; interpretation of Pearson's  $r$  was based on:  $r < .10$  = small,  $r < .30$  = medium, and  $r < .50$  = large (Cárdenas & Arancibia 2014; Cohen 1988; Cohen 1992). The significance level for this procedure was set at .05. All analyses were performed using IBM SPSS Statistics, v.25.

#### Step 2

Step 2 was in two parts. First, the mean value of the mountaineer's individual spending ( $Sp$ ) per day was estimated, based on Carlsen and Wood (2004):

$$Sp = \frac{C_i}{N_v * L_s} \quad (1)$$

where  $C_i$  is the cost of the items (accommodation, food, shopping and services);  $N_v$  is the number of visitors per group; and  $L_s$  is the length of stay or number of nights of accommodation in the region. The value for mountaineering spending ( $M_{sp}$ ) is obtained by adding together the spending items ( $\sum Sp$ ):

$$M_{sp} = \sum C_{i/ind} \quad (2)$$

where  $C_i$  is cost of accommodation (e.g. refuge, hotel);  $C_2$  is cost of catering (food and drinks);  $C_3$  is

Table 3 – Comparison between spenders and non-spenders. SD – Standard deviation;  $\chi^2$  – chi-squared;  $\Phi$  or  $r$  – effect size. MSP – Mountaineering spending.

| Variables                      | Total sample<br>n = 562 | Non-spenders<br>n = 219 | Spenders<br>n = 343 | Comparison                                        |
|--------------------------------|-------------------------|-------------------------|---------------------|---------------------------------------------------|
| Gender (%)                     |                         |                         |                     | $\chi^2 = .68$ , $p = .411$ , $\chi = .03$        |
| Male                           | 78.1                    | 79.9                    | 77.0                |                                                   |
| Female                         | 21.9                    | 20.1                    | 23.0                |                                                   |
| Age. Mean (SD)                 | 35.4 (11.8)             | 34.8 (12.1)             | 35.7 (11.7)         | $U = 39.68$ , $z = 1.13$ , $p = .259$ , $r = .05$ |
| Educational level (%)          |                         |                         |                     | $\chi^2 = 2.89$ , $p = .092$ , $\chi = .07$       |
| No university education        | 41.3                    | 45.7                    | 38.5                |                                                   |
| University education           | 58.7                    | 54.3                    | 61.5                |                                                   |
| Occupation (%)                 |                         |                         |                     | $\chi^2 = 10.43$ , $p < .01$ , $\chi = .14$       |
| Unemployed                     | 6.2                     | 7.8                     | 5.2                 |                                                   |
| Student                        | 16.4                    | 21.9                    | 12.8                |                                                   |
| Employed                       | 77.4                    | 70.3                    | 81.9                |                                                   |
| Mountain peak (%)              |                         |                         |                     | $\chi^2 = 46.07$ , $p < .001$ , $\chi = .29$      |
| Mulhacén                       | 20.1                    | 28.3                    | 14.9                |                                                   |
| Monte Perdido                  | 20.5                    | 11.0                    | 26.5                |                                                   |
| Aneto                          | 19.4                    | 11.9                    | 24.2                |                                                   |
| Pica d'Estats                  | 19.8                    | 25.6                    | 16.0                |                                                   |
| Pedraforca                     | 20.3                    | 23.3                    | 18.4                |                                                   |
| Visitor group size. Mean (SD)  | 3.8 (4.2)               | 3.4 (2.5)               | 4.0 (5.0)           | $U = 40.49$ , $z = 1.61$ , $p = .108$ , $r = .07$ |
| Length of stay. Mean (SD)      | 2.0 (1.8)               | 1.6 (0.9)               | 2.3 (2.2)           | $U = 48.42$ , $z = 6.31$ , $p < .001$ , $r = .27$ |
| Overnight stay in the area (%) |                         |                         |                     | $\chi^2 = 54.80$ , $p < .001$ , $\chi = .31$      |
| No overnight stay              | 25.4                    | 42.5                    | 14.6                |                                                   |
| Overnight stay                 | 74.6                    | 57.5                    | 85.4                |                                                   |
| Mountaineering experience (%)  |                         |                         |                     | $\chi^2 = .02$ , $p = .896$ , $\chi = -.01$       |
| Non-mountaineers               | 17.6                    | 17.4                    | 17.8                |                                                   |
| Regular mountaineers           | 82.4                    | 82.6                    | 82.2                |                                                   |
| Perceived crowding (%)         |                         |                         |                     | $\chi^2 = 4.66$ , $p < .05$ , $\chi = -.09$       |
| No overcrowding                | 67.4                    | 62.1                    | 70.8                |                                                   |
| Overcrowding                   | 32.6                    | 37.9                    | 29.2                |                                                   |

cost of shopping (local products) and  $C_s$  is cost of services (e.g. hiring mountain guides, bus tickets).

Second, the individual mountaineer's spending attributable directly to the visit to a particular mountain peak ( $M_{sp}$ ) was calculated from the visit motivation variable, extracted from the surveys, following the methodology of Farías-Torbidoni & Morera (2017). This establishes the percentage of the total expenditure made according to the value selected for the visit motivation (evaluated on a Likert scale from 1 to 5):

$$M_{sp} = M_{sp} * \%A_f (1 \text{ to } 5) \quad (3)$$

where  $A_f$  is the attribution factor; a value of 1 corresponds to a 10% attribution; 2 corresponds to a 30% attribution; 3 corresponds to a 50% attribution; 4 corresponds to a 70% attribution; and 5 corresponds to a 90% attribution. For more information on the percentage of attribution depending on the motivation for the visit, see Figure A1.

### Step 3

Finally, a forward stepwise logistic regression was conducted to explore the influence of potential explanatory variables on the likelihood of mountaineers' spending money during their visit ( $Y$ ). The potential explanatory variables, which are key to the

management of public use of PNAs, were: peak ( $X1$ ), gender ( $X2$ ), age ( $X3$ ), educational level ( $X4$ ), occupation ( $X5$ ), region of residence ( $X6$ ), environmental knowledge ( $X7$ ), PNA ( $X8$ ), frequency of visit to PNA ( $X9$ ), type of access ( $X10$ ), whether first ascent of peak ( $X11$ ), number of visitors per group ( $X12$ ), length of stay ( $X13$ ), overnight stay in the area ( $X14$ ), mountaineering experience ( $X15$ ), federation licence ( $X16$ ) and perceived crowding ( $X17$ ). At each step, variables were chosen according to their contribution to the model's coefficient of determination ( $R^2$ ); the Akaike Information Criterion ( $AIC$ ) was used to set a limit on the total number of variables included in the final model. Model effects were reported as Odds Ratios ( $OR$ ) along with their 95% Confidence Intervals ( $95\% CI$ ). Statistical significance was assumed when  $p < .05$ . Statistical modelling was performed in R v4.2.2 (R Core Team, 2022) and the selection of variables was made using the MASS package (Venables & Ripley 2002).

### Results

#### Profiles of mountaineering visitors, spenders and non-spenders

The present study comprised 562 participants distributed roughly equally among the five study peaks

Table 4 – Spending per person per day attributable directly to the visit to one of the five Spanish mountains peaks [in euros]. SD – Standard deviation. M, MP, A, PE and P – Bonferroni post hoc is statistically significant for Mulhacén (M), Monte Perdido (MP), Aneto (A), Pica d'Estats (PE) and Pedraforca (P).

| Variables             | Total sample<br>n=562 | Peak                  |                        |                           |                         |                       | Comparison               |
|-----------------------|-----------------------|-----------------------|------------------------|---------------------------|-------------------------|-----------------------|--------------------------|
|                       |                       | Mulhacén<br>n=113     | Monte Perdido<br>n=115 | Aneto n=109               | Pica d'Estats<br>n= 111 | Pedrafor-<br>ca n=114 |                          |
|                       | Mean (SD)             |                       |                        |                           |                         |                       |                          |
| Accommodation<br>(SD) | 6.34 (14.15)          | 4.56 (12.28)<br>A     | 5.93 (13.80)           | 10.05 (16.37)<br>M, P     | 8.79 (18.11)            | 2.59 (6.31)<br>A      | H(4)= 16.83,<br>p < .01  |
| Catering<br>(SD)      | 2.32 (4.08)           | 1.48 (2.59)<br>MP, A  | 1.96 (2.59)<br>M, PE   | 3.36 (5.31)<br>M          | 2.02 (4.32)<br>MP, A    | 2.83 (4.68)           | H(4)= 27.28,<br>p < .001 |
| Shopping<br>(SD)      | 0.86 (3.58)           | 0.53 (2.12)           | 0.75 (2.99)            | 0.83 (3.17)               | 1.32 (5.78)             | 0.86 (2.77)           | H(4)= 4.81,<br>p = .307  |
| Services<br>(SD)      | 1.10 (10.38)          | -<br>MP               | 3.96 (21.64)<br>M, P   | 1.04 (6.35)               | 0.46 (3.53)             | -<br>MP               | H(4)= 16.08,<br>p < .01  |
| Total spend<br>(SD)   | 10.62 (20.05)         | 6.56 (13.66)<br>MP, A | 12.60 (29.37)<br>M     | 15.28 (19.31)<br>M, PE, P | 12.60 (21.03)<br>A      | 6.28 (9.47)<br>A      | H(4)= 31.01,<br>p < .001 |

(see Table 3). The general profile of the visitor to Spain's emblematic mountains was male (78.8%), around 35 years old, university educated (58.7%), employed (77.4%). The typical mountaineer surveyed was visiting in a group of about four people and was staying on average two days. Overall, perceived overcrowding was high (32.6%). In terms of spending, accommodation was the variable on which visitors spent the most.

Out of the 562 surveyed participants, 343 (61%) were spenders and 219 (39%) were non-spenders. Spenders and non-spenders showed similar profiles in terms of gender, average age and level of education. Non-spenders exhibited a higher proportion of students and individuals without employment in comparison to spenders. The number of visitors per group was also slightly higher for spenders compared to non-spenders. There were significant differences in the duration of the visits, which tended to be longer for the spenders. Significantly more spenders than non-spenders stayed overnight in the area. Finally, a significantly smaller proportion of spenders than non-spenders reported perceiving overcrowding.

#### Distribution of spending by mountain peak

The distribution of visitor spending across the five study peaks shows considerable variation, while in all peaks some mountaineers reported no spending (€0), maximum expenditures reached €247.50 in Monte Perdido, €99 in Pica d'Estats, €90 in Mulhacén, €75.60 in Aneto and €47.50 in Pedraforca (Figure 2).

On average, spending on accommodation was €6.34, which was higher than for the other variables; shopping attracted the least spending, with an average of €0.86 per person. By peak, the highest spending on accommodation was by the Aneto mountaineers (€10.05); there were statistically significant differences in spending between the Mulhacén and Pedraforca mountaineers compared to the Aneto mountaineers. The Aneto mountaineers were also the biggest spenders on catering (€3.36), with significant differences observed between them and those of Mulhacén, Monte

Perdido, Aneto and Pica d'Estats. For the variable of buying local products, the Pica d'Estats mountaineers were the biggest spenders (€1.32), but no significant differences were found between mountaineers on the five peaks. In terms of services, the highest spending was €3.96, by the Monte Perdido mountaineers, with significant differences compared to the Mulhacén and Pedraforca mountaineers. The highest spenders overall were the Aneto mountaineers, with €15.28 per person per day. The lowest spenders were the Mulhacén and Pedraforca mountaineers (€6.56 and €6.28 respectively). Overall, there were statistically significant differences in total spending between the different peaks. See Table 4. (For more information on the distribution of spending by items, see Figure A2).

#### Determinants of direct spending on mountaineering visits

The logistic model obtained after variable selection had a moderate explanatory power ( $\sigma=1.05$ ,  $Tjur's R^2=0.24$ ,  $AIC=629.22$ ,  $BIC=681.20$ ), and included: peak, occupation, number of visitors per group, length

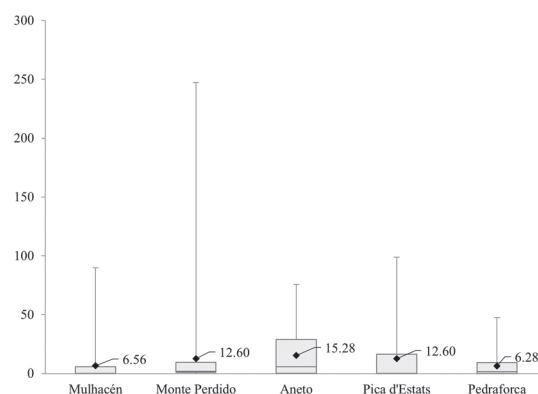


Figure 2 – Distribution of visitor spending of the study peaks. The boxplots indicate minimum, maximum, mean, median and quartiles values. Number of samples per area: Mulhacén = 113; Monte Perdido = 115; Aneto = 109; Pica d'Estats = 111; Pedraforca = 114.

Table 5 – Logistic regression analysis for potential predictors of mountaineers' spending. B – regression coefficient; Wald  $\chi^2$  – Wald test statistic; p – significance level; OR – odds ratio; CI – confidence interval for OR.

| Variables                              | B     | Wald $\chi^2$ | p      | OR   | 95% CI    |
|----------------------------------------|-------|---------------|--------|------|-----------|
| Intercept                              | −3.18 | 32.175        | < .001 | 0.04 | 0.01 0.12 |
| Peak [Monte Perdido]                   | 1.48  | 19.455        | < .001 | 4.41 | 2.31 8.65 |
| Peak [Aneto]                           | 1.25  | 13.952        | < .001 | 3.49 | 1.83 6.81 |
| Peak [Pica d'Estats]                   | −0.19 | 0.382         | .537   | 0.83 | 0.45 1.51 |
| Peak [Pedraforca]                      | 1.56  | 20.876        | < .001 | 4.77 | 2.48 9.48 |
| Occupation [Student]                   | −0.06 | 0.015         | .902   | 0.95 | 0.38 2.32 |
| Occupation [In employment]             | 0.96  | 5.471         | < .05  | 2.61 | 1.16 5.87 |
| Visitors group size                    | 0.10  | 6.932         | < .01  | 1.11 | 1.03 1.20 |
| Length of stay                         | 0.37  | 9.066         | < .01  | 1.45 | 1.16 1.88 |
| First ascent peak [Yes]                | 0.36  | 2.942         | .086   | 1.43 | 0.95 2.15 |
| Overnight in the area [Overnight stay] | 1.58  | 32.003        | < .001 | 4.85 | 2.84 8.50 |
| Perceived crowding [Overcrowding]      | −0.79 | 12.842        | < .001 | 0.45 | 0.29 0.70 |

of stay, overnight stay in the area and perception of crowding. The intercept in the final model corresponded to peak = *Mulhacén*, occupation = *Unemployed*, visitor group size = 0, length of stay = 0, overnight in the area = *No overnight stay*, and perception of crowding = *No overcrowding*. Model terms and effect estimates can be found in Table 5.

The choice of peak influences the chances of spending money. For example, visitors to Monte Perdido and Pedraforca were 4.41 and 4.77 times more likely respectively to spend money than visitors to Mulhacén. Visitors in employment are 2.61 times more likely than unemployed visitors to engage in spending during their visit. With each additional person in the group, the probability of spending increased by 1.11 times. Similarly, mountaineers who spent the night in the area were 4.85 times more likely to spend money than those who did not stay overnight. In addition, each day that visitors stay in the area increases the probability of spending money by 1.45 times. Finally, perceived overcrowding during the visit reduces the likelihood of spending money 0.45 times.

## Discussion

In order to achieve more sustainable management of mountaineering within PNAs, detailed information is required on the economic, social and environmental impacts that the activity generates. Estimating the direct spending of mountaineering in PNAs at national scale, as in our study, provides a basis to make decisions and develop more sustainable strategies for tourism.

Our study applied a methodology based on the direct visitor spending model, which considered the proportion of spending attributed to the particular mountain peak being visited. Since no previous economic

studies deal specifically with mountaineering using this same methodology at national or international level, in order to discuss our results, we draw on studies using different methodologies that have advanced the knowledge of the economic impact of mountaineering or other sports in nature.

## Profiles of mountaineering visitors, spenders and non-spenders. Strategies to convert non-spenders into spenders

As previously described, spenders and non-spenders shared similar profiles in gender, average age and education level. However, non-spenders included a higher proportion of students and unemployed individuals. Group sizes were slightly larger among spenders, who also tended to stay longer and were more likely to spend the night in the area. In addition, a smaller proportion of spenders perceived overcrowding compared to non-spenders.

The presence of a substantial share of non-spenders (39% of the sample) represents both a challenge and an opportunity for enhancing the economic contribution of mountaineering. Encouraging this group to increase their expenditure could significantly reinforce local economic benefits. Our findings, together with insights from previous literature, suggest several avenues for management action. First, incentivizing larger group visits through promotions or discounts may build on the higher spending patterns observed in bigger groups, as supported by Kruger et al. (2012) and Mehmetoglu (2007). Second, promoting extended stays could foster additional spending, since longer visits have been repeatedly identified as a strong determinant of expenditure in protected areas (Fredman 2008; Seguí-Urbaneja et al. 2025). Finally, addressing perceived overcrowding emerges as a key element, whereby providing information on less crowded visiting periods or implementing visitor flow management strategies could mitigate negative perceptions and indirectly encourage spending (Weiler et al. 2019; Rogowski 2025; Luque-Gil et al. 2018).

## Visitor spending and differences between peaks

The average spend per mountaineer was estimated as €10.62 per day, indicating relatively low spending compared to previous studies on other mountaineering and sport profiles in PNAs (Farías-Torbidoni et al. 2022b; Fernández et al. 2020; Job 2008; Raya et al. 2017; Schirpke et al. 2018; Seguí-Urbaneja et al. 2025), where reported daily spending typically ranges between €20.30 and €67.50. Where the distribution of spending is concerned, as in the studies carried out by Lima et al. (2012) and Schirpke et al. (2018), we found that accommodation followed by catering were the variables on which mountaineers spent the most.

Significant differences in spending were found in relation to the different peaks, with higher spending being identified on the peaks that were less accessible (that is, where the ascent route implied a greater effort):

mountaineers on Aneto spent most during their visits (€15.28). There are two possible main explanations for these results, as demonstrated by Farías-Torbidoni & Barić (2020) for visitors to the Alt Pirineu Natural Park in Spain: (i) the direct connection between the availability of park facilities and spending; and (ii) the direct connection between levels of physical activity and visitors' spending. In our own case studies, Aneto offers more public infrastructure, providing catering and accommodation services (a mountain refuge) close to the main access to the peak. Aneto is also the most difficult climb in terms of its technical and physical requirements, followed by Monte Perdido and Pica d'Estats.

#### Determinants of direct spending. Managing perceived overcrowding

The findings pertaining to the determinants of expenditure align with variables such, destination, occupation, duration of stay and overnight stay in the region, consistent with prior research (Fredman 2008; Kruger et al. 2012; Mehmetoglu 2007). In particular, our results regarding duration of stay, overnight stay in the region and visitor group size are in line with those reported by Seguí-Urbaneja et al. (2025). In our case, staying overnight in the area as the highest predictor of spending among mountaineers. In addition to the obvious reasons (overnight stays may be associated with spending on accommodation), this could be because free overnight stays are prohibited or regulated in certain areas in the PNAs studied, while certain peaks require overnight stays for their ascent. However, the results for the number of visitors per group variable were contrary to the results of Kruger et al. (2012), who found that smaller groups were more likely to spend more than larger groups. It should, however, be pointed out that in our study, unlike in Cini and Saayman (2014), Fredman (2008) and Mehmetoglu (2007), gender and age were not identified as determinants of visitor spending.

In addition to these results, it is worth highlighting our finding of the non-perception of overcrowding as one of the determinants of spending by mountaineers, establishing for the first time a positive correlation between a perception of non-overcrowding of the area visited and a higher probability of spending. One potential explanation for the noteworthy finding of non-perception of overcrowding as a determinant of spending by mountaineers could be rooted in the psychological and experiential aspects of outdoor activities (Manning 2011; Apollo & Wengel 2021). Mountaineers may associate a lack of overcrowding with a more pristine and enjoyable experience, leading to a higher likelihood of spending. The positive correlation established in this study suggests that mountaineers, when perceiving the environment as less crowded, may be inclined to invest more in their overall experience, such as extended stays, additional services or higher-end equipment, contributing to increased

spending patterns. This connection between the perception of non-overcrowding and spending behaviour introduces a novel dimension to our understanding of the economic dynamics in mountaineering contexts.

From a conceptual perspective, several studies have linked the perception of overcrowding to visitor satisfaction within the framework of expectation theory (Manning 2011). Our study aligns with this interpretive framework but adds a further contribution: when the experience exceeds expectations, for example, by encountering a less crowded environment than anticipated, not only does satisfaction increase, but so does the propensity to spend. This establishes a positive relationship between the perception of non-overcrowding and economic behaviour, offering a novel dimension to the analysis of public use in protected natural areas.

However, even though we know that the perception of overcrowding is a subjective phenomenon, determined by individual expectations (Berrocal et al. 2013; Luque-Gil et al. 2018; Moyle & Croy 2007) and therefore difficult to control directly, there are planning and management tools capable of modulating this perception through interventions in objective characteristics of the environment. In this sense, one of the most effective ways to indirectly influence the social perception of overcrowding is through management of the physical capacity of the area.

Based on this, a practical application that could be derived from the results would be to use this information to influence the determinants of spending. Furthermore, managing the perception of overcrowding emerges as a pivotal factor in influencing visitor spending and promoting environmental protection. By implementing strategic measures that enhance the overall tourist experience while safeguarding natural resources, destinations can not only boost their economies, but also ensure the long-term sustainability of their appeal. For instance, the following measures could be implemented to mitigate overcrowding: i) visitor quotas: establishing a limit on the number of visitors allowed per day or during peak periods can help manage crowd sizes effectively (Leung et al. 2019; González et al. 2021); ii) reservation systems: implementing an advanced reservation system for popular attractions and sites can distribute visitor arrivals evenly throughout the day and prevent sudden influxes (Miller et al. 2023; Rogowski 2025); iii) peak pricing: introducing dynamic pricing that increases during peak periods can discourage overcrowding by incentivizing visits during non-peak times (Alpízar 2006; Vázquez-Lavín et al. 2025); iv) infrastructure development: enhancing infrastructure, such as expanding parking facilities, improving transportation options and creating additional access points, can accommodate larger numbers of visitors more efficiently (Rogowski 2025); v) local engagement: involving the local community in tourism management decisions and encouraging community-based tourism initiatives can help strike a balance between

visitor numbers and the community's capacity (Apollo & Wengel 2021; Farías-Torbidoni et al. 2022a; Hammer et al. 2012; Rogowski 2025); vi) off-peak promotions: offering promotions or incentives for visiting during non-peak seasons can help distribute tourist traffic more evenly throughout the year (Lima et al. 2012; UNWTO & UNEP 2005).

Implementing a combination of these measures, tailored to the specific characteristics of each destination, can contribute to a more sustainable and enjoyable tourism experience while minimizing the negative impacts of overcrowding. This study advocates for a holistic approach that embraces responsible tourism as a catalyst for both economic prosperity and environmental well-being.

## Conclusions and limitations

This study has analysed the determinants of spending of mountaineering in Spain and established the average spending per person on five emblematic mountain peaks, providing an insight into the contribution of the activity in the generation of wealth locally. The analytical methodology implemented is striking for its simplicity, which contributes to the possibility of carrying out comparable studies for other sports activities or in different environments.

Among the main findings of this study, the following stand out: i) the identification of predictors of direct spending related to socio-demographic characteristics (occupation), visitation (mountain peak, visitor group size, length of stay and overnight stay in the area) and perceptions (overcrowding); ii) a relationship between the spending generated and the level of accessibility of the peak (the lower the accessibility, the higher the spending).

The study's findings have the potential to inform strategies to maximize the economic benefits of mountain tourism for the local population while protecting the environment. In relation to the results obtained in this study generally, three recommendations could be made: i) the promotion of group visits as opposed to individual visits; ii) encouraging longer visits; iii) introducing measures to reduce the feeling of overcrowding during the recreational experience.

It is important to emphasize, however, that any action to increase the direct local economic impact should take sustainability into account. In other words, it should focus not simply on the immediate economic aspects per se, but also on environmental and social aspects. Managing the perception of overcrowding emerges as a pivotal factor in influencing visitor spending and promoting environmental protection. By implementing strategic measures that enhance the overall tourist experience while safeguarding natural resources, destinations can not only boost their economies, but also ensure the long-term sustainability of their appeal. At the same time, as suggested by Mayer et al. (2010), the implementation of measures should

be accompanied by close monitoring of visitors to the PNA, in order to evaluate the area's use more broadly, as well as the economic impact of this specific form of mountain tourism.

This study, however, is not free from limitations. The analysis focuses exclusively on demand-side variables, without incorporating supply-side factors such as service availability, infrastructure quality or price structures, which may also influence spending. Future research could adopt a more comprehensive approach by integrating both visitor and destination-side variables to deepen the understanding of spending behaviour. Additionally, expanding the analysis to include other mountain-based recreational activities or other types of protected areas could help validate and extend the findings of this study.

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## Appendix

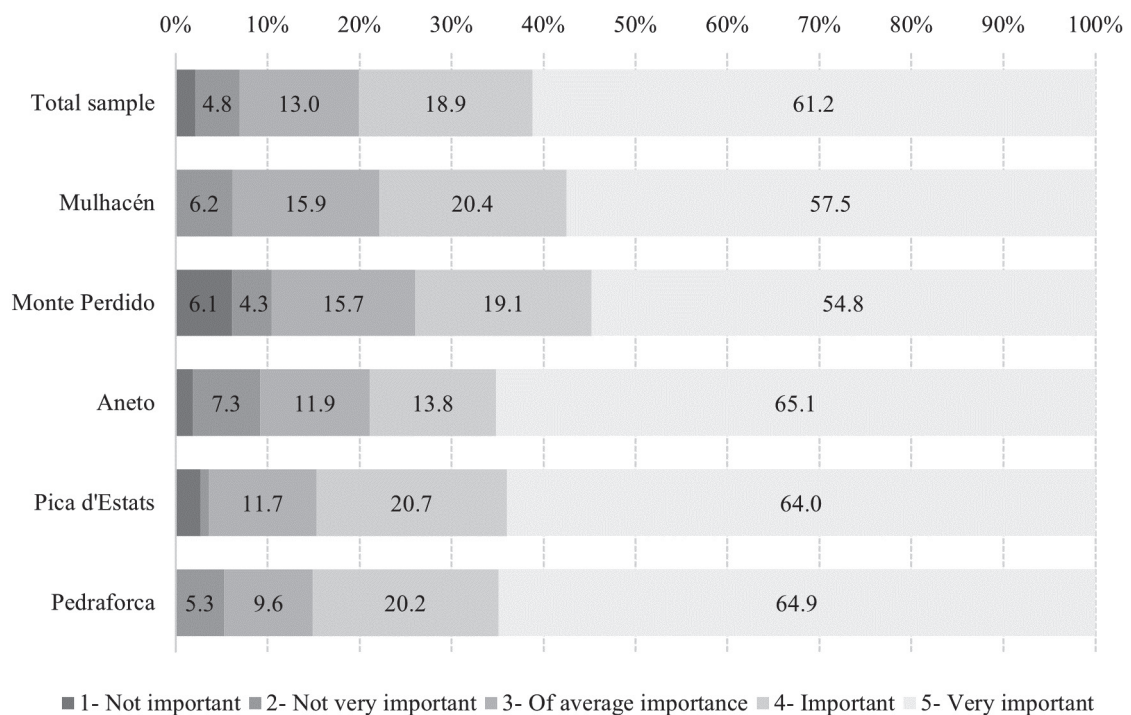


Figure A1 – Percentage of attribution depending on the motivation for the visit. In order to improve the interpretation of the graph, percentages below 2.8 have been removed.

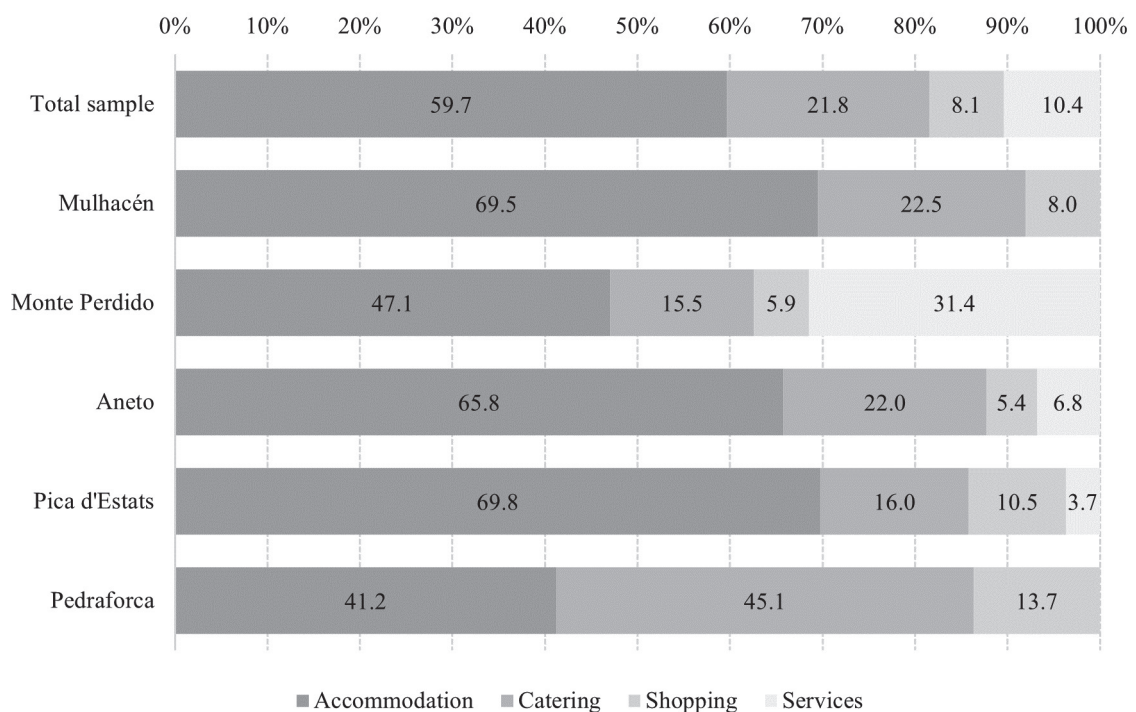


Figure A2 – Distribution of visitor spending by items per mountain peak.