

Research Article

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Social Carrying Capacity in Island Destinations: Interpreting Visitors' Opinions in Madeira Island

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Abstract: Social carrying capacity is an additional dimension of tourism carrying capacity. This paper aims to provide further understanding beyond physical values describing carrying capacity for a touristic site on an island destination, namely, the Laurisilva of Madeira. This UNESCO site is the major tourist attraction on the island. The component of social carrying capacity was added to assess satisfaction levels registered in 481 completed questionnaires and find relevant factors reflecting social values and enjoyment while visiting the site. Nonparametric tests were performed to study the relationship between sociodemographic variables and satisfaction measurements. Statistically, cleanliness and natural conditions, trail amenities, trail conditions, environmental conditions, and pollution levels were the five dimensions relevant to gauging satisfaction related to visiting the natural heritage site. Social carrying capacity showed an average satisfaction of 71%, but mean scores concluded visitors to be only slightly satisfied and differences in satisfaction levels regarding the education level of respondents. These are essential dimensions for good site management and for planning management actions for the island destination. This method of analysis is feasible for site management and is complementary to the corresponding physical thresholds.

Keywords: Social carrying capacity; Laurisilva; Sustainable management; Island destinations, UNESCO

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1 Introduction

Tourism managers, concerned with possible impacts from visitor flow, use operational data to plan and manage attractions (González-Guerrero, Robles, Pérez, Ibarra, & Martínez, 2016). The importance of carrying capacity has been increasing since the 1960s; however, it is a complex calculation and challenging to address in tourism. Carrying capacity is a management concept dependent on measurable criteria, often difficult to obtain, and has always been linked to natural resources and environmental management; thus, it is constrained by ecological factors (Manning, 2011). Tourism carrying capacity includes a diversity of “physical, social, and economic effects induced by tourism, each of which is characterised by its characteristics and consequences” (Bertocchi, Camatti, Giove, & Borg, 2020, p. 3). There are associated thresholds, linked mainly to physical limits within a specific area, that do not reflect social values and perceptions. Such limits will never be comprehensive enough to manage tourism because social values such as human values, perception, satisfaction levels, and needs must be considered (Wagar, 1964).

Studies on carrying capacity have always been relevant to assisting the growth of tourism projected until 2030 (United Nations World Tourism Organization [UNTWO], 2018); however, the pandemic created by COVID-19 has shown the need to readjust the forecasts previously made. There is a need to understand the concepts of carrying capacity for managing spaces complying with maximum capacity standards and respecting imposed social distancing.

Suppose the carrying capacity was already used as a sustainability indicator related to environmental problems due to tourism (Martínez, Cabrera, Puche, & Muelas, 2020). In that case, it is also used in the post-COVID-19 period to reorient tourist spaces classified as overloaded or under insensitive management concerning the visitors' flow and low levels of visitor satisfaction or resources showing signs of deterioration (Cruz, 2020).

A tourist destination like Madeira, that depends heavily on tourism, needs better knowledge about the state of its tourist resources and sustainable guidelines for managing its attractions. According to Direção Regional de Estatística da Madeira (DREM) (2020), 74.2% of the Madeiran active population works in services, of which 11.7% are directly related to tourism. Of the 1.48 million tourists who visited Madeira in 2019, it was found that the most significant incoming markets were Portuguese, German, English, and French, placing the revenue per available room (RevPar) between 32.90 and 59.90 euros (Travel, 2019).

Madeira Island is a place of excellence for outdoor activities such as nature walks, namely hiking on Laurisilva da Madeira, an ecosystem characterized by trees of the Lauraceae family; it is a primitive forest with the high ecological value found in the Archipelagos of Madeira, Azores, Canaries, and Cape Verde. The Laurisilva of Madeira was classified in 1999 by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as a natural heritage. However, in the reports on the conservation status, concerns about the lack of control of the carrying capacity in Rabaçal and Ribeiro Frio were highlighted, as well as deficiencies in the infrastructure providing information, parking, and safety instructions (International Union for Conservation of Nature [IUCN], 2017; UNESCO, 2009).

Within the calculation of physical values for carrying capacity in Rabaçal (Mota, Franco, & Santos, 2021), this paper aims to provide a statistical analysis of the social component based on visitors' degree of satisfaction.

2 Literature Review

2.1 Tourism Carrying Capacity

Since 1930, concern about the number of visitors registered in outdoor environments, such as natural parks or natural areas, has absorbed management and planning teams (González-Guerrero et al., 2016; Manning, 2011). The metric used as a control indicator focuses on the number of visitors per day and primarily relates the existing natural resources to environmental management measures. Furthermore, obtaining a limit value represents a challenge to measuring the impact of the appropriate use of resources (Manning, 2011).

Wagar (1964), on the other hand, warned of the need to study the physical values of the carrying capacity related to conditions external to the environment, those based on

values and social norms capable of generating a visitor's perception and the individual level of satisfaction. In this way, studies registered the importance of socioeconomic dimensions as determinants for analysing the tourist carrying capacity of an attraction (Bertocchi et al., 2020).

As per Marzetti and Mosetti (2005, p. 3), the approach to social carrying capacity has two perspectives:

1. For residents, it refers to contacts established between residents and visitors and is the limit of visitors tolerated by the host population without reducing their quality of life
2. For visitors, it refers to contacts between themselves and is the limit of visitors tolerated without reducing the quality of the recreational experience or desiring to go to an alternative site or return home.

Over time, authors (such as Inskip, 1991; Joshi & Dahal, 2019; Manning, 2001, 2002, 2011; Stankey, 1988; Zacarias, Williams, & Newton, 2011) produced studies on carrying capacity that also addressed levels of social acceptance and relationships with different levels of perception by locals and visitors. Although carrying capacity studies are taken as a starting point for the management of outdoor spaces, the interactions between tourist resources, the perception of their quality, and the visitor's experience must be considered.

Alternative theories to calculating a physical number, such as a limit of the tourist carrying capacity, led to managing the visitors' level of satisfaction, which influences the global appreciation of a natural attraction (Stankey, 1988). Hence, by addressing social characteristics, the visitor's experience related to the maintenance of natural resources is valued. For example, Prakash, Perera, Newsome, Kusuminda, and Walker (2019) focused on social factors in which they measured values of dissatisfaction related to management actions and security conditions found in an outdoor environment. Zacarias et al. (2011) studied the differences in perception between locals and visitors on Faro Beach, in Portugal, with locals being more sensitive to the observed crowd levels. In another perspective, López-Bonilla and López-Bonilla (2008) presented limits for tourist carrying capacity based on psychological factors that suggest a change in the level of satisfaction registered in a tourist destination at different times of the year. Thus, they considered "the maximum level of use that can be absorbed by an area without an unacceptable decline in the quality of experience of visitors and unacceptable adverse impact on the area's society" (López-Bonilla & López-Bonilla, 2008, p. 118).

A holistic approach to the definition of carrying capacity limits chooses awareness actions in natural parks (Guo

& Chung, 2017) and becomes a key to tourism planning and management (Bertocchi et al., 2020; Shelby & Heberlein, 1984). For example, Zehrer and Raich (2016) recorded differences in crowding perception levels, which are associated with exogenous factors found in different settings of a tourist attraction, and the type of outdoor experience that the visitor is exposed to. Studies indicate that the visitor's age at a ski resort is decisive and influences the perception of crowding on the ski slopes. The younger and older generations are identified as the most sensitive in this type of tourist attraction, reinforcing the position of Jurado, Damian, and Fernández-Morales (2013), in which they referred to this sensitivity by the younger generations.

According to Jurado et al. (2013), Mirkarimi, Mohamadzadeh, and Galdavi (2015), and Zehrer and Raich (2016), gender is also a determinant to study the social carrying capacity of a tourist attraction, and Mirkarimi et al. (2015) found that women were more uncomfortable with the level of crowding found in Daland Forest Park, in Iran.

Social issues provide a variety of perspectives contributing to social carrying capacity. Imagine the imposition of restrictions on parking to reduce the flow of visitors on a mountain trail. This measure, however, has social consequences as visitors tend to look for alternative parking areas and to create replacement trails to access the main trail (Miller, Fefer, Kraja, Lash, & Freimund, 2017).

2.2 Madeira's UNESCO Site for Tourism Use

The tourism industry is the primary driver of the Madeira Island economy, representing 26.6% of the regional GDP in 2015 (DREM, 2018). Two-thirds of the island is a natural park covered with *levadas* (human-made water channels with pathways alongside), used by residents and visitors (Oliveira & Pereira, 2008). Tourism in Madeira relies on natural resources for visitor consumption, mainly the laurel forest UNESCO World Heritage Site (UNESCO, 1999). The forest attracts special interest as it is a water source, which led to the construction of the highland waterways. The approximately 1400 km of human-made infrastructure constantly channels water from the north of the island for agricultural use, including sugarcane plantations and vineyards producing Madeira wine (Quintal & Fernandes, 2010). The paths alongside the highland waterways, which connect villages and urban structures, enable visitors to walk through the laurel forest, offering a globally unique sightseeing experience. The paths are often used for tourist activities.

The Laurisilva of Madeira protects the primary laurel forest, which can be found in Madeira, the Azores, and the Canary Islands. Its ecological value lies in its biological diversity as it exists in an ecosystem that plays a vital role in offsetting the island's hydrologic system.

"The site contains the largest surviving relict of the virtually extinct Laurisilva forest type that was once widespread in Europe. This forest type is considered a centre of plant diversity containing numerous rare, relict, and endemic species, especially bryophytes, ferns and flowering plants. It also has a very rich invertebrate fauna. Endemic species include the Madeiran long-toed pigeon and some 66 species of vascular plants." (UNESCO, 1999, p. 1).

The inscription of the Laurisilva of Madeira (UNESCO, 1999) responds to four natural criteria:

- (i) Earth's history and geological features
- (ii) Ecological processes
- (iii) Superlative natural phenomena, scenic beauty
- (iv) Biodiversity and threatened species

In 1999 when the United Nations Educational, Scientific and Cultural Organisation designated the Laurisilva of Madeira a World Heritage Site, it raised conservation concerns regarding impacts from tourism, including visitor attendance. It stated that carrying capacity should be controlled, and car-parking infrastructure and safety measures should be implemented. The IUCN (2014) classified impacts on the site from tourism or visitors or recreation as minor but on the increase.

Since 2017, the International Union for Conservation of Nature (IUCN) had voiced *significant concerns* regarding its last assessment when it designated the Laurisilva of Madeira orange, which was a downgrade from the previous report in which the laurel forest was designated light green and described as *good with some concerns* (IUCN, 2017). The Institute of Forests and Nature Conservation (IFCN in Portuguese), the property stakeholder, protested this rating because the IUCN did not follow standard procedure by failing to assess the state of the forest and issuing an unfair report. In March 2019, the Regional Secretary of the Environment and Natural Resources, Susana Prada, was called to the Regional Parliament to clarify the downgrade (Sousa, 2019). The report stated that high tourist numbers call for suitable management measures to avert threats to site conservation. Rabaçal and Ribeiro Frio were named specific areas where tourism or visitors or recrea-

tional usage was beyond capacity limits. Also identified were issues relating to solid-waste management and irresponsible site usage for human physiological needs. Site overcapacity highlights the need to study visitor impacts in terms of noise and bird feeding. The mass influx of tourists coupled with personnel and funding shortages hinders adequate site management.

After consulting the IFCN for existing data and information related to tourism activities in the Laurisilva of Madeira, it was determined that data were scarce, and there were no studies on tourism carrying capacity. Thus, a research gap was identified, which this study addresses in answer to the IUCN reports mentioning the need for studies of this nature. Moreover, the property managers can benefit from a validated method for measuring carrying capacities, which can be applied to any land-based property.

2.3 Method Hypotheses

Physical thresholds related to tourism carrying capacity (TCC) for site management on Madeira Island were calculated by collecting statistical data from field observations of visitor flow in the Rabaçal area between May 15th and June 17th, 2018, from 11 am to 5 pm each day. A questionnaire was developed and administered to visitors who agreed to participate in the study. Therefore, a convenience sample was used to register satisfaction levels related to the social characteristics of the study. Data were analysed with SPSS 25 to answer the following research question:

Research Question (RQ): Which sociodemographic determinants have a positive influence on satisfaction levels regarding social carrying capacity in the UNESCO Site Laurisilva of Madeira?

As seen previously, demographic and social factors, such as gender, age, education level, and income, can influence the perceived crowding and satisfaction of a touristic site or experience (Jurado et al., 2013). In fact, these demographic and social factors can also influence the tourist satisfaction level regarding the TCC. Hence, to answer RQ, the following hypotheses were posited:

H1: The age factor among residents and tourists has an equal median when scoring their satisfaction level regarding TCC at the UNESCO site Laurisilva of Madeira compared to tourists.

H2: The gender factor among residents and tourists has an equal median when scoring their satisfaction level regarding TCC at the UNESCO site Laurisilva of Madeira compared to tourists.

H3: The country of residence among residents and tourists has an equal median when scoring their satisfaction level regarding TCC at the UNESCO site Laurisilva of Madeira compared to tourists.

H4: The household income factor among residents and tourists has an equal median when scoring their satisfaction level regarding TCC at the UNESCO site Laurisilva of Madeira compared to tourists.

H5: The academic qualifications factor among residents and tourists has an equal median when scoring their satisfaction level regarding TCC at the UNESCO site Laurisilva of Madeira compared to tourists.

For both study groups, statistical differences were based on nonparametric tests (Whitney U and Kruskal-Wallis) requiring that null hypotheses, the distribution of both populations, are equal (Marôco, 2011).

2.4 Technical Description of the Sites in Rabaçal

As described by Mota et al. (2021), Rabaçal is composed of green areas surrounding access from the ranger house to the house of Rabaçal; an old shelter converted into a café and a two-bedroom lodging for visitors in the middle of the laurel forest. There are five trails with different levels of difficulty and typology. The most visited are the Levada das 25 Fontes (PR6) and Levada do Risco (PR6.1); the Levada do Alecrim and Vereda da Lagoa do Vento are the least known to visitors. Therefore, the study focused only on the PR6 and PR6.1, and for TCC physical figures, the starting points of PR6 and PR6.1 were taken to be at casa do Rabaçal; therefore, 2900 visitors in total were registered while walking in both trail directions (Mota et al., 2021).

Park rangers and maintenance staff were often seen on the trails overseeing visitors and conducting maintenance work on the trail or the stone bed of the waterways to increase efficient and safe access to the *levadas*. Trails are linear and share the start/endpoints. They are not always flat and are only wide enough for one person in many locations. The trails go up and down the hills, always making safety an issue. Trails were identified with

arrows indicating directions and length; alternative paths connect PR6 and PR6.1, but these are not identified nor maintained.

There are steep sections of the trails where it is difficult to walk due to slippery ground, and on rainy days, they become more difficult to hike and less safe due to mud zones; thus, there is a high risk of accidents.

Some parts of the trails are suitable for gatherings of people; it is common to see groups of up to 35 people. Such areas become hotspots for resting, eating, or just enjoying the laurel forest, and some were even used for discarding rubbish. Overall, trails were well maintained and clean, but debris such as paper tissues, plastic film, sweet wrappers, plastic bottles, and broken glass bottles were all linked to food and drink consumption while hiking. Rabaçal has toilet facilities at the café, but people were seen to relieve themselves by the trail, contributing to the familiar sight of faecal matter with paper tissue at the side of the trails, at PR6.

The Levada das 25 Fontes trail is in the Calheta Municipality. Starting at Casa do Rabaçal, the Levada das 25 Fontes is 2.7 km long and one-way and ends at the 25 Fontes lagoon. Thus, users must make the return journey back along the on-average 1.5 m-wide route, which takes approximately 3 hr. In the second half of 2018, the IFCN restored old paths to make a circular route returning from the lagoon, where PR6 is narrow. Users still need to give way to those walking in the opposite direction due to its narrowness. Moreover, they can be forced to walk near the edge where vertigo sufferers are at risk if they look down the steep mountain drop.

The Risco trail (PR6.1) is in the same municipality and is flat, mostly at 1160 m, ending at an impressive 100 m waterfall. The 1.3-m-wide stone trail starts on a gentle incline at the house of Rabaçal and becomes flat after 200

m. It has an average width of 2.5 m and takes around 2 hrs to complete. The last section ends in front of the waterfall.

2.5 Measuring Tool

The questionnaire was drafted in English then translated into the most common tourist languages, namely Portuguese, French, Spanish, and German. The translations were carried out by native speakers of each language and then back-translated to check conceptual equivalence (Sekaran, 2003). The questionnaire had three parts; the first was intended to collect details about the trip. Because of the variety of visitors to Rabaçal, the questionnaire was directed to local visitors and workers and domestic and foreign tourists. It included an item asking if the interviewee had a disability and another enquiring about the amount of money spent at the nature-based tourist attraction. The second part registered the satisfaction level to study sociocultural aspects. Questions related to site management and conditions were adapted from published studies focused on tourism capacity (García & Ventura, 2014; Needham & Rosenberger, 2011; Okech, 2010; Wiberg, 2009; Zacarias et al., 2011). There were also some new questions about trail cleanliness and sense of crowding. A 7-point Likert-type scale was used to measure satisfaction level, with 1 representing “not satisfied” and 7 “very satisfied”. The third section aimed to collect socio-demographic information, ending with a comment box for suggestions.

A pilot test was performed with local workers and tourists to avoid ambiguity regarding language and interpretation. Special attention was given to the semantics used to facilitate reading and understanding of each translated question. The questions were clear and objective, with only two requiring minor changes in wording.

On seven random days between May and June 2018, the final assessment was conducted at the house of Rabaçal, where 481 people answered the questionnaire after visiting PR6/PR6.1, satisfying the requirement for a representative sample with a 95% confidence interval of the universe of 2,158,943 people, covering the total population in the Madeira Archipelago and total arrivals to Madeira by plane and cruise ship.

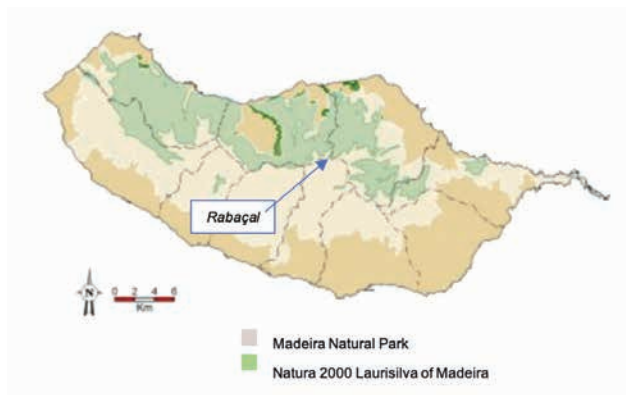


Figure 1: Map of Madeira Island with the Laurel Forest and the Natural Park of Madeira, Source: ifcn.madeira.gov.pt

3 Results

3.1 Descriptive Analysis for PR6/PR6.1

Numerous groups consisted of 20 to 24 people, walking 1.5 m apart and sometimes closer together. Although groups were arriving in the morning or at noon, this was not constant. It was intended to question users after they visited the trails; therefore, counting started at 12, with higher peaks until 3 pm.

Visitor characteristics of PR6/PR6.1 are shown in Table 1. A descriptive analysis of the sample ($N=481$) indicates it to be composed mainly of German (38.2%) and French (18.8%) tourists. The analysis also reveals that over half of the respondents are aged between 45 and 65 (60.0%), employed (63.6%), with higher-education qualifications (67.3%), and average purchasing power (nearly half earn between €2501 and €5000 per month). Only 2.5% of the total is composed of local workers, who were counted as respondents on Rabaçal for work reasons such as café staff, tour guides, park rangers, photographers, videographers, or researchers. This question was presented to assess the magnitude of people working in the area, mainly tour guides; however, most refused to participate in the study.

Rabaçal itself does not have inhabitants, but the local population was considered as the percentage of answers from respondents who lived on Madeira for the time of the study.

3.2 Studying Social Carrying Capacity: Essential Variables for Measurement

The data were analysed in three stages. First, the visitor profile was determined using descriptive analysis. Second, the proposed scales composed of 24 variables were subjected to a preliminary analysis to assure a reliability verification. Therefore, exploratory factor analysis (EFA) was applied to the satisfaction level measurement variables with an absolute frequency superior to 385 answers, which excludes the items “Q7.9. ease of movement or access” and “Q7.13. administration of the space”.

From the factor analysis, it was possible to aggregate 22 satisfaction variables to a smaller set of dimensions formed by CFA (Components of factor analysis). The principal component analysis was applied with varimax rotation, and only factors with an eigenvalue equal to or greater than one was considered significant (Table 2). In the last stage, the Mann Whitney U and Kruskal-Wallis

tests with independent samples were used to investigate how sociodemographic variables are related to measured satisfaction levels.

From the varimax-rotated factor matrix (Table 2), five factors representing 65.97% of the explained variance were extracted from 22 variables. These factors (or components) were identified and used to measure the validity and reliability of data. The Kaiser-Meyer-Olkin (KMO) criteria were used to analyse the factorial analysis validity, measuring variable homogeneity by comparing simple correlations with partial correlations observed between the variables. A KMO value between 0.8 and 0.9 indicates that factor analysis is adequate, and variables have good homogeneity (Marôco, 2011).

The KMO test indicates good homogeneity (0.856) of data, meaning the information gathered from the sample is considered appropriate for factor analysis.

The Cronbach's Alpha (score reliability) allows the determination of the inferior limit of the internal consistency of a group of variables, where a value of 0.6 indicates a satisfactory internal consistency and reliability of the dimensions (Malhotra & Birks, 2007). According to George and Mallery (2003), a value between 0.7 and 0.8 is considered acceptable, between 0.8 and 0.9 good, and above 0.9 excellent. Associated by communalities among variables, components were assigned to the following satisfaction dimensions associated with social carrying capacity:

- **Dimension 1 – Cleanliness and natural conditions.** This dimension presents excellent internal consistency ($\alpha=0.932$) and accounts for 13.216% of the variation in the data. It comprises the satisfaction level with the cleanliness of the Risco trail, the cleanliness of the viewpoint of the Risco trail, the cleanliness of the 25 Fontes trail, the cleanliness of the 25 Fontes lake, the forest condition, and the native plants in the landscape.
- **Dimension 2 – Trail amenities.** There is an acceptable internal consistency of the dimension ($\alpha=0.750$). This dimension accounts for 13.216% of the variation in the data and is composed of the satisfaction level with the awareness of tourism potential, information signs, parking availability, free admissions, opportunities to escape crowds, site maintenance of the tourist attraction, and staff demeanour.
- **Dimension 3 – Trail conditions.** This dimension presents an acceptable internal consistency ($\alpha=0.823$). In this dimension, which explains 6.552% of the variance, the number of rubbish bins, toilets, and on-site information about emergency services are the main items.

Table 1: Sociodemographic Profile and Trip Description of Visitors of PR6/PR6.1 (N=481).

	Frequency (%)		Frequency (%)
Gender		Accommodation	
Male	53.0%	Cruise ship	0.0%
Female	47.0%	Hotel	51.1%
Age		Resort	3.6%
15 to 24	2.7%	Serviced apartment	3.4%
25 to 34	17.3%	Tourist apartment	14.9%
35 to 44	9.4%	Lodge	1.5%
45 to 54	27.3%	B&B/Hostel	1.7%
55 to 64	32.7%	Local accommodation	8.5%
>65	10.6%	Friends/relatives house	1.9%
Marital status		Private house	12.3%
Single	16.4%	Camping	1.1%
Married/Non-marital union	78.4%	Stay duration (days)	
Divorced	3.7%	<5	4.0%
Widower	1.5%	5 to 8	52.1%
Country of residence		9 to 15	42.8%
Portugal	6.9%	>15	1.1%
France	18.8%	Group size (individuals)	
Germany	38.2%	<3	73.4%
Spain	2.3%	3 to 5	18.8%
United Kingdom	2.9%	6 to 10	3.1%
Benelux	12.1%	11 to 20	1.8%
Scandinavia	1.3%	>20	2.9%
Other European countries	15.2%	Local workers	2.5%
Non-European countries	2.3%	Visit duration (minutes)	
Occupation		<30	0.2%
Employed	63.6%	30 to 60	17.4%
Self-employed	13.4%	61 to 120	10.1%
Student	1.5%	121 to 180	27.3%
Unemployed	0.6%	181 to 240	28.0%
Pensioner	16.4%	>240	16.9%
Other	4.5%	Disability	
Net monthly household income		No	97.5%
<500€	1.7%	Yes	2.5%
501€-1000€	4.8%	Expenditure during the visit	
1001€-1500€	9.0%	Did not spent	9.5%
1501€-2500€	14.0%	<10€	26.3%
2501€-3500€	20.2%	10€-20€	31.9%
3501€-5000€	26.1%	21€-30€	9.5%
5001€-7500€	15.7%	31€-50€	5.6%
>7500€	8.4%	>50€	7.5%
Education		I don't know/Prefer not to answer	9.7%
Elementary	3.8%		
Secondary	29.0%		
University degree	45.8%		
Master's/PhD degree	21.5%		

Table 2: Factor Analysis to Know Which Variables Measure Which Factors by Using a Varimax-Rotated Factor Matrix

Variable	Component					Mean score
	1	2	3	4	5	
Q7.17. Cleanliness of the 25 Fontes trail	0.882					5.923
Q7.15. Cleanliness of the Risco trail	0.879					5.986
Q7.18. Cleanliness of the 25 Fontes lagoon	0.845					5.957
Q7.16. Cleanliness of Risco trail	0.842					6.054
Q7.19. Forest condition	0.711					6.021
Q7.20. Native plants in the landscape	0.653					6.207
Q7.3. Availability of parking areas		0.747				5.081
Q7.2. Information signs		0.678				5.248
Q7.1. Awareness of tourism potential		0.637				5.438
Q7.4. Free admissions		0.588				6.120
Q7.12. Courteousness of personnel		0.532				5.962
Q7.11. Maintenance of the tourist attraction		0.520				5.286
Q7.5. Opportunity to escape crowds		0.399				4.316
Q7.7. Number of toilets			0.852			3.888
Q7.8. Cleanliness of toilets			0.821			3.798
Q7.6. Number of rubbish bins			0.700			3.849
Q7.10. On-site information about emergency services			0.681			3.444
Q7.23. Learn about nature				0.836		4.851
Q7.24. Conscious environmental management				0.799		5.345
Q7.14. Presence of wildlife				0.551		4.711
Q7.21. Levels of noise pollution					0.819	6.078
Q7.22. Levels of air pollution					0.775	6.264
Eigenvalue	7.708	2.907	1.442	1.364	1.093	
Percentage of variance explained	35.038	13.216	6.552	6.201	4.966	
Total variance explained	65.974					

Notes: Kaiser-Meyer-Olkin (KMO): 0.856.

Extraction Method: Principal Component analysis

Rotation Method: Varimax with Kaiser Normalisation

a. Converged rotation in six iterations.

- **Dimension 4 – Environmental conditions.** There is a satisfactory internal consistency of the dimension ($\alpha=0.677$). This dimension, explaining 6.201% of the variance, includes learning about nature and awareness of environmental management.
- **Dimension 5 – Pollution level.** This dimension presents an acceptable internal consistency ($\alpha=0.799$). Explaining 4.966% of the variance, this dimension includes the levels of noise pollution and air pollution.

The level obtained for social carrying capacity with the respective performance using the dimensions extracted from the EFA is given in Table 3. The mean scores in the table are the averages from each factor obtained in Table 2, and the general method for rounding was used to find the respective satisfaction level.

The Likert-type scale is fixed to the exact values 1 to 7; therefore, satisfaction levels ranged from neutral value judgements to moderately satisfied, with the most outstanding dimensions related to pollution (5) and cleanliness and natural conditions (1) of Rabaçal. Most mean

Table 3: Mean Scores for Satisfaction Levels Referring to Social Carrying Capacity

Social factor	Mean score	Level	Mean satisfied	Mean neutral	Mean dissatisfied
Dimension 5	6.171	Moderately satisfied	92%	5%	3%
Dimension 1	6.025	Moderately satisfied	74%	14%	12%
Dimension 2	5.350	Slightly satisfied	34%	21%	44%
Dimension 4	4.969	Slightly satisfied	62%	20%	18%
Dimension 3	3.745	Neither satisfied nor dissatisfied	93%	4%	3%
Social carrying capacity	5.252	Slightly satisfied	71%	13%	3%

Table 4: Testing of Sociodemographic Variables for Contributing Factors to Satisfaction with the UNESCO Site Laurisilva of Madeira

Hypotheses	Dimension	N	Test	Mean rank	p-value	Decision
H1 (Age)	3 (Trail conditions)	365	Kruskal-Wallis	17.367	0.004	Reject
H2 (Gender)	3 (Trail conditions)	353	Mann-Whitney	18.347	0.003	Reject
	2 (Trail amenities)	341		19.214	0.014	Reject
H3 (Country of residence)	3 (Trail conditions)	363	Kruskal-Wallis	20.830	0.008	Reject
	4 (Environmental conditions)	409		29.768	0.000	Reject
	5 (Pollution level)	447		19.981	0.010	Reject
H4 (Household income)	All dimensions	481	Kruskal-Wallis			Accept
H5 (Academic qualifications)	3 (Trail conditions)	345	Kruskal-Wallis	8.954	0.030	Reject

levels for satisfaction are above 62%, except for Dimension 3 which was on the level for slightly satisfied, counting the greater dissatisfaction of 44% of respondents. Furthermore, Dimension 3 registered a mean score in the slightly dissatisfied level but rounding up positioned it on level 4, which is neither satisfied nor dissatisfied. The social carrying capacity for Rabaçal is the average value calculated from the mean scores of the five relevant dimensions. As a result, respondents were slightly satisfied, scoring 71% of satisfaction with reduced percentages for neutral and dissatisfied visitors.

3.3 Influence of Sociodemographic Variables on Satisfaction

Using the five dimensions as grouping variables as illustrated in Table 2, the Mann-Whitney U and Kruskal-Wallis tests assessed the suggested hypotheses. Thus, nonparametric tests analysed differences in two independent samples by analysing the equality of the median as indicated in Table 4.

The variable “age” has more than two groups; therefore, the Kruskal-Wallis test was used to show a statistical difference between groups when using the grouping variable “dimension 3 - Trail conditions”. With $\chi^2_{KW}(2) = 17.367, p = 0.004, n = 365$, H_1 was rejected due to statistical dissimilarity as shown in Figure 2. Moreover, no considerable differences were found for the remaining grouping variables.

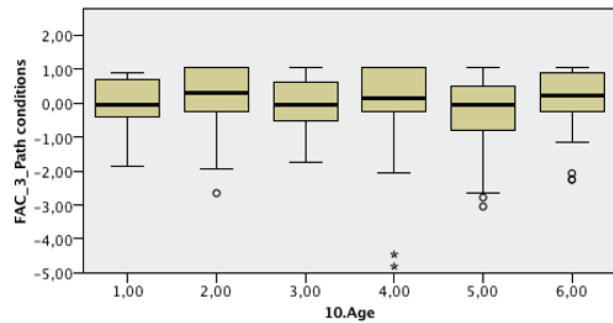


Figure 2: Kruskal-Wallis with Independent Samples Relating Age with Dimension 3 - Path Conditions

Testing the groups representing “gender”, as shown in Figure 3, the Mann-Whitney U test rejected H_2 when using the grouping variable “dimension 3 - Trail conditions”. There is statistical evidence with a p -value of 0.003 showing that both gender scores are not equal. The probability indicates a 3:1000 if the *populations* of men and women measure their satisfaction level with the UNESCO site Laurisilva of Madeira; there is a 3 in 1,000 chance of obtaining the sizeable difference in the 353 respondents. The remaining grouping variables verified statistical evidence of retaining H_4 with $p > 0.05$.

The variable “country of residence” in Figure 4 used the Kruskal-Wallis test to show statistical differences when using the grouping variables “dimensions 2, 3, 4, and 5”. Hence, tourists from different countries score differently for their satisfaction level about the UNESCO site Laurisilva of Madeira, regarding trail amenities and conditions, environmental conditions, and pollution levels. Countries were codified as 1-Portugal, 2-France, 3-Germany, 4-Spain, 5-United Kingdom, 6-Benelux, 7-Scandinavia, 8-Other European countries, and 9-non-European countries. When using the grouping variable Dimension 1 – Cleanliness and natural conditions, H_3 is retained with $p > 0.05$ regardless of country of residence. Hence, the distribution

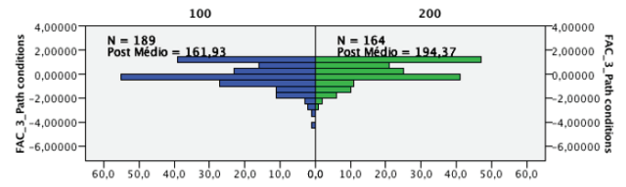


Figure 3: Mann-Whitney U Test Relating Gender with Dimension 3 - Trail Conditions

of scores for satisfaction about the UNESCO Site Laurisilva of Madeira is statistically equal.

However, with $p < 0.05$, H_3 is rejected when using the remaining grouping variables. Dimension 2 indicates statistical differences between the three following groups of countries “Portugal, Germany, Benelux” – “France, Spain, Other European countries” – “United Kingdom, Scandinavia”; Non-European countries were outstanding from all statistical values. Dimension 3 combines countries as “Portugal, Germany, Spain, United Kingdom, Benelux” – “France, Scandinavia, Other European countries”, with non-European countries outstanding from all statistical values. Dimension 4 combines countries as “Portugal, Scandinavia, Non-European countries” – “France, Spain, United Kingdom, Other European countries” – “Germany,

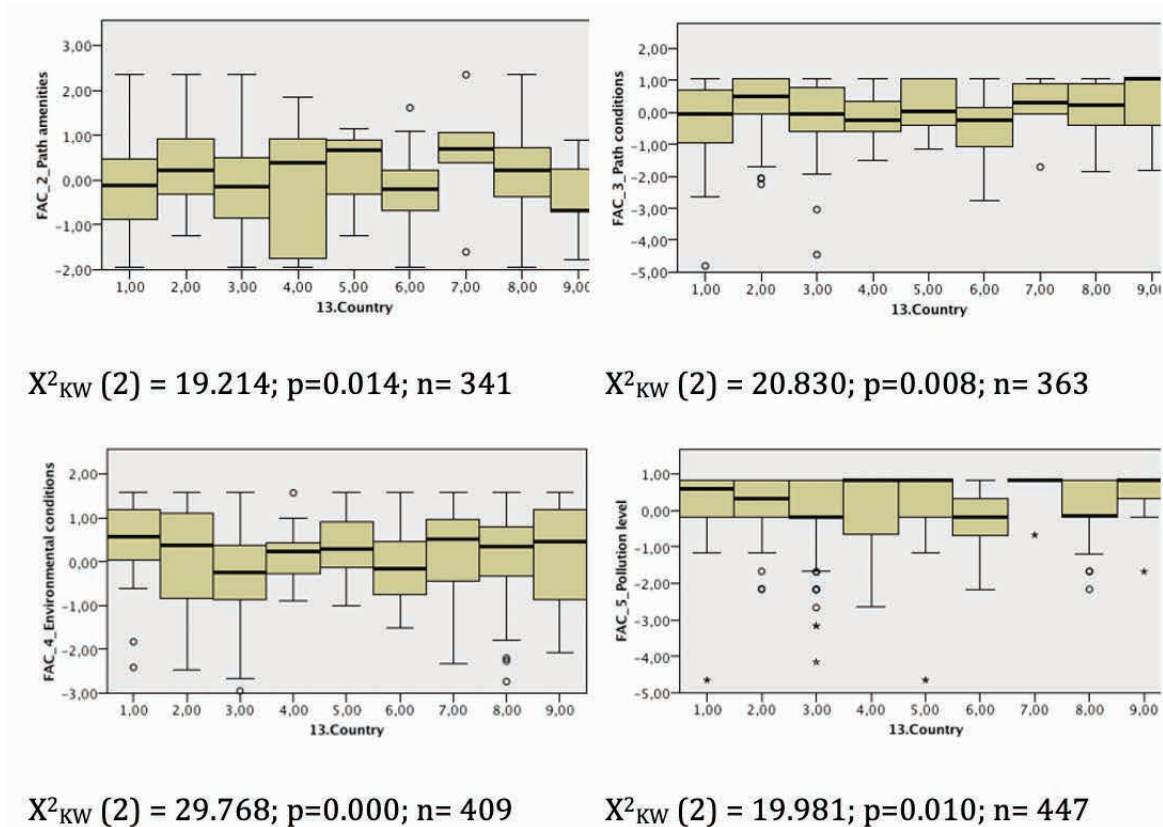


Figure 4: Kruskal-Wallis with Independent Samples Relating the Variable Country with the Grouping Variables Dimension 2 - Path Amenities, Dimension 3 - Path Conditions, Dimension 4 - Environmental Conditions, Dimension 5 - Environmental Pollution

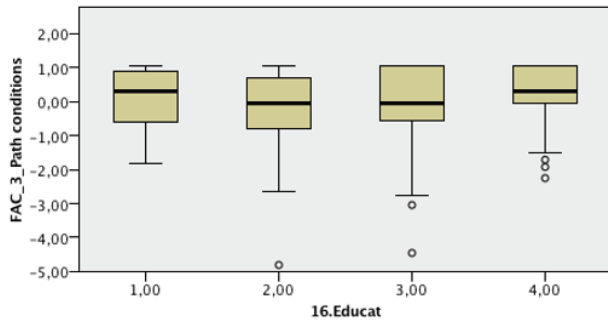


Figure 5: Kruskal-Wallis with Independent Samples Relating Education with Dimension 3 - Path Conditions

Benelux”, and with Dimension 5, countries were grouped as “Portugal, France” – “Germany, Benelux, Other European countries” – “Spain, United Kingdom, Scandinavia, Non-European countries”.

It was found that household income had no statistical significance for the distribution of scores for satisfaction with the UNESCO Site Laurisilva of Madeira. The Kruskal-Wallis test indicated $p > 0.05$ for all grouping variables, therefore, accepting H_4 .

The variable “education” was tested with the Kruskal-Wallis test. Figure 5 shows a statistical difference when using the grouping variable “dimension 3 - Trail conditions”, being the only test with $\alpha < 0.05$. Hence, tourists score differently for satisfaction level about the UNESCO site Laurisilva of Madeira regarding trail conditions. With $\chi^2_{KW}(2) = 8.954, p = 0.030, n = 345, H_4$ is rejected, and no significant differences were found for the remaining grouping variables.

Hence, education levels were grouped as “1, 4” – “2, 3”, indicating that satisfaction levels with trail conditions were statistically similar for respondents with elementary education and Master’s or PhD degree, likewise for respondents with secondary school and university degrees.

4 Discussion

Concerning RQ, tourists from different countries have different opinions regarding nature-based tourism and walking routes. Every experience carries added value for scoring satisfaction levels in every dimension presented for social carrying capacity (Figuroa & Rotarou, 2016; Manning, 2011). The additional component comprises qualitative “markers”, which were handled by following statistical methods to find relevant aspects for site management in this study. Independent of the number

of visitors to Rabaçal, the marks achieved for social carrying capacity were the first milestone showing that 71% of visitors were satisfied. Now it is possible to compare value judgements regarding the increase or decrease of satisfaction levels in different seasons of the year with a ratio for unsatisfied and satisfied visitors (López-Bonilla & López-Bonilla, 2008).

Despite the car parking area and safety instructions being a concern (IUCN, 2014, 2017; UNESCO, 2009, 2014), visitors were satisfied with the trail amenities, leaving some notes for improvement, especially regarding information signs for trail directions and info about the ecosystem, and offering their thoughts about finding too many cars in the parking area, likewise buses with big groups arriving at the site.

Also, the impacts of noise and the fixed dimension for pollution levels kept respondents’ satisfaction levels high while visiting Rabaçal. Overall, the image created of Madeira Island and the existing tourism assets are reinforced by developing an emotional connection with the UNESCO site with positive interaction, contributing to higher satisfaction levels (Machado, Santos, & Sarmiento, 2009). Figures grouped satisfaction regarding respondents’ education levels, giving interesting outputs such as low- and high-educated people sharing the same opinion regarding trail conditions. Chang, Stylos, Yeh, and Tung (2015) stated the direct relationship between education and exploring available information, with high levels of education having more experience in travelling and thus interest in finding information about the destination, and lower education levels tending to refer to previous experiences or word of mouth. Transposing to the natural asset, planning a trip to Rabaçal also requires gathering information about expected trail conditions. Therefore, the seven variable questions composing “trail conditions” gain high value for managing satisfaction levels.

5 Conclusion

The social carrying capacity component provides a supplementary analysis, built on social values and individual opinions (Wagar, 1964), playing an essential role in gauging satisfaction by comparing satisfied and unsatisfied visitors. This study established five dimensions composed of valuable topics for managing the UNESCO site and was the first assessment of its kind. Having 71% satisfaction does not mean that the level is high; thus, further analysis identified the respective accuracy for each dimension. For the first assessment, the average

satisfaction levels did not score negative observations in the scale. To understand the evolution of social carrying capacity, further assessments must be made in different seasons for comparison (López-Bonilla & López-Bonilla, 2008). Detecting changes in the number of satisfied visitors between periods allows for such differences to be explored.

As the Laurisilva of Madeira has significant ecological value and is one of the most important attractions on the island, there is an opportunity for gauging tourism satisfaction in different island locations. Moreover, the regional government and the island tourism board should follow recommendations to expend more effort in protecting resources and educating tourists about the importance of the Laurisilva. Until 2020, tourism grew on Madeira Island, requiring management actions on the tourist destination. Nevertheless, the post-COVID-19 planning is essential for compliance with constraints such as reduced tourist arrivals, social distancing, and tourists' behaviour. Hence, evaluating visitors' satisfaction is a worthwhile for the decision-making process. As environmental protection and raising awareness are suitable for promoting island tourism, enforced behaviour guidelines and pro-environmental actions will contribute to the tourists' rational decisions and reduce disrespectful behaviour on the destination (Wang, Huang, Gong, & Cao, 2020).

It was discovered that a decrease in dissatisfaction levels indicates that capacity has been exceeded and needs to be analysed for considerable deviations. There is room for a strategy to increase satisfaction by extending the presented dimensions and evaluating free-choice educational experiences while visiting the site (Prakash *et al.*, 2019; Storksdieck & Falk, 2020). Visitors appreciate the opportunity to learn while visiting the site; therefore, information about current management actions are appreciated and keep satisfaction levels high (Gundersen, Mehmetoglu, Vistad, & Andersen, 2015).

6 Limitations and Implications

A further limitation is that the sampling and questionnaire distribution takes place only from 11 am to 5 pm and even that not every day, which reduces the probability of obtaining more answers and counting fewer people on the trails. This limitation could be solved by distributing the questionnaires for more extended periods during the day and using devices that monitor visitor flow 24 hours a day.

From a theoretical perspective, the study validated a new set of satisfaction dimensions on tourism carrying

capacity: cleanliness and natural conditions, path amenities, path conditions, environmental conditions, and pollution level. From a pragmatic point of view, it aids the government and policymakers by providing important insights for correctly managing trails classified as UNESCO Heritage Sites.

Madeira is a tourist destination experiencing few differences between seasons because there are several cultural and sports initiatives to adjust for seasonality throughout the year. Furthermore, the cruise lines arrive only during fall and winter (DREM, 2018). Because fieldwork was conducted during the pre-COVID-19 period and it is suspected that tourists might prefer travelling within borders during the recovering stage, nationalities and tourist arrivals decreased considerably. The visitors' profile should be conducted again and during a different season to understand eventual changes in the variables and level of satisfaction.

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