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The Coastal Scenery of São Miguel Island, Azores Archipelago: Implications for Coastal Management

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Abstract: In this study, coastal scenic beauty was assessed at 29 sites at São Miguel, which is one of the Azores Islands, i.e., a group of remote volcanic islands in the North Atlantic Ocean. The assessment was based on in situ observations and the use of the Coastal Scenic Evaluation System (CSES), which consists of a checklist with 26 physical- and anthropic-weighted parameters and the Fuzzy Logic Approach (FLA) mathematical tool. The study sites were classified into five classes according to their typology and their scenic value, ranging from Class I (natural sites of great scenic beauty) to Class V (unattractive, urbanized sites). Concerning beach typology, 13% were remote, 28% rural, 28% village, and 31% urban. Concerning scenic beauty, 10% of the sites belonged to Class I, 14% to Class II, 17% to Class III, 31% to Class IV, and 28% to Class V. The physical parameters were linked to the characteristics of the geological volcanic landscapes, and the anthropic parameters essentially reflected the presence of tourism and public services. The results of the assessment provide a scientific basis for developing a management strategy for the preservation and conservation of the coastal areas and their sustainable development.

Keywords: coastal geomorphology; beach; Coastal Scenic Evaluation System (CSES); remote islands; Atlantic Ocean

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1. Introduction

The Azores is the most remote archipelago located in the North Atlantic Ocean, and it consists of nine islands divided into three groups according to their geographical location: the western islands (Flores and Corvo), the central islands (Faial, Pico, São Jorge, Graciosa, and Terceira), and the eastern islands (São Miguel and Santa Maria) [1,2]. The focus of this research is the largest island of the archipelago, i.e., São Miguel, which emerged approximately four million years ago [3].

The coastline is a highly vulnerable environment that can be easily impacted by human activities such as tourism, agriculture, fishing, and industry [4,5]. Coastal areas, including popular destinations like continental Portugal and the Azores, attract tourists due to their favorable climate, natural beauty, cultural heritage, and the presence of tourist infrastructures [6,7]. Since the mid-20th century, coastal tourism has been on the rise, thus driving economic development in certain regions but also causing environmental degradation [8]. It is crucial to recognize the potential impact of increased tourism on coastal environments and to strike a balance between economic development and environmental preservation. At a global scale, the tourism market has seen rapid growth, with 1.5 billion international tourist arrivals in 2019. In terms of tourism receipts, the sector generated USD 3.5 trillion in 2019, which is equivalent to 4% of the world's GDP [9].

Tourism demand has also significantly increased over recent years in the Azores, making them an ideal destination for adventure, coastal, and rural tourism [8]. The aforementioned tourism typologies, together with the slow travel concept, allow for experiences and interactions with the natural environment that have propelled the archipelago to the top of the most exotic destinations in the heart of Europe [10]. The Azores are the first archipelago in the world to have obtained the EarthCheck certification issued by the Global Sustainable Tourism Council. This reflects the aspiration of combining the preservation of natural landscapes in line with responsible and conscientious tourism practices, e.g., by considering factors such as the "Big Five" [4] along with the influx of tourists in São Miguel and other Azores Islands [11]. The Big Five [4] are the principal reasons for visiting a coastal place, i.e., facilities, safety, no litter, water quality, and scenery—the latter of which is the topic of this article.

The landscape is a vital element in the quality of life of people around the world, and it is the context in which communities interact with their environment and make decisions about future developments [12]. Therefore, since the loss of scenic beauty or landscape quality is not immediate but occurs progressively and gradually, it is crucial to enhance the reconstruction of the evolution and transformation of coastal environments.

Rangel-Buitrago et al. [13] and Anfuso et al. [14] demonstrated that the Coastal Scenic Evaluation System (CSES) developed by Ergin et al. [15] constitutes a very useful tool to objectively characterize coastal sites, and it also opens up new perspectives for the conservation and correct management of coastal areas. The methodology has already been applied to >1000 coastal regions [16] belonging to different countries such as Mexico [17], Cuba [18], Colombia [13], Brazil [12], Peru [19], Chile [20], Malta, Turkey [21,22], Morocco [23,24], and northern France [25]. Moreover, there have also been several papers published that assessed coastal scenery using the CSES method in Spain, such as Williams et al. [26] for the coast of Andalusia; Iglesias et al. [27] on the Basque Country and Catalonia; Asensio-Montesinos et al. [28] on Alicante; and Mooser et al. [29] on the Balearic Islands.

This paper deals with the coastal scenic assessment, based on the use of the CSES method, of the São Miguel coastal area (Azores, Portugal), of which its landscape characteristics were previously analyzed by Quintela et al. [30,31]. This study was conducted keeping in mind that landscape degradation mainly affects the coastal scenery, and its protection depends on the participation of all public agents [32]. The results obtained by the use of different landscape assessment techniques provide improvements in the coastal landscape characteristics of tourist sites by reducing human impacts, facilitating management plans for future occupations and tourism developments, and preserving the scenic value, thereby favoring the development of sustainable tourism.

Coastal development, often associated with persistent and gradual human encroachment due to inadequate planning, poses a significant threat to the coastal and marine environments. Therefore, understanding the natural aspects of the coastline and its encompassing characteristics, as well as the evaluation of the landscape, becomes crucial for the establishment of effective and robust coastal management plans.

This paper essentially aims to classify assessed sites using the CSES methodology. The secondary objectives are the identification of the evolution in the investigations of coastal sites by comparing the results obtained within this study with the ones obtained for the same places 13 years ago by Quintela et al. [30,31], as well as to propose sound solutions for improving beach quality and to protect/preserve the natural environment.

2. Study Area

The volcanic island of São Miguel, which is ca. 65 km east–west, 16 km north–south, and covers a total area of 742 km^2, is the largest of the Azores Archipelago in the North Atlantic Ocean (Figure 1a). The coastline is ca. 180 km long and exhibits a mesotidal environment [33]. In this paper, we investigated a total of 29 coastal sites, thereby covering a significant portion of the coastline of São Miguel (Figure 1b).

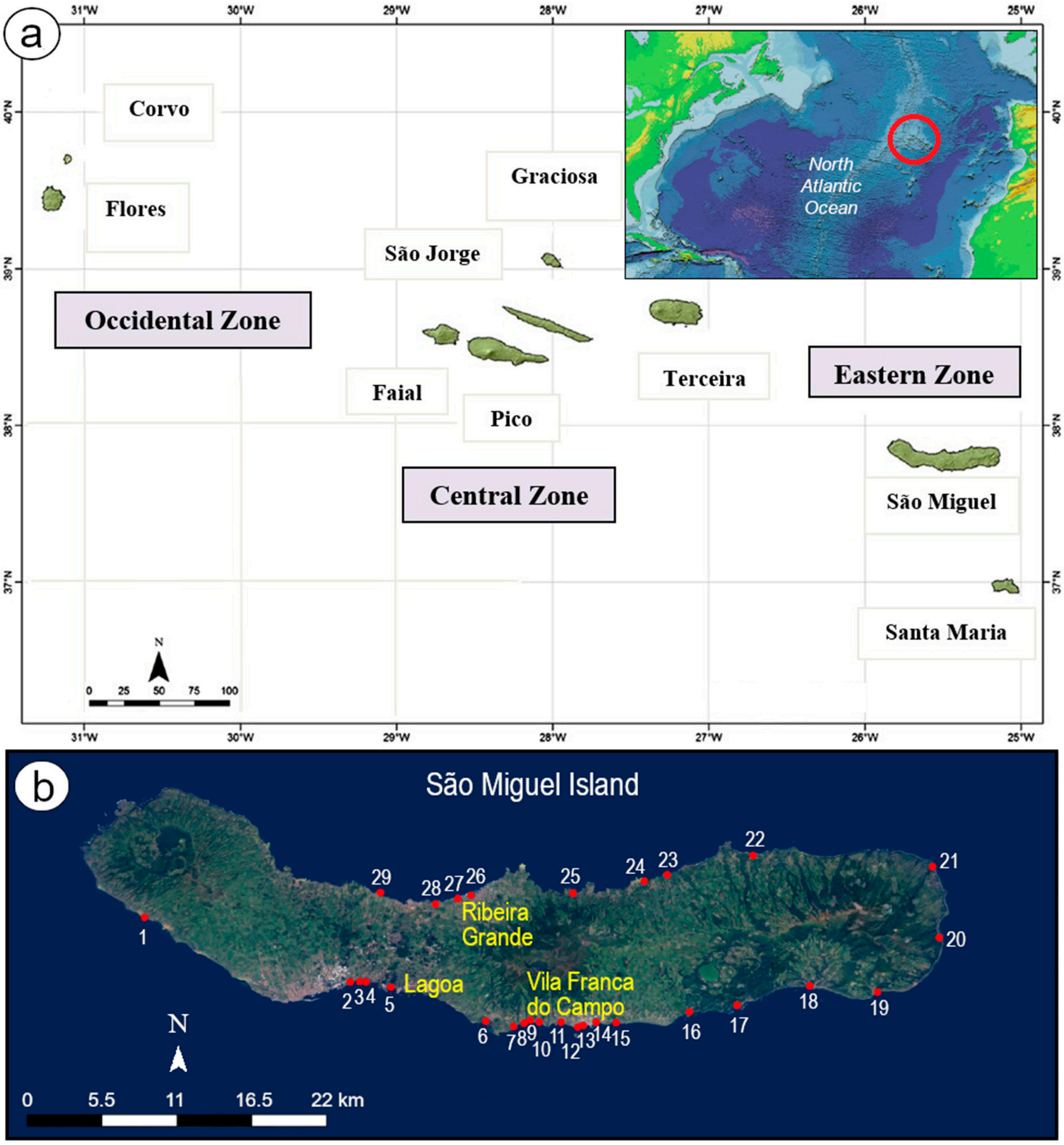

Figure 1. (**a**) Map of the study location showing the Azores Islands in the North Atlantic Ocean. (**b**) The locations of the 29 study sites in the island of São Miguel. The most important cities are also shown.

Mountainous chains are present all over the island, with maximum heights that reach 400 m in the central part of the island, 873 m (Pico das Éguas) in the western part, and 1080 m (Pico da Vara) in the eastern part of the island. When the mountains meet the ocean, there are steep coastal sectors and cliffs of different heights, as well as slopes and attractive morphological features. The coast is formed by dark rocky sectors and beaches with sediments (essentially sand and gravel) of different sizes.

The island's economy is mainly driven by agriculture, fishing, and tourism. São Miguel includes several picturesque towns and villages, and Ponta Delgada is the capital and the principal town (Figure 1b), as well as a hub for administrative and cultural activities. Other towns like Ribeira Grande, Lagoa, and Vila Franca do Campo (Figure 1b) also significantly contribute to the island's economy. These coastal communities are known for their fishing industries: fresh seafood constitutes the main dish of the local cuisine.

Additionally, São Miguel's fertile soil supports agriculture, including dairy farming and the cultivation of pineapples and tea. The population of São Miguel Island is estimated to be ca. 150,000 people. Each town and village has a unique charm and cultural traditions, thus making São Miguel a captivating destination for local, national, and international tourists.

3. Methods

In this paper, the landscape assessment classification was based on the application of the Coastal Scenic Evaluation System (CSES) by carrying out in situ observations at the 29 coastal study sites during March and April 2022.

The CSES methodology, which was developed and initially published by Ergin et al. [15], consists of a checklist that evaluates 26 weighted parameters, i.e., 18 physical- and 8 human-related. Therefore, at the investigated sites, each one of the 26 parameters was collected with the help of the checklist [15] (Table 1), i.e., they were scored on a numerical scale from 1 to 5, with 1 indicating absence or low quality and 5 indicating outstanding characteristics. The obtained matrices were integrated with the weights of the 26 parameters that had different importance, i.e., each parameter had a dissimilar weight.

Table 1. The list of parameters used for the assessment of landscapes according to the CSES methodology [15].

N	Physical Parameters		Rating				
			1	2	3	4	5
1		Height (m)	Absent	5–30 m	31–60 m	61–90 m	>90 m
2	CLIFF	Slope (°)	Absent	>45°	circa 60°	circa 75°	circa vertical
3		Special features *	Absent	1	2	3	Many (>3)
4		Type	Absent	Mud	Cobble/Boulder	Pebble/Gravel	Sand
5	BEACH FACE	Width (m)	Absent	≤5 > 100	>5 ≤ 25	>25 ≤ 50	>50 ≤ 100
6		Color	Absent	Dark	Dark tan	Light tan/bleached	White/gold
7		Slope (°)	Absent	<5°	5°–10°	10°–20°	20°–45°
8	ROCKY SHORE	Extent (m)	Absent	< 5 m	5–10 m	10–20 m	>20 m
9		Roughness	Absent	Distinctly jagged	Deeply pitted and/or irregular	Shallow-pitted	Smooth
10	DUNES		Absent	Remnants	Fore dune	Secondary ridge	Several
11	VALLEY		Absent	Dry valley	(<1 m) Stream	(1–4 m) Stream	River/limestone gorge
12	SKYLINE LANDFORM		Not visible	Flat	Undulating	Highly undulating	Mountainous
13	TIDES		Macro (>4 m)		Meso (2–4 m)		Micro (<2 m)
14	COASTAL LANDSCAPE FEATURES **		None	1	2	3	>3
15	VISTAS		Open on one side	Open on two sides		Open on three sides	Open on four sides
16	WATER COLOR AND CLARITY		Muddy brown/gray	Milky blue/green/opaque	Green/gray/blue	Clear blue//dark blue	Very clear turquoise
17	NATURAL VEGETATION COVER		Bare (<10% vegetation only)	Scrub/garigue (marram/gorse, bramble, etc.)	Wetlands/meadow	Coppices, maquis (±mature trees)	Varity of mature trees/mature natural cover
18	VEGETATION DEBRIS		Continuous (>50 cm high)	Full strand line	Single-accumulation	Few scattered items	None

Table 1. *Cont.*

N	Physical Parameters	Rating				
		1	2	3	4	5
	Human parameters					
19	NOISE DISTURBANCE	Intolerable	Tolerable		Little	None
20	LITTER	Continuous accumulations	Full strand line	Single-accumulation	A few scattered items	Virtually absent
21	SEWAGE DISCHARGE EVIDENCE	Sewage evidence		Same evidence (1–3 items)		No evidence of sewage
22	NON_BUILT ENVIRONMENT	None		Hedgerow/terracing/monoculture		Field mixed cultivation ± trees/natural
23	BUILT ENVIRONMENT ***	Heavy industry	Heavy tourism and/or urban	Light tourism and/or urban and/or sensitive	Sensitive tourism and/or urban	Historic and/or none
24	ACCESS TYPE	No buffer zone/heavy traffic	No buffer zone/light traffic		Parking lot visible from coastal area	Parking lot not visible from coastal area
25	SKYLINE	Very unattractive		Sensitively designed high/low	Very sensitively designed	Natural/historic features
26	UTILITIES ****	>3	3	2	1	None

* Special cliff features: indentation, banding, folding, screes, and irregular profile; ** coastal landscape features: peninsulas, rock ridges, irregular headlands, arches, windows, caves, waterfalls, deltas, lagoons, islands, stacks, estuaries, reefs, fauna, embayment, tombola, etc. *** Built environment: caravans come under tourism. Grading 2: large intensive caravan site; Grading 3: light, but still intensive caravan sites; and Grading 4: sensitively designed caravan sites. **** Utilities: power lines, pipelines, street lamps, groins, seawalls, and revetments.

Once the data had been collected, the analysis was carried out using the Fuzzy Logic Approach (FLA) mathematical tool. This tool is usually used for analyses of data that involves a degree of uncertainty in order to partially eliminate individual subjectivity. The FLA has been used in many research areas where subjectivity affects the attainment of accurate results, from financial systems to the remote sensing of cloud and ice cover. In the CSES method, the FLA tool is used to reduce the error linked to the possibility of a scenic value assessor ticking the wrong attribute box in the checklist. As an example, the width of the beach ranges from "absent", "<5 and >100 m", "between 5 and 25 m", "25 and 50 m", and "50–100 m". The FLA technique overcomes the problem of the wrong interval being selected, i.e., a beach width being recorded in the 25–50 m box when in fact it was 50–100 m. It is extremely unlikely that a jump of two attributes would be checked.

According to the scores recorded at the 26 parameters, a final evaluation index (D) is obtained, and the tool then allows each site to be attributed to one of five classes, from Class I, i.e., natural sites of excellent scenic beauty, to Class V, i.e., very urbanized sites of very low scenic value. More specifically, the five classes are as follows:

- Class I (a D value of ≥ 0.85): Extremely attractive natural sites with very high scenic values and no or very low anthropogenic activities.
- Class II (a value of $0.85 > D \geq 0.65$): Attractive natural or semi-natural sites with high scenic values and acceptable anthropogenic activities.
- Class III (a value of $0.65 > D \geq 0.40$): Sites with low scenic interest that are, in some cases, attractive but with obvious anthropogenic activities.
- Class IV (a value of $0.40 > D \geq 0$): Unattractive urban sites with low landscape values and a high presence of anthropogenic activities.

- Class V (a D value of < 0): Urban sites with low landscape value and intensive anthropogenic development.

In addition, to characterize the level of human occupation and accessibility, a part of the BARE (Bathing Area Registration and Evaluation) system developed by Williams and Micallef [34] was also applied. This methodology recognizes five types of coastal areas:

- Resort areas are generally tourist complexes that can be in any type of environment but have no industrial activities nearby. Resort beaches are usually used by residents staying at the hotel/apartment/camping centers associated with the beach that manages it. They may be open to the public for a fee.
- Urban coastal zones are sites located in the immediate urban environment (city or town) and can therefore serve large communities with well-established public services.
- Village zones are those associated with an urban area that reflects organized but small-scale community services (cafes/bars).
- Rural areas are located outside of the urban environment, and they are not accessible by public transport and have no public service facilities.
- Remote areas are largely defined by their difficult accessibility, either on foot (>300 m) or by boat, and they are not served by public transport and no have public service facilities.

Sites were also classified according to the methodology adapted by Micallef and Williams [35] in terms of their physical characteristics:

- Sand beaches are beaches that are formed of loose sediments that are less than 4 mm, where the degree of protection to wave fronts is variable and bathing activity takes place in the open sea.
- Pebble beaches are sites consisting of sediments larger than 4 mm.
- Harbors have bathing areas that are the result of harbor or marina structures and are used for bathing activity. In particular, the slopes of the gangways and the area alongside the quays.
- Swimming pools refer to all bathing areas where the water plane is enclosed. They can be natural, semi-natural, or artificial structures. Indeed, in the Azorean Archipelago, most of these areas are made up of lava platforms due to the volcanic origin of the islands.

Lastly, to support the field work, the following were used: (i) a paper guide/map of the island of São Miguel containing a "Geographic Information Database" [36] that shows very specific data such as the type of access to the site, the itinerary, and the original name of each site; (ii) Google Earth images; (iii) the georeferenced system and cartography of the "Instituto Geográfico do Exército de Portugal" (CIGeoE—Centro de Informação Geoespacial do Exército, accessed May 2022); and (iv) a graphic database for each site created by taking photographs (approximately 40–50 per site) from different parts and in various perspectives (at 360°).

4. Results: Classification and Distribution of the Investigated Sites

The scenic evaluation resulting from this study provided scores according to the CSES methodology for a total of 29 sites that are distributed along the coastline. The most relevant results for each site can be observed from the calculation of the evaluation matrices, where they are defined in Classes I to V, as well as by using the rating histograms, the bar charts of weighted averages, the degree of the affiliation curve (Figure 2), and the evaluation index (D).

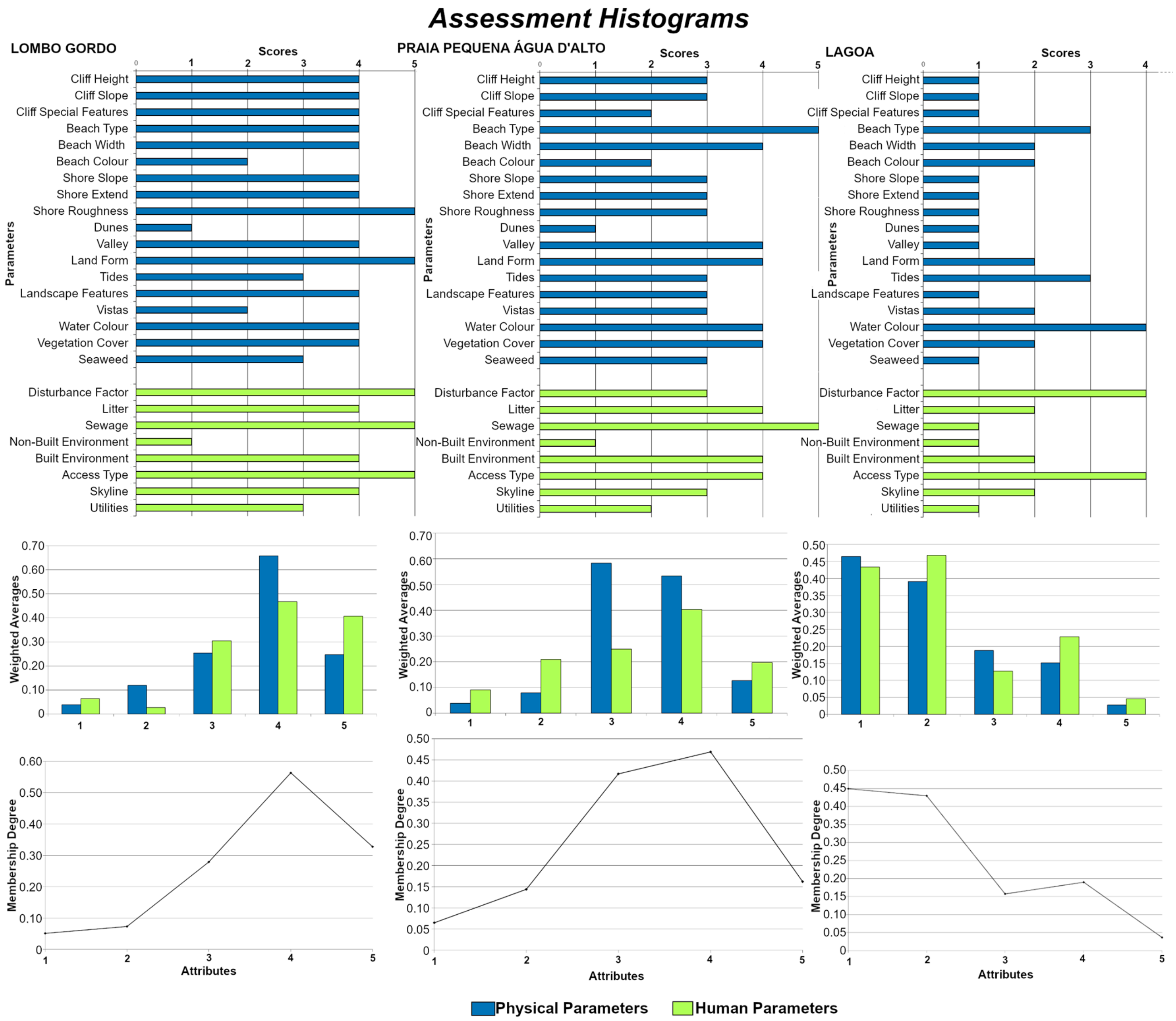

Figure 2. Scenic evaluation histograms, weighted averages, and membership degree curves for Lombo Gordo (D: 0.92, Class I), Praia Pequena Água d'Alto (D: 0.51, Class III), and Lagoa (D: −0.76, Class V). Regarding the membership degree, a curve skewed to the right side reflects high scenic assessment values as a result of a high rating on Attributes 4 and 5; conversely, a left-skewed curve reflects low-quality assessment values.

The results were as follows: 10% of the sites belonged to Class I (natural sites of great scenic beauty); 14% to Class II, 17% to Class III; 31% to Class IV; and 28% to Class V (urban sites with low landscape value and intensive anthropogenic development). The last two classes were the dominant classes present on the island. Table 2 shows the 29 assessed sites that were distributed: 13% were remote, 28% rural, 28% village, and 31% urban. The last two types of coastal areas, which are characterized by a high level of anthropogenic pressure, were the dominant types of land on the island. It should be noted that no resort areas were found in São Miguel. In general, it was observed that coastal zones within Class I and II all essentially belonged to remote and rural areas; all the Class III and IV sites, but two, belonged to urban, rural, and village zones; and, finally, the Class V sites were almost all urban type, except for one which is village (Table 2).

Table 2. The investigated sites and related "D" values from Class I to V. The site typologies and characteristics are also shown.

Sites (Number Indicates Location in Figure 1b)	Geographical Coordinates	D Value	Class	Type	Characteristics
Lombo Gordo (20)	37°47′12.07″ N/25°8′28.59″ W	0.92	I	Remote	Sand
Praia d'Amora (16)	37°43′29.90″ N/25°20′56.82″ W	0.88	I	Remote	Sand
Viola (23)	37°50′19.41″ N/25°22′3.54″ W	0.87	I	Remote	Sand
Ribeira das Tainhas (15)	37°42′58.27″ N/25°24′36.59″ W	0.81	II	Rural	Sand
Maia (24)	37°50′0.44″ N/25°23′11.94″ W	0.72	II	Rural	Sand
Praia Santana (28)	37°48′51.94″ N/25°33′37.43″ W	0.68	II	Rural	Sand
Praia do Degredo (11)	37°42′59.81″ N/25°27′21.34″ W	0.66	II	Remote	Sand
Da Boca De Ribeira (21)	37°50′43.73″ N/25°8′48.79″ W	0.58	III	Rural	Pool
Zona Balnear da Foz das Coelhas (22)	37°51′17.07″ N/25°17′46.39″ W	0.52	III	Rural	Pebbles
Praia Pequena Água d'Alto (9)	37°43′5.12″ N/25°28′53.57″ W	0.51	III	Village	Sand
Ribeira Quente (17)	37°43′49.81″ N/25°18′34.34″ W	0.49	III	Urban	Sand
Praia dos Moinhos (25)	37°49′24.78″ N/25°26′45.31″ W	0.47	III	Village	Sand
Poços das Calhetas (29)	37°49′26.52″ N/25°36′22.23″ W	0.31	IV	Rural	Pool
Local Água d'Alto (8)	37°42′56.57″ N/25°29′11.82″ W	0.25	IV	Village	Pebbles
Povoação (18)	37°44′47.98″ N/25°14′56.83″ W	0.21	IV	Urban	Sand
Porto Dos Batéis Feterias (1)	37°48′13.22″ N/25°48′8.71″ W	0.20	IV	Rural	Pool
Faial da Terra (19)	37°44′29.12″ N/25°11′33.88″ W	0.19	IV	Village	Pebbles
Santa Bárbara (27)	37°49′8.19″ N/25°32′30.60″ W	0.13	IV	Village	Sand
Baixa d'Areia (6)	37°43′2.41″ N/25°31′7.24″ W	0.13	IV	Village	Pebbles
Ilhéu de Vila Franca do Campo (12)	37°42′45.08″ N/25°26′31.27″ W	0.03	IV	Village	Pebbles
Praia Grande Água d'Alto (10)	37°42′59.92″ N/25°28′26.58″ W	0.02	IV	Rural	Sand
Pópulo (4)	37°44′59.59″ N/25°37′5.58″ W	−0.03	V	Urban	Sand
Milicias (3)	37°45′1.08″ N/25°37′24.65″ W	−0.17	V	Urban	Sand
Monte Verde (26)	37°49′18.03″ N/25°31′50.99″ W	−0.33	V	Urban	Sand
Vinha d'Areia (14)	37°42′59.85″ N/25°25′36.19″ W	−0.36	V	Urban	Sand
Caloura (7)	37°42′46.90″ N/25°29′43.34″ W	−0.36	V	Village	Port
Porto Vila Franca (13)	37°42′49.49″ N/25°26′15.12″ W	−0.42	V	Urban	Port
São Roque (2)	37°44′59.52″ N/25°37′52.72″ W	−0.60	V	Urban	Sand
Lagoa (5)	37°44′44.10″ N/25°35′50.85″ W	−0.76	V	Urban	Pebbles

Regarding the physical characteristics, most of the coastal sites evaluated (62%) were made up of sand-type sediments, 21% had pebbles, and 10% were pool-type sites. Porto Dos Batéis Pool in Feterias and the Natural Pool of Boca De Ribeira were semi-artificial pools (nos. 1 and 21, Figure 1b), and Poços das Calhetas was a natural pool (no. 29, Figure 1b). Finally, 7% of the sites belonged to the harbor typology, i.e., Caloura and the Porto Vila Franca beach (nos. 7 and 12, Figure 1b and Table 2).

In the following subsections, the different classes are described.

4.1. Class I

In total, 3 out of the 29 coastal sites belonged to this class, were categorized as remote, and consisted of sandy sediments (Table 2). These were far from the urban centers and showed a complex location and/or accessibility and unique landscape features of considerable beauty. Within this class, there was the beach of Lombo Gordo at the top (no. 20) (Figure 2), followed by Praia d'Amora and Viola (nos. 16 and 23, Figures 1b and 3).

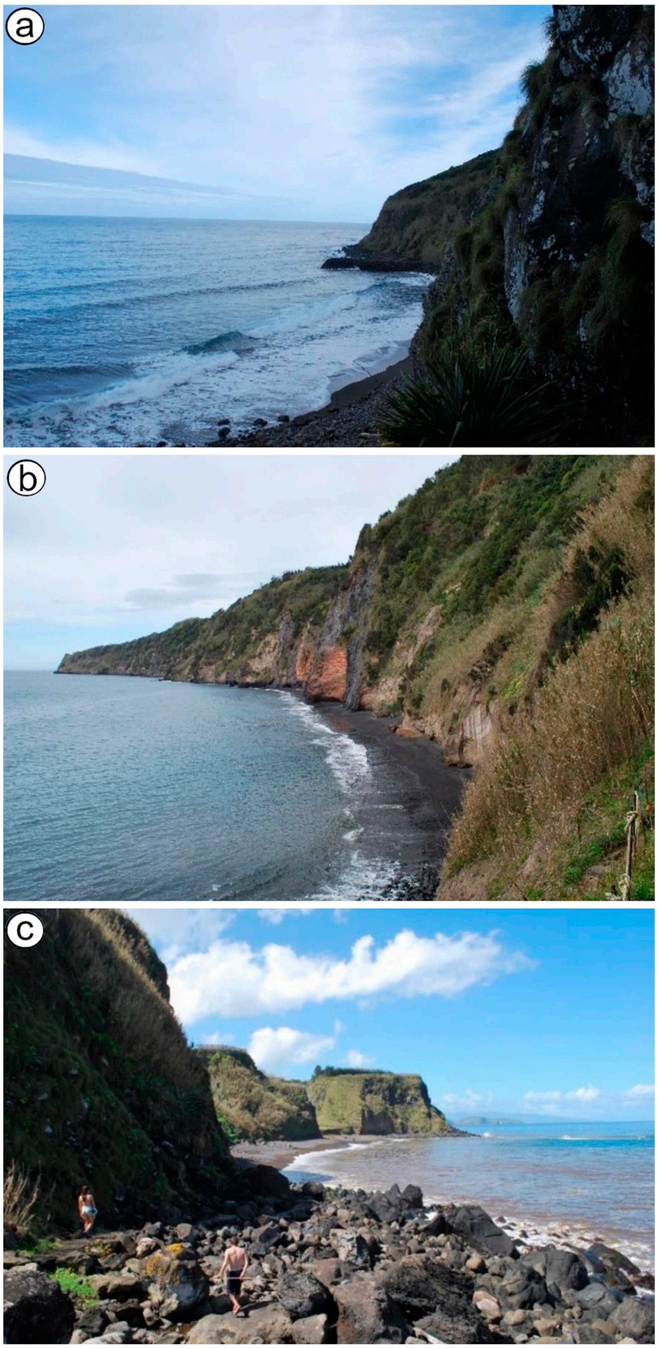

Figure 3. Class I, i.e., extremely attractive natural beaches with a very high landscape value. (**a**) Lombo Gordo beach (no. 20 in Figure 1) in the northeast part of the island; (**b**) Praia d'Amora beach (16); and (**c**) Viola beach (no. 23).

4.2. Class II

Four coastal sites belonged to this class, and three of them were associated with rural areas. Moreover, one of them, Degredo Beach (no. 11, Figure 1b), was considered remote (Table 2). All sites included in this class were sandy beaches, i.e., the Praia do Degredo, Ribeira das Tainhas, Maia, and Praia Santana beaches (nos. 11, 15, 24, and 28, Figures 1b and 4).

Figure 4. Class II, i.e., attractive natural beaches with high landscape value. (**a**) Ribeira das Tainhas Beach (no. 15 in Figure 1); (**b**) Maia Beach (no. 24); (**c**) Praia Santana Beach (no. 28); and (**d**) Degredo Beach (no. 11).

4.3. Class III

Five sites belonged to this intermediate class, and they presented heterogeneous characteristics that influenced their landscape attractiveness (Table 2, Figure 2). They were essentially categorized between the rural and village types, except for one of them, i.e., Ribeira Quente beach (no. 17, Figures 1b and 5), which was included in the urban type. The Praia Pequena Água d'Alto, Ribeira Quente, and Praia dos Moinhos beaches (nos. 9, 17, and 25, Figure 1b) were classified as sandy beaches, while the Zona Balnear da Foz das Coelhas (no. 22, Figure 1b) was classified as a pebble beach. Additionally, the Piscina Natural Da Boca De Ribeira (a natural swimming pool, no. 21, Figure 1b) was also included in this class (Figure 5).

Figure 5. Class III, i.e., essentially rural or village beaches with intermediate scores on natural and human parameters. (**a**) Piscina Natural Da Boca De Ribeira (no. 21 in Figure 1); (**b**) Zona Balnear da Foz das Coelhas (no. 22); (**c**) Praia Pequena Água d'Alto Beach (no. 9); (**d**) the Beach of Ribeira Quente (no. 17); and (**e**) Praia dos Moinhos Beach (no. 25).

4.4. Class IV

This class included 9 sites out of the 29 assessed (Table 2). The sites were essentially constituted of village (5), rural (3), and urban (1) areas with low scores for the anthropic parameters. This class included Porto Dos Batéis Feterias pool (no. 1), Baixa d'Areia (no. 6), Local Água d'Alto (no. 8), Praia Grande Água d'Alto (no. 10), Ilhéu beach in Vila Franca do Campo (no. 12), Povoação beach (no. 18), Faial da Terra beach (no. 19), Santa Bárbara (no. 27), and Poços das Calhetas natural pool (no. 29, Figure 1b). Most sites consisted of pebbles, and three of them (Praia Grande Água d'Alto, Povoação, and Santa Bárbara beaches) were constituted of sandy sediments (nos. 10, 18, and 27, Figure 6).

Figure 6. Class IV, i.e., mainly unattractive urban beaches with low landscape value. (**a**) Poços das Calhetas (no. 29 in Figure 1); (**b**) Local Água d'Alto (no. 8); (**c**) Povoação Beach (no. 18); (**d**) Piscina Porto Dos Batéis (no. 1); (**e**) Faial da Terra Beach (no. 19); (**f**) Santa Bárbara Beach (no. 27); (**g**) Baixa d'Areia Beach (no. 6); (**h**) Ilhéu de Vila Franca do Campo Beach (no. 12); and (**i**) Praia Grande Água d'Alto Beach (no. 10).

4.5. Class V

Class V was recorded at eight sites that were clearly urban, i.e., areas of free access with well-established public services but with intensive development and poor landscape values (Table 2). They were unattractive sites associated with the presence of harbors and anthropogenic structures such as access infrastructures, seawalls, bars, etc., i.e., they definitively showed a high degree of modification to the environment. Examples of this class were the beaches of São Roque (no. 2), Milicias (no. 3), Pópulo (no. 4), Lagoa (no. 5, Figure 2), Vinha d'Areia (no. 14), and Monte Verde (no. 26, Figure 1b), as well as the harbors of Caloura and Porto Vila Franca (nos. 7 and 13, Figure 1b). In addition, most of them had sandy sediments except for São Roque, which was composed of pebbles (no. 2, Figure 7).

Figure 7. Class V, i.e., urban areas with intensive development. (**a**) Pópulo Beach (no. 4 in Figure 1); (**b**) Milicias Beach (no. 3); (**c**) Lagoa Beach (no. 5); (**d**) Monte Verde Beach (no. 26); (**e**) Vinha d'Areia Beach (no. 14); (**f**) São Roque Beach (no. 2); (**g**) Caloura Harbor (no. 7); and (**h**) Porto Vila Franca Harbor (no. 13).

5. Discussion

5.1. Landscape Assessment in São Miguel

The physical and anthropic parameters that allow one to classify the investigated sites into the five classes according to their scenic beauty [15] are detailed and discussed below.

5.1.1. Physical Parameters

The need for solitary contact with nature, as advocated by Jean-Jacques Rousseau in 1775, emphasizes nature's inexhaustible spectacle that never tires the eyes and heart [37]. Despite its small size, the Azores Archipelago showcases diverse sites of great geodiversity shaped by volcanic activity that has given rise to various natural marvels, from calderas to lava fields [38]. The recorded geodiversity, along with factors like location and climate, contribute to unique ecological conditions and establish a link between geodiversity and biodiversity [39]. The mountainous landscape gives rise to diverse coastal cliffs that allow for high scores on the first three parameters of the CSES (i.e., cliff height, slopes, and special features) [15].

Some of the evaluated coastal sites are sandy, while others are constituted of gravel, pebbles, and cobbles. The sites investigated generally presented limited beach width due to the high beach/rocky shore slope values observed and the narrow continental shelf of the island. The sandy and other types of sediments recorded vary according to their volcanic origin, ranging from gray deposits in the north to black pumice in the south. Despite the fact that many authors claim that the color of the beach sand is one of the most important parameters for beach choice [40], which is true for white/golden sediments [41,42] and also dark sediments (which are not considered as attractive as light ones), the presence of darker sediments in São Miguel did not affect the final score of the sites too much as several Class I and II beaches have dark sediments (e.g., Lombo Gordo, Figure 2).

Rocky platforms are present almost everywhere due to the erosion of cliffs. This allowed for a scoring of the other three parameters from the assessment checklist proposed by Ergin et al. [15], i.e., rock shore slope, extent, and roughness. Coastal sites with many landscape components to assess are more likely to register a high D value with the landscape assessment method (CSES). That is, those sites with cliff, beach face, and rocky shore parameters generally obtain high scores, as was also observed in southeastern Cuba and Spain [18,28].

The dune parameter was the one that delivered the lowest scores, as they are almost absent in São Miguel. They were only present in five sites but obtained low scores since they were in remnants or poorly developed.

The valley-related parameter was also not very common. However, a few sites showed such a parameter, and watercourses, i.e., sites with rivers or streams, are known to be more attractive to users [15].

Beach users prefer a mountainous skyline landform [15], a feature that obtained good scores at São Miguel due to the mountainous orography of the island. The skyline was visible from almost all investigated sites, as the areas were flat at only a few places. The skyline is generally very undulating or is undulating and, at several places, mountainous.

Most beaches contained coastal landscape features, e.g., rock ridges, irregular headlands, islands, etc., which constitute an added value.

Concerning the vistas parameter, there was a great deal of variability; most of the sites were open on two sides due to the presence of cliffs and headlands.

The water color was also found to be quite attractive and showed a dark blue color due to chemical, biological, and physical factors.

São Miguel Island, known as the "Ilha verde" (Green island), owes its vegetation lushness to the fertile soil and abundant rainfalls [43,44]. The coastal areas feature diverse vegetation, including Azorean endemics, while the inland areas host dense forests, thereby creating a naturally beautiful appearance that favors high scores for the natural vegetation cover that surrounds the sites.

Vegetation debris was found at almost all sites. The invasive algae *Rugulopteryx okamurae*, contributes to coastal accumulations of vegetation debris, thus affecting the scenic value [45,46].

To conclude, the Azores's geodiversity, when linked to EarthCheck's dynamics, presents unique scenic environments. Efforts to inventory, protect, and promote geological heritage, including UNESCO-backed geoparks like the Azores Geopark, contribute to the sound management of coastal landscapes [47,48].

5.1.2. Anthropic Parameters

Concerning noise disturbance, none of the investigated sites recorded intolerable noise. At most sites, there was little or no noise, and there were a few sites that, mostly urban ones, recorded tolerable noise mainly linked to motor vehicles or the presence of people.

Different sites presented beach litter due to beach visitors and/or due to being dragged upon the shore by marine currents. Different studies have highlighted the Azores Islands as a deposit area for floating plastic items and fragments that greatly impact its coastal areas and marine ecosystems [49,50]. In addition, in São Miguel, Quintela et al. [31] identified the presence of beach litter and highlighted its main pollution issues. It is easy to find litter in remote and depopulated islands, as was the case for King George Island in Antarctica [14], the Galápagos Islands in Ecuador [51], Henderson Island in the South Pacific [52], etc.

Anthropic parameters, especially in urban areas, impacted the overall rating of the sites, thereby emphasizing the relevance of carrying out proactive modifications [53]. The establishment of geoparks and the Azores Geopark's extensive network reflect the ongoing efforts to preserve and enhance the region's scenic values.

Any beach can be improved using the CSES methodology [15], which is an excellent tool for landscape management. Most appropriate actuations consist in the enhancement of anthropic parameters as they are the easiest to modify in respect to the natural ones. For example, if an anthropogenic infrastructure (e.g., small sheds for storing fish or nautical equipment) are removed from Ribeira das Tainhas (no. 15, Table 2), it will be upgraded from Class II (D = 0.81) to Class I (D = 0.92). If litter is removed from Poços das Calhetas (no. 29, Table 2), the site will be enhanced from Class IV (D = 0.31) to Class III (D = 0.41). As a final example, if the noise disturbance at Pópulo beach (no. 4, Table 2) is reduced, the site will be upgraded from Class V (D = −0.03) to Class IV (D = 0.05).

5.2. The Coastal Landscape Classification of São Miguel Island (2009–2022)

In this section, the comparison of the data collected in this study is presented with that which were gathered 13 years ago by Quintela et al. [30,31]. The 2009 paper was based on the application of the CSES methodology and the determination of the site typologies and sub-typologies as per Micallef and Williams [35], and it also focused on the social perceptions of the coastal areas, which were obtained through questionnaires that were completed by 321 beach visitors. The absence of information about bathing areas prompted that study to investigate how to ensure the proper management and preservation of the region based on the identified social aspects and user perceptions.

Another island-wide study, conducted in 2012 [31], concentrated on the "solid materials of human origin discarded in the sea or reaching it through waterways or domestic and industrial discharges" [54]. This broader study delved into the factors affecting litter appearance, such as beach typologies, litter sources, and scenic evaluations based on public perception. The work re-evaluated the 11 proposed bathing areas (BA) according to the Quintela et al. [30] typologies, thereby categorizing them on the presence of beach litter. The data were analyzed and discussed considering the interactions among the different factors, i.e., the results of the CSES assessment proposed by Ergin et al. [15], the beach litter content, the BA typologies, and user perceptions.

Furthermore, 8 out of the 11 sites evaluated in 2009 and 2012 were analyzed within the present paper, but 3 were discarded (i.e., Mosteiros beach, Areais beach, and Piscinas São Vicente) because they were not accessible due to coastal erosion processes (Table 3).

None of the common 8 bathing areas investigated in 2009/2012 and in the present paper saw a change in their typology, i.e., all of them conserved their urban, village, and rural typologies. More specifically, four sites, i.e., Pópulo Beach, Milicias, Ribeira Quente, and Povoação, were urban regions, and two sites were evaluated as village areas, including Praia dos Moinhos and Caloura Port. The remaining two sites were evaluated as rural regions, including Porto Dos Batéis Pool in Feterias and Praia Água d'Alto Beach. It is worth noting that none of the sites evaluated in these studies were considered remote. Furthermore, six of the areas have sandy sediments; however, one was of the pool type, and the remaining one was a port, thus corroborating the notion that sandy sediment is the prevailing type of coastal sediment on the island and that this has not changed in the last decade.

Table 3. The D value, class, and beach typology of the sites investigated in 2012 [31] and 2022 (i.e., this paper).

Assessed Coastal Sites	D-Value		Class		Typology
	2012	2022	2012	2022	2012 and 2022
Piscina das Feteiras	0.61	0.20	III	IV	Rural
Pópulo	0.26	−0.03	IV	V	Urban
Milícias	0.13	−0.17	IV	V	Urban
Dos Moinhos	0.80	0.47	II	III	Village
Porto da Caloura	0.53	−0.36	III	V	Village
Agua d'Alto	0.26	0.02	IV	IV	Rural
Ribeira Quente	0.28	0.49	IV	III	Urban
Povoação	0.37	0.21	IV	IV	Urban

In considering the CSES assessment [15], for the eight sites evaluated in 2012 and in the present paper, five sites were classified as Class IV (Milicias Beach, Pópulo, Praia Água d'Alto, Ribeira Quente, and Povoação); two sites as Class III (Porto Dos Batéis Pool in Feterias and Caloura Port); and, finally, one site (Moinhos Beach) as Class II. After 13 years from their first evaluation, Ribeira Quente was the only one that improved its position due to the good management and maintenance practices that were carried out at the site. Other sites obtained lower scores, which is an alarming issue of considerable concern. It is noteworthy that Caloura Port, Milicias Beach, and Pópulo are currently classified as Class V, thus reflecting their deterioration and abandonment. It is also worth emphasizing the case of Caloura Port, which was classified as Class III in 2012 and now it belongs to Class V, thereby reflecting a significant lack of control and proper management actions. Porto Dos Batéis Pool in Feterias and Moinhos Beach now also belong to lower classes (Class IV and Class III, respectively). Finally, the Agua d'Alto and Povoação beaches remained in Class IV, although their D value has decreased.

In conclusion, in the last decade, several coastal areas have declined to lower classes, thus reflecting their deterioration, neglect due to poor management actions, and the notable increase in anthropogenic load because of the enhancement of tourism that started in 2015 due to the increased accessibility to the island (which was facilitated by low-cost carriers [55]).

5.3. The Azores as a Hub for Coastal Evaluation in Comparison to Other Landscape Assessment Studies

CSES assessment has been used in numerous studies worldwide, and it has been applied to a wide variety of coastal areas [56]. Among the more recent landscape assessment studies, it is noteworthy to mention the one conducted in Ecuador and the Galápagos Islands [57], which included a total of 67 analyzed sites. The setting of the Galápagos Islands is similar to the Azorean Archipelago: at both places, there are beaches with high scenic scores that attract many visitors every year. It might be expected that most of the Ecuadorian beaches would have high scenic scores; however, the results revealed that 51%

of the beaches (34 out of 67) belonged to the two lowest classes: 31% to Class IV and 20% to Class V. Indeed, the beaches located within areas with a protection status showed the lowest degree of human impact, as reflected by the good scores in all of the anthropic parameters. Similarly, sites with few litter items were found in protected areas, especially in the Galápagos National Park. This was also attributed to the type of tourists visiting the beach (international travelers principally) and their environmental awareness; meanwhile, beaches with lower scores were located in more urbanized and continental areas.

Another landscape assessment study, which also considered site typologies in accordance with Micallef and Williams [35], was carried out in the Cuban Archipelago—a zone that occupies a total area of 110,922 km^2 in the Caribbean region [18]. The results indicated a clear influence of anthropogenic parameters on the classification of its coastal sites: 7 out of the 100 evaluated beaches belonged to Class I, where almost all of them were located in rural areas with low-human-activity impact and high scores in natural parameters. Moreover, 19 out of 100 sites belonged to Class II; showed white coral sand beaches, turquoise water, and vigorous vegetation; and were devoted to host international tourists. Their good scores were linked to the low impact of tourist development due to their suitable location and design. Furthermore, 26 out of the 100 sites belonged to Class III. However, the highest number of evaluated places, 32 out of 100, were classified as Class IV because of their poor environmental setting. Finally, a total of 15 sites were categorized as Class V. As in the Azorean Archipelago, Cuba is at risk due to the fact that an increase in tourism pressure can result in the degradation of natural landscape beauty [18].

Lastly, the CSES assessment was also recently applied in the Balearic Islands, which is located in the western Mediterranean [29]. These islands present a variety of coastal scenarios, from extensive dark and white sandy beaches and rocky coasts to very undulating or mountainous environments with high and vertical cliffs comparable to São Miguel Island. The data revealed that 56% of the sites were in Class I, 31% in Class II, and 13% in Class III. There was a complete absence of Class IV and V sites. Menorca and the Formentera islands showed the highest scores in scenic beauty due to their good anthropogenic parameter, as well as excellent physical parameter scores. The results obtained in Mallorca and the Ibiza islands were more contrasting as the landscape is usually affected by human impact, mainly due to touristic pressures.

It is important to highlight that the Balearic Islands constitute one of the most visited European tourist destinations, receiving millions of visitors. However, despite this, sound conservation and management actions has allowed the region to preserve its natural environment. This example is mandatory for the Azorean Archipelago, which is experiencing a tourism boom. Local coastal managers have to identify suitable management priorities to prevent/limit environmental degradation due to increased human pressure and to enhance the scenic resilience of the São Miguel coast.

6. Conclusions

The coastal area of São Miguel Island has a variety of highly attractive tourist sites that stand out for their natural beauty and possessing a geomorphology of volcanic origin, which give rise to a characteristic landscape with a very undulating relief, majestic and discontinuous cliffs, clear waters with a “Midnight Blue” color, dark sediments, and small beaches that are often backed by the lush vegetation that is very common on the island. Such scenic beauty represents an opportunity for income generation and the future economic development of both urban and rural communities.

This study allowed for a greater understanding of the unique scenic characteristics of the coastal area at the 29 analyzed sites, including sandy, pebble, and gravel beaches, as well as the natural and semi-natural pools that are placed along the coastline and the bathing areas close to ports/harbors. The Class I beaches represented essentially natural places with minimal human activities, thus coinciding with remote site typologies. Class II included natural beaches with low human occupation; areas that were usually remote; rural sites often showing the houses of fishermen, farmers, and shepherds; family residences;

buildings focused on tourism; and, in some cases, modern constructions that were well integrated into the landscape. In general, Class III belonged to the rural typology and included beaches with different levels of human occupation that, at places, inevitably affected the natural scenic beauty. The last two classes, i.e., Class IV and V, were the dominant kind on the island, and they encompassed village and urban typologies. Class IV showed a great diversity of coastal scenarios, from places with little natural scenic attractiveness to highly affected beaches due to inappropriate human use. In contrast, Class V was essentially found in urbanized areas with little natural beauty. The categorization of places into classes allowed for a perspective and a robust approach that enabled the scenic evaluation of the coastline. It should be noted that the arrangement of the study areas was concentrated in the southern part of the island, which is where population centers have emerged in the last few decades.

The results of the present paper provide valuable information for future tourism management plans that can contribute to a good integrated management of coastal areas. Little can be done to improve natural parameters, with some exceptions (such as by planting vegetation and carrying out nourishment/restoration works to improve beach/dune characteristics). However, much can be done to improve anthropogenic parameters, such as by reducing noise disturbance and litter, or improving the visual impact of beach facilities by adapting them to the local environment. For this reason, local coastal managers should focus their efforts on improving all anthropogenic parameters investigated in this study. Correct management and action measures will help to reverse negative human impacts on the scenic value of beaches. A large percentage of the investigated beaches could improve their classification by one or even two classes if simple actions such as cleaning campaigns, maintenance, and facility relocation were carried out. Finally, it is important to implement the various coastal management policies that are encouraged by EarthCheck to avoid the settlement of new industrial infrastructures that strongly affect the delicate balance of maritime–coastal ecosystems and the scenic beauty of a coastline.

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