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A Novelty Methodological Approach to Coastal Scenic Quality Evaluation—Application to the Moroccan Mediterranean Coast

Noureddine Er-Ramy [1], Driss Nachite [1], Giorgio Anfuso [2,*] and Soria Azaaouaj [1]

[1] LR3G, Applied and Marine Geosciences, Geotechnics and Geohazards, Faculty of Sciences, University of Abdelmalek Essaadi, Tetouan 93000, Morocco; ramy.nourdin@gmail.com (N.E.-R.); dnachite@uae.ac.ma (D.N.); soriaazaaouaj@gmail.com (S.A.)
[2] Department of Earth Sciences, Faculty of Marine and Environmental Sciences, University of Cádiz, 11510 Puerto Real, Spain
* Correspondence: giorgio.anfuso@uca.es; Tel.: +34-956-016167

Abstract: Many tourists around the world are interested in coastal sites of exceptional scenic quality. This paper aims to assess the landscape quality of 50 sites along the Moroccan Mediterranean coast based on a novelty Coastal Scenic Quality Evaluation (CSQE) method able to classify the attractiveness of the sites and to distinguish exceptional ones with high tourist potential. This proposed methodology relies on evaluating coastal areas through easily obtainable indicators in order to simplify its application to other regions around the world. Four landscape dimensions were selected: Substratum, Sea-Coastal Area, Vegetation and Scenic Background. Each dimension was numerically assessed and ranged from 0 to 1. The values of each dimension along the sites were classified as: <0.2 (very low); 0.2 to <0.4 (low); 0.4 to <0.6 (medium); 0.6 to <0.8 (high) and ≥0.8 (very high). The results show that the overall scenic quality score of the Moroccan Mediterranean coast is 0.6 (high quality), reflecting a potential tourist destination of high scenic value. Substratum, Sea-Coastal Area and Vegetation dimensions obtained a high quality score (0.6 to <0.8), while the Scenic Background dimension recorded medium quality (0.4 to <0.6). Urbanization, the presence of litter and sewage evidence were the main factors of degradation of the Moroccan coastal landscapes, i.e., 32 out of 50 sites (64%) obtained low scores (from 0 to 2) for these three variables. Sound management actions have to be taken to reduce their impacts, in order to preserve and improve the natural landscape, and strength its capacity to host the various tourist activities.

Keywords: scenic quality; seaside tourism; landscape dimensions; litter and sewage; preservation

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1. Introduction

Tourism presently represents one of the largest and most profitable industries in the world [1,2]. Within this broad industry, coastal tourism is emerging as the market leader [3,4], and one of the fastest growing [5,6] and most dynamic activities [7]. Coastal tourism derives its importance from the attraction of the sun, the sea and sand—the "3S" market [8,9]—and the beauty of the natural landscape [10]. Due to the links it has with other sectors of industry, coastal tourism plays a crucial role in creating employment and investment opportunities [11] and directly and indirectly influencing income growth [12], thus representing a very powerful socio-economic driver [13,14].

In order to benefit from this dynamic and take advantage of global tourism demand [15], numerous countries have adopted their own development strategy, especially the Mediterranean countries [1]. The Mediterranean region is now the world's leading tourist destination [12], and tourism activities are highly concentrated in coastal areas, which host almost a third of international tourist arrivals [2]. Mediterranean coastal areas are quite diverse and of great economic interest, given their great wealth of natural resources linked to the heterogeneity of historical, geographical and geological factors [16]. The most popular tourism development strategy in the Mediterranean is focused on summer coastal vacations and the achievement of quantitative targets, mainly along the coast [17]. Under this influence, coastal areas are one of the most populated and developed land areas in the world [18], making the relationship between human settlements and the development of economic activities very significant [19]. The human population settled in coastal areas has increased exponentially in the last few decades [20]. As a result, presently, >40% of the world's population lives in coastal regions [21], and in several countries, >95% of the population lives within 100 km of the coast, e.g., Greece (99%), the UK (98%), Japan (97%), Norway (97%) and others [22].

An exceptional coastal landscape is one of the main factors that a tourist takes into consideration when deciding which destination visit [23,24], and, according to Williams and Micallef [25], it is one of the five parameters of extreme importance for coastal tourists—the "Big Five", i.e., scenery, water quality, facilities, no litter and safety.

Landscape can be defined as "*an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors*", ([26], p. 2), and "*the maintenance of the landscape quality of beaches must be the main priority*" ([27], p. 1448). The coastal landscape quality is a very important element for tourism and is a highly valued resource for aesthetic, cultural and economic reasons [28]. International coastal tourism depends mainly on beautiful beaches [15,29]. Visitors' perception is a very relevant aspect that determines the attractiveness of a beach [13], and hundreds of millions of people travel around the world to find very attractive places [30].

Beaches can be assessed and classified in several ways [25], but their classification as a tourist destination implies that the concept of beach quality must be linked to environmental concerns, which requires a global perspective that combines physical and human aspects [31,32]. Landscape assessment has been under way for decades [33–35], but it has recently become enormously important thanks to the development of tourism. In parallel, appreciation of the aesthetic value of landscapes has increased, as has the number of people interested in scenic spaces [36,37]. Indeed, the main objective of the assessment and management of coastal landscapes is to attract more and more tourists who are interested in seaside tourism [30].

Landscape quality has been assessed using various methods and practices [38–40], and the relationship between society and landscape can be analyzed in different ways [41]. In this context, the main objectives of this paper are: (i) to assess the quality of 50 beaches along the Moroccan Mediterranean coast based on a novel coastal landscape assessment methodology carried out by analyzing a set of selected variables and indicators, and (ii) to identify and enhance potential tourist sites. In particular, aspects such as beach cleanliness, environmental quality, aesthetic and morphological aspects, and public facilities and equipment are considered based on previous existing classifications of scenic quality assessment [42,43]. Thus, this work aims to present a new robust scientific tool capable of providing solid baseline information on the state of the selected coastal areas, in order to show the different sources of impacts and to identify and characterize those aspects and elements that need to be improved in future short- and long-term management strategies, so as to maintain, preserve and enhance the quality of the coastal landscapes.

2. Study Area

Morocco, thanks to its particular geographical position at the northwestern tip of the African continent, with the Mediterranean Sea to the north and the Atlantic Ocean to the west, benefits from two important maritime façades 3500 km in length (Figure 1). The Mediterranean coastline extends up to 512 km from Saïdia to Cap Spartel and about 3000 km from Cap Spartel to Lagouira, along the Atlantic Ocean.

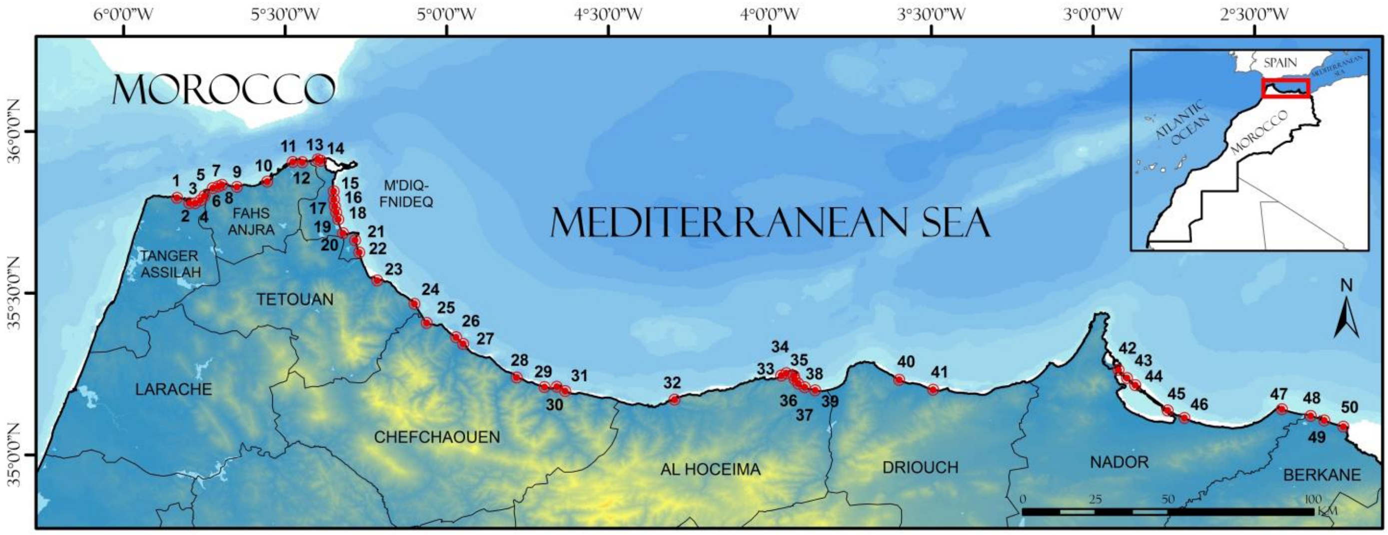

Figure 1. Geographical location of the sites studied.

Along the Mediterranean side, the coastline is characterized by narrow beaches and numerous *oueds* (rivers and streams) proceeding from the backing Rif mountain ridge. Therefore, high cliffs are very frequent and interrupted by deep valleys, forming small sandy or gravel pocket beaches [44]. In this study, we selected 50 beaches, from 0.5 to 10 km in length, which constitute the most frequented and/or representative natural and varied scenic heritage sites of the Mediterranean coast of Morocco [45]. Several beaches are located in SBEI areas (Site of Biological and Ecological Interest) and national parks. The beaches of Tetouan, Tangier, Al Hoceima and Saïdia are the most important from a tourist point of view, due to their large number of maximum daily visitors, i.e., from 10,000 to 80,000 [46]; meanwhile, other places record ca. 1 million each of visitors during the summer period (June, July and August) [47].

3. Methods

In this paper, to evaluate coastal landscapes, the methodological approaches developed by Pérez-Hernández et al. [42] and Peña-Alonso et al. [43] were adapted to the Moroccan context according to the type/availability of data and the specific natural characteristics of the beaches investigated.

The aforementioned methodological approaches were obtained through various techniques, including filed enquires to beach users to determine coastal environment attractiveness. The original methodological approach has been successfully applied along the coasts of Corralejo and Gran Canaria Islands (Spain) and is based on five main steps (Figure 2): (1) Search for variables in the literature. (2) Classification and selection of appropriate indicators. (3) Estimation of evaluation criteria for selected variables. (4) Estimation and attribution of landscape variables, and (5) landscape evaluation.

The importance of this new Coastal Scenic Quality Evaluation (CSQE) method lies in the provision of reliable data on the health of coastal areas, the results obtained enabling the sustainable and effective management of these sensitive environments. The proposed methodology takes into consideration different aspects of coastal landscape based on a variety of indicators that are easily available, applicable to all coastal areas around the world and, most importantly, highly appreciated by beach users. The proposed methodology differs from previous methodologies because it links the landscape quality with several relevant environmental quality indicators that also constitute priority criteria for beach users.

Considering that this methodology can be made universal due to its facility of application, the results of this research are very important for the scientific community, in particular for future coastal landscape studies similar to that presented in this paper in terms of site characteristics and the nature of human pressures.

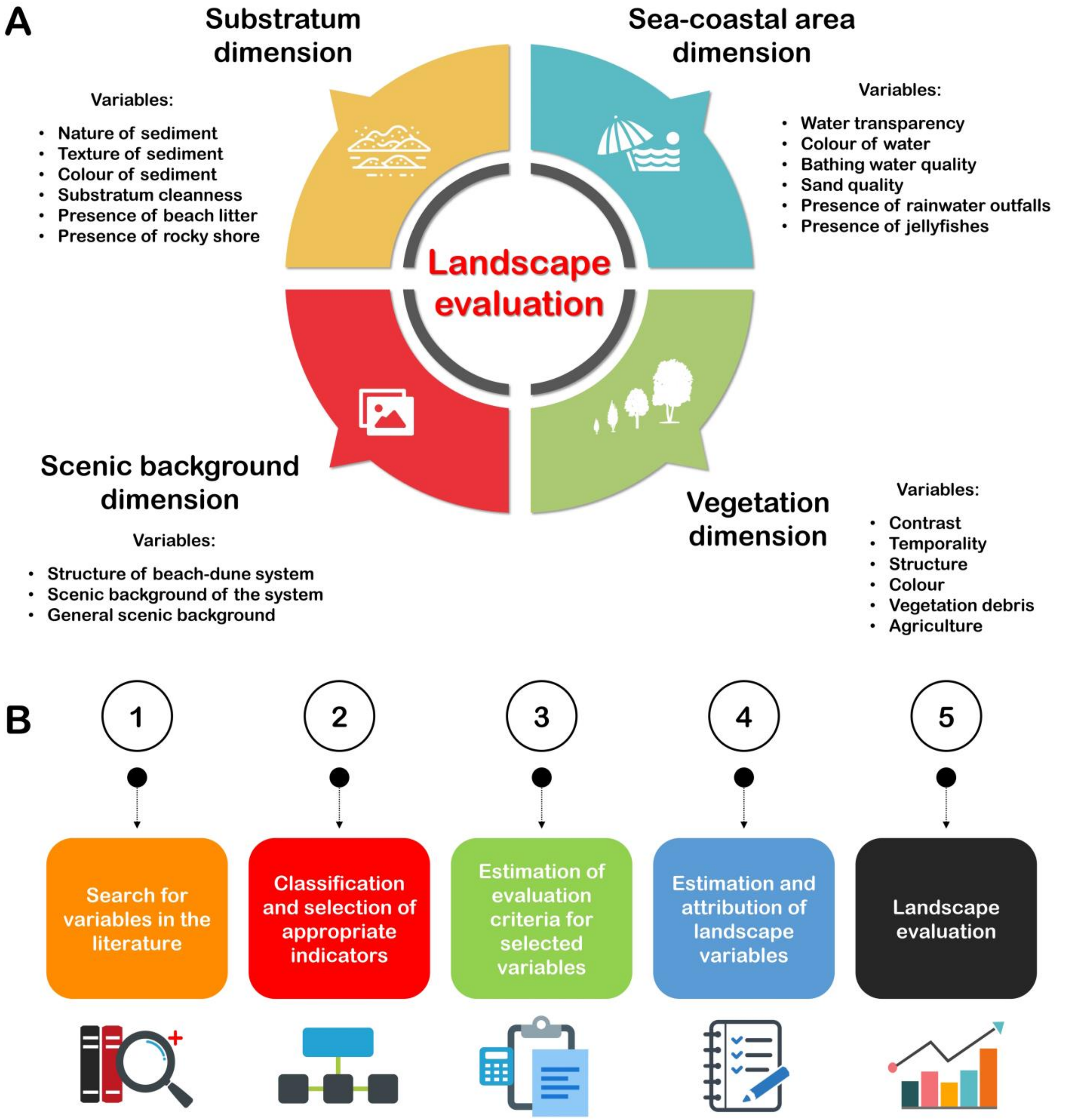

Figure 2. Sketch of dimensions and variables (**A**) and main steps (**B**) of the proposed landscape evaluation (CSQE) method.

Step 1. Search for variables in the literature

The identification and selection of the variables to be measured to assess the coastal landscape were carried out through an exhaustive literature search, including a review of published material, reports and governmental databases. The variables were selected according to: (i) their importance for beach users, i.e., essentially following the results of the public perception surveys published in different studies, and (ii) their relevance to maintaining landscape coastal quality. Changes were made to the original methodology of Pérez-Hernández et al. [42], as follows:

1. Due to a lack of data, a variable was replaced by another. As an example, environmental quality variables, the evaluation of which is required by González et al. [48] to determine healthy natural spaces that conserve their natural landscapes, is considered by many authors of great importance in any beach evaluation [49]. Therefore, "Foam", "Tar" and "Oil" were replaced by "Bathing water quality", "Sand quality" and "Presence of rainwater outfalls", which are very important for beach users and constitute integrated measures of the aesthetic and hygienic quality of the beach [27,50];
2. Due to the specific nature of the beaches investigated, some variables were changed. For example, "Existence of cobble windbreakers" was replaced by the variable "Presence of rocky shore", since the original one was too specific and its existence limited to the place of application of the original method, and the new one is a very important scenic element for beach classification [25,51];
3. It was necessary to change evaluation criteria depending on the type of data available (e.g., "Presence of beach litter" and "Vegetation", in such cases the ranking of the data was changed from percentage to grades, or from percentage to typology);
4. In some cases, related variables have been combined into a single variable (e.g., "Landscape integration of buildings" and "Horizontal line" from the original method have been combined into one variable since both analyze the presence/type of buildings, and named "Landscape Integration of Buildings SB-B").

Finally, 33 variables were identified based on 30 previously published studies /investigations (Table 1).

Step 2. Classification and selection of appropriate indicators

After determining the selected indicators or variables based on the natural, human and aesthetic aspects of the coastal landscape, four dimensions were identified to classify these indicators: Substratum (S); Sea-Coastal Area (CA); Vegetation (V) and Scenic Background (SB) [42].

Each dimension is made up of a set of variables that determines its state, quality and contribution to the enhancement of a coastal landscape (Table 1). These dimensions characterize the elements that are part of the coastal landscape concept.

- The Substratum (S) dimension includes a set of variables that describe the main structure and composition of the beach substrate within a coastal landscape, i.e., its natural, aesthetic, anthropogenic characteristics and properties [52]. This dimension includes six variables: nature, texture and color of sediment, substratum cleanness, presence of beach litter and presence of rocky shore.
- The Sea-Coastal Area (CA) dimension represents variables concerning the integrated measurement of the aesthetic and environmental quality of the beach [50] measured by natural, aesthetic and anthropogenic variables. It includes six variables: water transparency, bathing water quality, color of water, sand quality, presence of rainwater outfalls and jellyfishes.
- The Vegetation (V) dimension assesses the visual and natural characteristics of the land use/cover. Vegetation is an important parameter for assessing the quality of the landscape, and therefore its management and preservation. This dimension plays a fundamental role in the characterization and conservation of the natural landscape's diversity [53,54]. The variables identified in the vegetation dimension are: contrast, temporality, structure, color, vegetation debris and agriculture.

Table 1. Rating of variables and sub-variables used for the assessment of coastal landscape (CSQE).

D	N°	Variable	Rating 0	Rating 1	Rating 2	Rating 3	Rating 4	Sources	Method
Substratum (S)	1	Nature (S-N)	Cobbles or boulders	Sand and cobbles	—	Coarse sand	Fine sand	[43,55,56]	[43,56]
	2	Texture (S-T)	Cobbles	—	Mixed	—	Sand	[41,52,57–60]	[42]
	3	Color of sediment (S-C)	Black	Brown	—	Golden	White	[41,43,50,52,56–61]	[43,56]
	4	Substratum cleanness (S-S)	Unavailable	—	Seasonal/occasional	—	Continuous	[43,56]	[43,56]
	5	Presence of beach litter (S-W)	Poor	Fair	—	Good	Excellent	[43,50,56,62]	[62]
	6	Presence of rocky shore (S-R)	Absent	<5 m	5–10 m	10–20 m	>20 m	[51]	[51]
Sea-Coastal areas (CA)	1	Water transparency (CA-W)	Muddy	—	—	—	Transparent	[43,50,56,60]	[43,56]
	2	Bathing water quality (CA-B)	Insufficient	Sufficient	—	Good	Excellent	[25,31,46,63]	[46]
	3	Color of water (CA-C)	Muddy brown/grey	Milky blue green; opaque	Green/grey blue	Clear blue/dark blue	Very clear turquoise	[41,50–52,57–59,64,65]	[51]
	4	Sand quality (CA-S)	Three types of contamination	Two types of contamination	—	One type of contamination	Absent	[66–69]	Authors
	5	Presence of rainwater outfalls (CA-R)	Present				Absent	[46,50,51]	[50]
	6	Presence of jellyfishes (CA-J)	Very frequent	Frequent	Infrequent	Very rare	Absent	[50]	[50]
Vegetation (V)	1	Contrast (V-C)	No vegetation	Low contrast	—	Moderate contrast	High contrast	[43,56,57,70]	[43,56]
	2	Temporality (V-T)	None	Occasional		Seasonal	Permanent	[41,58,60]	[60]
	3	Structure (V-S)	Bare (<10% vegetation only)	Scrub/garigue/grass	Wetland /meadow	Coppices, maquis	Variety of mature trees	[51,58,60,71]	[51]
	4	Color (V-L)	Brown	—	Light green	—	Dark green	[57]	[42]
	5	Vegetation debris (V-D)	Continuous (>50 cm High)	Full strand line	Single accumulation	Few scattered items	None	[51,58]	[51]
	6	Agriculture (V-A)	None	—	Hedgerow/terracing/monoculture	—	Mixed cultivation ± trees/natural	[51]	[51]
Scenic background (SB)	1	Structure of beach–dune system							
	1.1	Beach shape (SB-S)	Closed (3/4)	—	Open (1/4)	—	Linear (1.5/4–2/4)	[41,43,52,55–57,59,60]	[43,56]
	1.2	Beach length (SB-L)	<250 m	250-<1000 m	1000-<2500 m	2500-<5000 m	>5000 m	[25,43,56]	[25]
	1.3	Slope (SB-P)	>30%		0–15%		15–30%	[41,55,60,72,73]	[60]
	1.4	Beach width (SB-W)	Absent	<5 m->100 m	5-<25 m	25-<50 m	50–100 m	[43,51,55,56,65]	[51]
	2	Scenic background of the system							
	2.1	Relief of land scenic background (SB-R)	Concave	—	Flat	—	Dunes/cliffs	[43,51,56,74]	[43,56]
	2.2	Existence of water bodies (SB-E)	Without water	—	—	—	With water	[43,56,72,73]	[43,56]
	2.3	Landscape integration of buildings (SB-B)	High-rise on the front line	Low-rise buildings	Stepped buildings on hillside	Sparse buildings	Without buildings	[43,56,59]	[43,56]
	2.4	Kind of sea horizon (SB-H)	Industrial/ port/shanty	Urban	Agricultural	With islands	Natural or free	[43,56]	[43,56]
	3	General scenic background							
	3.1	Natural perception (SB-N)	Dunes, equipment and buildings	—	Natural landscape and equipment	—	Natural landscape	[36,70,71,75]	[42]
	3.2	Viewshed (SB-V)	Open on one side	Open on two sides	—	Open on three sides	Open on four sides	[51,55,60,72,75]	[51]
	3.3	Viewshed shape (SB-P)	Small coves	—	Open and flat beach	—	Cove between cliffs	[41,55,60,72]	[42]
	3.4	Landscape diversity (SB-D)	Dunes, equipment and buildings	—	Natural landscape	—	Natural landscape and equipment	[52,58–60,64,71,74,75]	[42]

- The Scenic Background (SB) dimension describes the visual characteristics of the landscape of a site according to the structure, composition and the general perception of the landscape in terms of the combination of natural and anthropogenic components [42]. This dimension was analyzed according to three major variables: (i) beach background (shape, length, width and slope), (ii) land and marine backgrounds (relief, water bodies, buildings and sea horizon) and (iii) their combination (natural perception, Viewshed and its shape, and landscape diversity).

In total, 33 variables were selected (6 concern Substratum; 6, Sea-Coastal Area; 6, Vegetation; 15, Scenic Background (with 3–12 sub-variables)) (Table 1).

Step 3. Estimation of evaluation criteria for selected variables

Evaluation criteria were assigned for each selected variable (Table 1). These evaluation criteria were taken from a series of references in the literature identified in step 1, which are already ranked from good to bad. The researchers only had to give them an appropriate score from 0 to 4.

For some variables, no evaluation criteria have been mentioned in the literature, or the criteria that exist are not applicable to the nature of the available data (e.g., sand quality CA-S). In this case, different consultations were carried out between the authors of this paper to establish appropriate evaluation criteria.

Step 4. Estimation and attribution of landscape variables

The scores for selected variables were obtained in three ways using various techniques, including:

(i) Fieldwork for the evaluation and examination of the variables through site observations/estimations (e.g., substratum nature, texture, color of sediment, etc.). As an example, the Substratum dimension has four variables—"Cobbles or boulders", "Sand and cobbles", "Coarse sand", and "Fine sand". A beach with "Sand and cobbles" is scored 1 and a "Fine sand" beach is scored 4;

(ii) Geographic Information Systems (GIS) to check spatial variables such as beach length, width, slope and Viewshed, etc.;

(iii) Searches for results in the database of public institutions, national reports and guides, for a few variables that require a monitoring program, such as the environmental quality variables (e.g., bathing water quality, sand quality, presence of jellyfishes), and the scores were obtained through the use of this database.

Step 5. Landscape evaluation

To rate the selected indicators, each variable was scored on a five-point scale from 0 (absence or poor quality of the element concerned and unappreciated elements) to 4 (excellent quality or much appreciated elements) (Table 1).

After estimating the assigned value for each variable, the value of each dimension (Is) was calculated as the fraction between the sum of the values assigned to each variable (Vi) and the sum of the maximum possible values (Vp max) of the variables in a selected dimension [42]:

$$\text{Is} = \text{Vi}/\text{Vp max} \quad (1)$$

Subsequently, a numerical value of 0 to 1 was determined for each landscape dimension. Similarly, an average value of the four dimensions was obtained that reflects the quality of the coastal landscape of a selected beach. All the values were rated as follows: <0.2 (very low); 0.2 to <0.4 (low); 0.4 to <0.6 (medium); 0.6 to <0.8 (high) and ≥ 0.8 (very high). In meantime, a Pearson correlation analysis was applied to analyze the different correlations that exist between the variables of each dimension studied.

Finally, the sites studied were classified into different typologies according to the Williams and Micallef classification [25]. This classification separates coastal sites into five categories according to the degree of anthropogenic influence—remote, rural, village, urban and resort—taking into consideration criteria such as accessibility, environmental conditions, accommodation capacity and community services.

4. Results and Discussion

The description and the most significant characteristics of the sites studied are presented in this section. According to the methodology, five classes of values were established, but, in this study, the obtained values only belonged to three classes since the value of the landscape indicator (Is) ranged from very high and high to medium values. None of the beaches recorded low or very low values. The results are presented in Table 2, and graphically as a histogram (Figure 3) and a radar plot (Figure 4).

Table 2. Quality of coastal landscape of the sites studied.

N°	Site	Beach Type	Dimensions				Scenic Quality
			Substratum	Coastal Areas	Vegetation	Scenic Background	
1	Marqala	Urban	0.7	0.5	0.8	0.4	**0.6**
2	Tangier Municipal	Urban	0.7	0.5	0.2	0.5	**0.5**
3	Tangier Malabata	Urban	0.7	0.6	0.1	0.5	**0.5**
4	Ghandouri	Urban	0.8	0.6	0.1	0.4	**0.5**
5	Mrisat	Rural	0.8	0.8	0.8	0.7	**0.8**
6	Playa Blanca	Rural	0.6	0.8	0.8	0.4	**0.6**
7	Sidi Kankouche 1	Rural	0.8	0.9	0.8	0.7	**0.8**
8	Sidi Kankouche 2	Rural	0.8	0.9	0.8	0.7	**0.8**
9	Oued Aliane	Rural	0.8	0.8	0.9	0.8	**0.8**
10	Ksar Sghir	Village	0.7	0.5	0.3	0.5	**0.5**
11	Dalya	Rural	0.8	0.8	0.8	0.6	**0.8**
12	Oued El Marsa	Rural	0.5	0.8	1.0	0.5	**0.7**
13	Belyounech 2	Village	0.6	0.9	0.8	0.6	**0.7**
15	Belyounech 1	Village	0.6	0.7	0.8	0.7	**0.7**
15	Rifienne	Resort	0.7	0.6	0.3	0.5	**0.5**
16	Almina	Resort	0.5	0.8	0.7	0.4	**0.6**
17	Restinga	Resort	0.6	0.6	0.1	0.4	**0.4**
18	Marina Smir	Resort	0.6	0.6	0.1	0.4	**0.4**
19	Kabila	Resort	0.5	0.8	0.1	0.4	**0.4**
20	M'Diq	Urban	0.7	0.5	0.1	0.3	**0.4**
21	Cabo Negro	Resort	0.8	0.8	0.7	0.6	**0.7**
22	Martil	Urban	0.7	0.5	0.5	0.6	**0.6**
23	Amsa	Rural	0.5	0.9	0.9	0.5	**0.7**
24	Oued Laou	Village	0.4	0.6	0.7	0.6	**0.6**
25	Kaa Asrass	Rural	0.5	0.6	0.5	0.6	**0.6**
26	Stehat 2	Remote	0.4	0.8	0.7	0.8	**0.7**
27	Stehat 1	Village	0.4	0.6	0.6	0.5	**0.5**
28	Amtar	Rural	0.4	0.9	0.5	0.5	**0.6**
29	Jebha-Zamana	Village	0.3	0.9	0.8	0.6	**0.7**
30	Jebha-Maresdar	Remote	0.5	0.9	0.6	0.6	**0.6**
31	Jebha-El Hwad	Remote	0.4	0.9	0.8	0.6	**0.7**
32	Bades	Rural	0.5	0.9	0.8	0.7	**0.7**
33	Izdhi	Urban	0.3	0.5	0.3	0.5	**0.4**
34	Sabadia	Urban	0.4	0.5	0.5	0.4	**0.4**
35	Quemado	Urban	0.8	0.8	0.8	0.4	**0.7**
36	Cala Bonita	Urban	0.3	0.6	0.6	0.3	**0.4**
37	Isli	Rural	0.3	0.7	0.6	0.6	**0.5**
38	Sfiha	Rural	0.5	0.8	1.0	0.5	**0.7**
39	Souani	Rural	0.3	0.9	0.9	0.7	**0.7**
40	Sidi Driss	Rural	0.3	0.9	0.8	0.6	**0.6**
41	Sidi Amer O Moussa	Rural	0.4	0.9	0.8	0.6	**0.7**
42	Miami	Urban	0.6	0.6	0.1	0.4	**0.4**
43	Boqueronesa West	Rural	0.7	0.8	0.9	0.7	**0.8**
44	Boqueronesa East	Rural	0.7	0.8	0.8	0.9	**0.8**
45	Taourirt	Rural	0.8	0.8	0.9	0.7	**0.8**
46	Kariat Arekmane	Resort	0.8	0.8	0.7	0.5	**0.7**
47	Ras El Ma	Village	0.7	0.8	0.8	0.4	**0.7**
48	Saïdia Med West	Resort	0.5	0.8	0.8	0.6	**0.7**
49	Saïdia Med East	Resort	0.5	0.8	0.7	0.5	**0.6**
50	Saïdia	Urban	0.6	0.7	0.7	0.5	**0.6**
	Mean		**0.6**	**0.7**	**0.6**	**0.5**	**0.6**

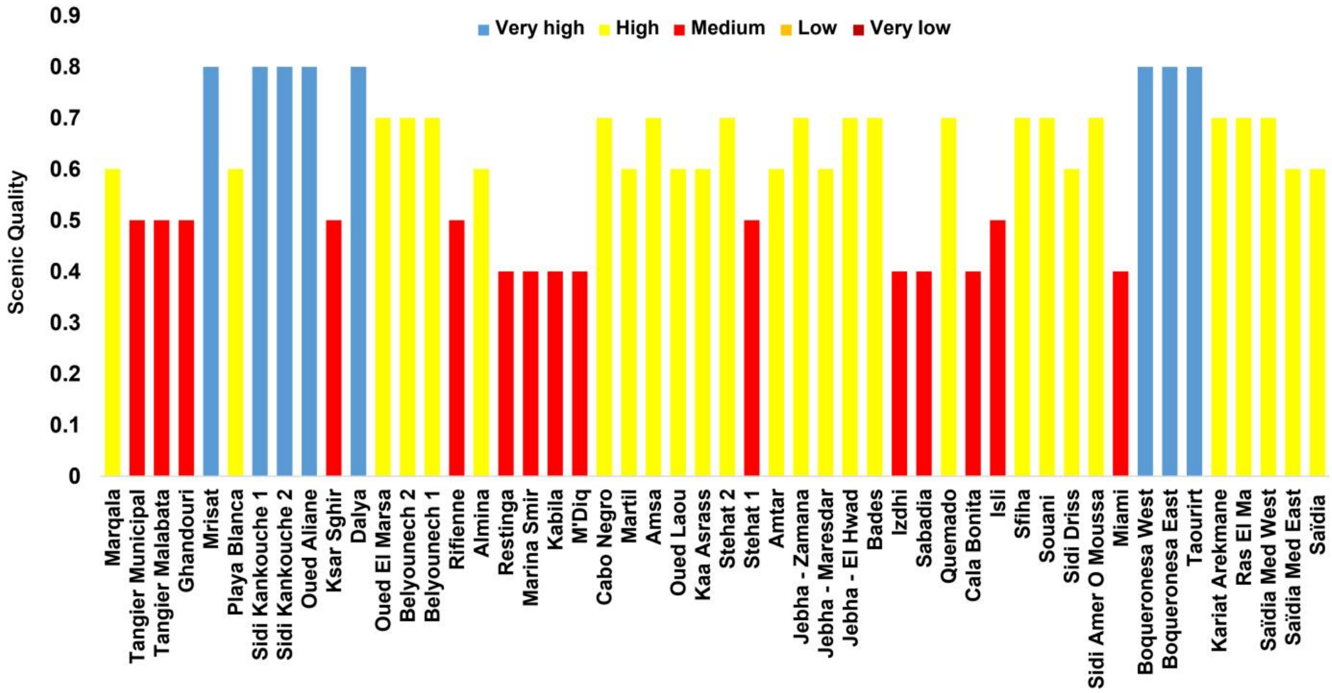

Figure 3. Landscape quality of the 50 studied sites according to classes.

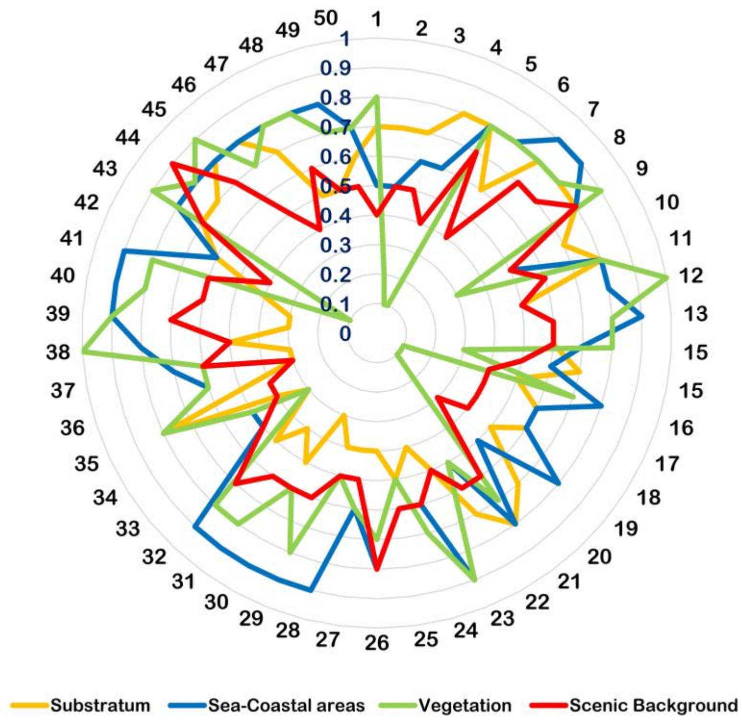

Figure 4. The scenic quality of the sites studied (by No.) according to each dimension.

4.1. Landscape Assessment of Selected Beaches

According to the results obtained, the average coastal landscape quality score was 0.6, which corresponds with high quality. The beaches that obtained the best quality (0.8) are located in the north-west (No. 5, 7–9, 11) and in the north-east (No. 43–45) of the coast investigated (Table 2, Figures 1 and 3). These are natural, extremely attractive sites with excellent coastal landscapes (Figure 5), located far from urban centers, and they still preserve their natural and aesthetic aspects because tourist activities are only carried out there during the summer period, and not many tourists are recorded. These sites are highly rated due to their natural attractions and their exceptional characteristics in terms of the Substratum, Sea-Coastal Area and Vegetation dimensions, and they present a very attractive natural Scenic Background (Figure 4).

Figure 5. Examples of sites with high and very high scenic values, with their exceptional landscape features: (**A**) Taourirt; (**B**) Belyounech 2; (**C**) Quemado and (**D**) Dalya.

High scores were obtained at other beaches, especially those located in the provinces of Al Hoceima and Chefchaouen (Table 2, Figures 1 and 3). These are excellent coastal sites with attractive landscapes (Figure 5) that have been modified by urban developments. They are well rated for the Vegetation, Sea-Coastal Area and Scenic Background dimensions (Figure 4), and in the Substratum dimension, they obtained medium to low scores because of the presence of pebble and gravel sediments.

Medium scores were recorded for the sites in Tangier and Tetouan provinces (Table 2, Figures 1 and 3). These are urban coastal tourist sites well equipped with developed tourist infrastructures. They are characterized by high constructions and intensive developments visible from long distances that considerably reduce their natural aspects, and a high level of human occupation for recreational/tourist purposes associated with a high number of maximum daily visitors that can reach 80,000 people during the summer period [46]. These sites are well rated in most cases for the Substratum dimension, but are less highly rated for the other dimensions (Figure 4). The Substratum, Sea-Coastal Area and Vegetation dimensions across all sites obtained a high scenic quality score (>0.6), and the Scenic Background dimension obtained a medium score of 0.5 (Table 2) because of the impact of human activities.

4.2. Assessment of Dimensions and Landscape Variables

4.2.1. Substratum Value

The highest values of the Substratum (S) dimension (i.e., a score of 0.8) were recorded at beaches such as Dalya, Oued Aliane, Quemado, etc. (Table 2 and Figure 4). These sites are fine sandy beaches with a golden color and are located in areas very well equipped with tourist infrastructures, constituting a very privileged destination that receives a large number of visitors. These beaches regularly host clean-up and maintenance actions. Beaches such as Marqala, Martil, Marina Smir, etc., obtained high scores (i.e., 0.6–0.7). These beaches are similar to the previous sites in terms of nature, texture and color of sediment, but they often undertake only seasonal clean-up operations or show poor quality in terms of litter presence, due to the high number of visitors. The remaining beaches had low and medium quality scores (<0.6) (Table 2 and Figure 4). Although some of these sites represent very remarkable coastal landscapes, they are characterized by a gravel or cobble substratum, with clean-up activities limited to the summer period, or even being totally absent at remote beaches.

With respect to the nature (S-N) variable (Figure 6A), "Fine sand" was recorded in 27 sites, "Coarse sand" in 4 sites, "Sand and cobbles" in 18 sites, and only 1 site showed "Cobbles/boulders". The texture (S-T) was "Sand" in 31 sites, "Mixed" in 18 sites and "Cobbles" in 1 site. Despite sandy landscapes representing only 20% of the coasts worldwide [76,77], sand was found to be the most highly preferred beach material by beach users, as observed by Morgan [31]. Regarding sediment color (S-C), 4 sites were reported as "White", 20 sites as "Golden", 25 sites as "Brown", and only 1 site as "Black". According to studies concerning the relevance of sediment color carried out by Peña-Alonso [56] and Ortiz [61], clear beach sediments are aesthetically more appreciated by beach users than dark sediments.

Concerning the variable substrate cleanness (S-S), 11 sites are subject to "continuous" mechanical and manual cleaning and maintenance, and 35 sites record "seasonal/occasional" clean-up activities often in the summer period or after strong winds or storms, usually carried out by volunteers as part of the ecological/educational activities of the local population. Only 4 sites recorded "unavailable" cleaning and were located in rural and remote sites. The sites with regular cleaning were found to be only the large beaches located in urban/recreational areas characterized by hotels and tourist infrastructures; this was also observed by Er-ramy et al. [45] in a paper on coastal scenery evaluation. Regarding the content of beach litter (S-W), it is correlated with the frequency of sediment cleaning, the number of visitors and the population density. None of the sites showed "Excellent" quality, 18 sites were rated "Good", 28 sites were rated "Fair", and 4 sites had the lowest ("Poor") quality. Various studies have considered the presence of litter as a strong justification for beach users avoiding and not visiting a beach [78–80]. Indeed, the cleanliness of beaches is an essential element in attracting tourists [81] and in achieving sustainable beach tourism [82]. Rocky shore presence is generally very low; it was absent at 28 sites, 15 sites presented a rocky shore width ">20 m", 4 sites "10–20 m", 2 sites "5–10 m", and a single site presented "<5 m".

4.2.2. Sea-Coastal Area Value

In the Sea-Coastal Area (CA) dimension, the highest scores were recorded at the beaches of Belyounech 2, Bades, Maresdar, etc., with values of 0.9 (Table 2 and Figure 4A). These sites are remote wild beaches where natural, aesthetic and environmental variables are still preserved, and tourist activities are low due to the difficulties of access. High scores were obtained at the sites of Belyounech 1, Isli, Oued Laou, etc. These sites are characterized by transparent waters, often light blue in color with excellent and good bathing water quality. The other sites showed medium scores. These are large urban and seaside sites where tourist activities, the very high number of visitors and the presence of more than one rainwater outfall directly influence the quality of bathing water and the hygienic quality of the sand.

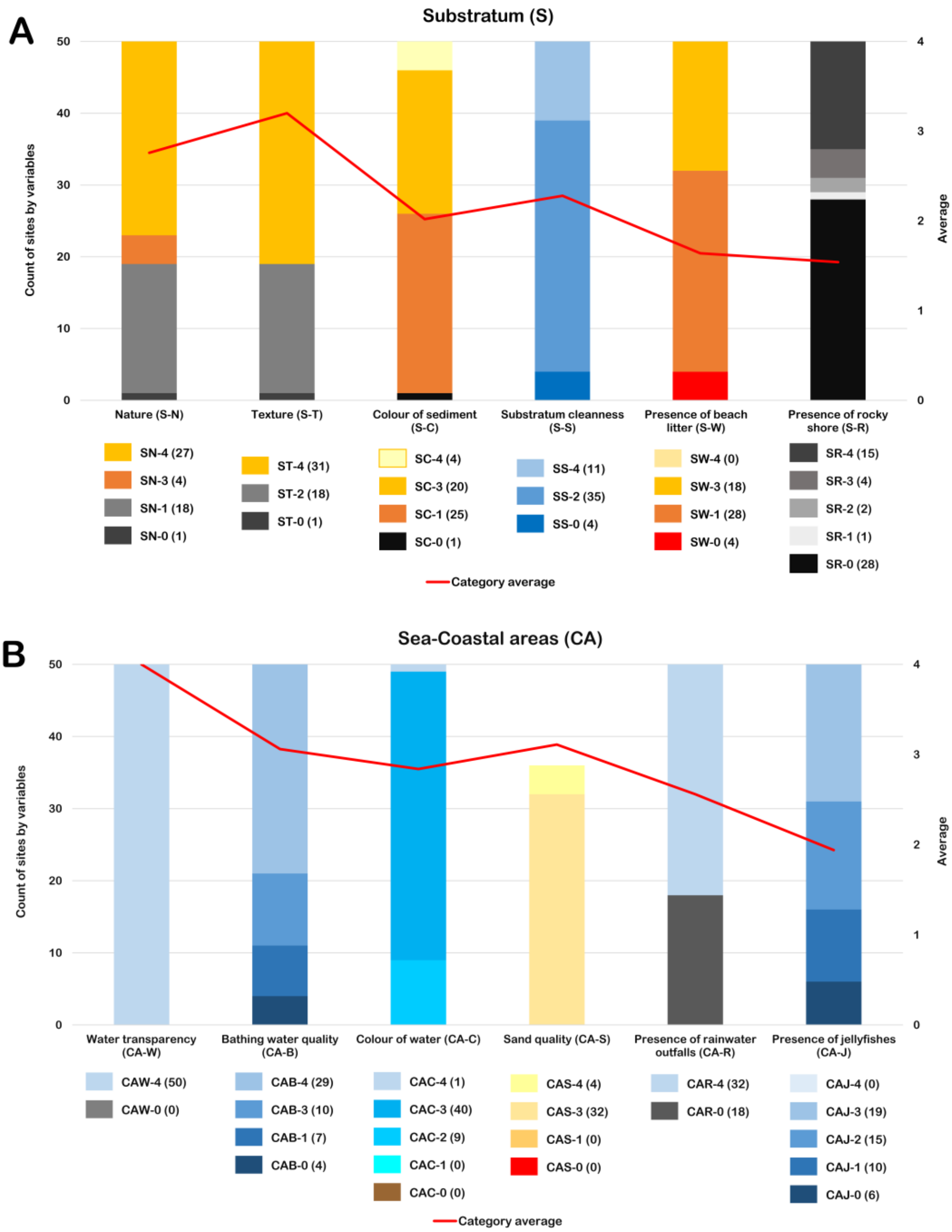

Figure 6. Scores of selected variables for the dimensions (**A**) Substratum and (**B**) Sea-Coastal Area. In parentheses are shown the numbers of sites that present the same rate for a determined variable.

According to Figure 6B, all sites were found to have "Transparent" water, which is often "Clear blue" (at 40 sites), while "Green blue" was found at 9 sites, and "Very clear turquoise" at 1 site, with "Excellent" bathing water quality at 29 sites, "Good" at 10 sites, "Sufficient" at 7 sites and "Insufficient" at 4 sites that do not comply with the legal standards [46]. The variable presence of rainwater outfalls shows a correlation with bathing water quality because 18 sites have discharge points. Unal and Williams [63] in their public perception study found that clean bathing water ranked first in beach selection. Morgan [31] found that bathing water quality and sewage are two very important factors for beach users in choosing and selecting a coastal destination. Despite the fact that water quality/pollution is generally not strictly related to landscape, it constitutes a fundamental factor in beach quality, and is one of the five most important criteria for beach selection. Water pollution also constitutes a real threat to coastal ecosystems, e.g., the abundance of nutrients can give rise to algae blooms. Therefore, water quality pollution can cause a variety of environmental concerns that can affect sites' scenic value in the medium and long term. For sand quality (CA-S), three parameters were evaluated according to the standards in force [69] through chemical and mycological analyses of the sand, namely: heavy metals, hydrocarbons and dermatophytes. The results show that 32 sites had at least one type of contamination, often by dermatophytes of the *Trichophyton rubum* type, or fungi such as *Chrysosporium keratinophylum* and *Alternaria* Sp., while 4 sites did not present any type of contamination and 14 sites had no available data. Jellyfishes (CA-J) were very rare at 19 sites, infrequent at 15, frequent at 10, and very frequent at 6 sites [83].

4.2.3. Vegetation Value

Concerning the Vegetation (V) dimension, almost half of the selected sites (24 out of 50) achieved very high quality (Table 2 and Figure 4). The highest scores were recorded at the sites of Sfiha, Oued El Marsa, Oued Aliane, etc., with values >0.9. A very extensive permanent vegetation cover forming a well-developed forest or maquis, with a high contrast of dark green colors, characterizes all these sites. High scores were recorded at Cabo Negro, Stehat 2, Isli, etc. These sites showed low, permanent vegetation that was less developed than in the previous sites, and was dark green in color with a moderate contrast. Wetlands or meadows were present in some cases, notably at Martil, Oued Laou and Saidia Med West.

With respect to the contrast (V-C) variable (Figure 7A), 15 sites showed "high contrast", 14 "moderate contrast", 13 "low contrast", and 8 sites had "no vegetation". For vegetation temporality (V-T), the differences were significant, i.e., 39 sites were characterized by permanent vegetation, 2 sites had occasional vegetation and 1 site showed seasonal vegetation. Concerning the structure (V-S), 8 sites had well-developed dense vegetation cover in the form of a forest, 13 sites matorral or maquis, 7 sites had wetland and 14 sites showed low herbaceous vegetation. As for the variable color (V-L), "dark green" was predominant at 35 sites, "brown" at 11 sites and "light green" at 4 sites. According to Thorpert and Nielsen [84], in terms of color, people prefer green tones over browns because they are considered cleaner and purer. Vegetation debris (V-D) was absent at 8 sites, while 24 presented "few scattered items", 12 sites "single accumulation" and 6 sites a "full strand line". The quality of this variable is effectively under the control of marine phenomena (tides, currents, storms), the presence of streams or rivers [85,86] and the frequency/typology of beach clean-up operations.

4.2.4. Scenic Background Value

Concerning the Scenic Background (SB) dimension, the highest scores were recorded at the beaches of Boqueronesa East, Oued Aliane and Stehat 2, which showed very high quality (Table 2 and Figure 4). These sites are natural and characterized by the presence of well-developed dune fields or high cliffs with rivers and streams, and the total absence of public buildings and facilities. The sites with high scores, such as Taourirt, Belyounech 2, Cabo Negro, etc., are natural and semi-urban sites, with a remarkable landscape and scattered or low-rise buildings, as well as some facilities that do not greatly affect the natural beauty of the landscape. The sites with medium values, i.e., Saïdia, Tangier Municipal, M'Diq, etc., are characterized by intense urban developments, tourist activities and facilities, and a high number of visitors during the summer period.

Concerning the sub-variables of the beach–dune system (Figure 7B)—the most appreciated natural space among coastal geomorphological landscapes [50,87,88]—the beach shape (SB-S) was often "linear" (41 sites), while at 8 sites it was "open", and only 1 site had a "closed" shape. The most representative beach length (SB-L) was "1000-<2500 m" recorded at 20 sites, followed by "250-<1000 m" at 15 sites and "2500-<5000 m" at 11 sites, indicating the predominance of medium-sized beaches. In contrast, as recorded at 28 sites, the most representative beach width (SB-W) was "50–100 m"—this represents the most optimal beach width in beach classification according to the Coastal Scenic Evaluation

System [51]. Maintaining beach width is essential to providing a comfortable recreation area in order to not increase the carrying capacity along the beach [8]. As for the slope (SB-P), most sites were characterized by a value of ">30%" (37 sites), followed by 7 sites with "15–30%" and 6 sites with "0–15%".

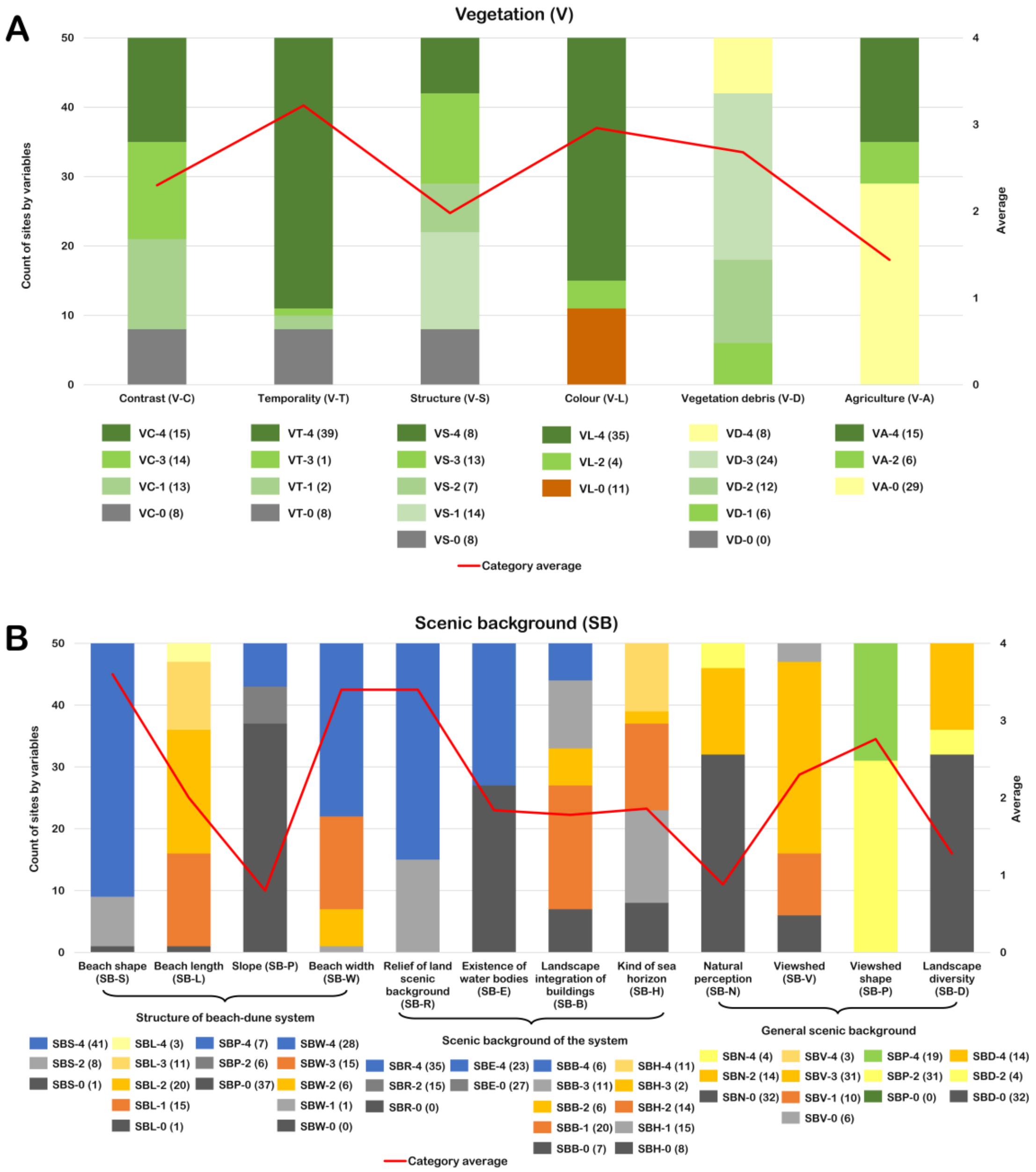

Figure 7. Scores of the selected variables for (**A**) Vegetation and (**B**) Scenic Background dimensions. In parentheses are shown the number of sites that present the same rate for a determined variable or sub-variable.

Concerning the sub-variables that constitute the scenic background of the system (Figure 7B), 35 sites presented "Dunes/Cliffs" forms in the relief of land scenic background (SB-R), and 15 sites were "flat". The Existence of water bodies (SB-E) was observed at 23 sites. Landscape integration of buildings (SB-B) was a key variable that differentiates between the sites; 20 sites were "low-rise", 11 "sparse", and 7 "high-rise on the front line", while 6 sites fit into each of the criteria "without buildings" and "stepped building". For the kind of sea horizon (SB-H), 15 sites were reported as "urban", 14 sites as "agricultural", 11 sites as "natural or free", 8 sites as "industrial / port", and only 2 sites "with islands". The majority of beach classifications assess the natural aspect of the landscape and the degree of human intervention, and therefore consider urban beaches as unattractive, because of such classifications. Lizarbe-Palacios, Aponte, and Botero [89] proposed the revision of landscape assessments by implementing new management strategies and measures that make it possible to enhance urban beaches.

In terms of the sub-variables that constitute the general scenic background (Figure 7B), the Viewshed in the open sea (SB-V) was "open on 3 sides" in 31 sites, "open on 2 sides" in 10 sites, "open on 1 side" and "open on 4 sides" in 6 and 3 sites, respectively. Natural perception (SB-N) and landscape diversity (SB-D) practically characterize the general scenic background; the criterion "dunes, equipment and buildings" was the most observed at 32 beaches, followed by "natural landscape and equipment" in 14 sites and "natural landscape" in 4 sites.

4.3. Correlation among Landscape Dimension Variables

The correlation analysis between the selected variables was calculated using the Pearson correlation coefficient. The results show significant and highly significant correlations among the different variables of each dimension (Table 3). In the Substratum (S) dimension, the nature (S-N) and texture (S-T) variables showed highly significant correlation, mainly due to the common natural characteristics considered, since both variables are significantly correlated with color of sediment (S-C) and substratum cleanness (S-S). This can be explained by the fact that the nature and texture of sediments directly determine their color, and affect the cleanness of the substratum and the type of clean-up operations (mechanical or manual). In the Sea-Coastal Area dimension, bathing water quality (CA-B) is positively correlated with the presence of rainwater outfalls (CA-R), which is normal since the presence of sewage is a determinant of bathing water quality [90]. These two variables have a moderate correlation with the Vegetation dimension's variables, such as contrast (V-C), temporality (V-T), structure (V-S) and color (V-L). The set has a significant correlation with the Scenic Background dimension variables such as relief of land scenic background (SB-R), landscape integration of buildings (SB-B), kind of sea horizon (SB-H), natural perception (SB-N) and landscape diversity (SB-D). These relationships can be explained in a simple way that defines the nature of the sites studied between, whether urban or natural: when the type of sea horizon is urban, there are buildings, and therefore rainwater outfalls are likely, the presence of vegetation is unlikely, and equipment is often present; vice versa if the type of sea horizon is natural. In the Scenic Background (SB) dimension, landscape integration of buildings (SB-B), kind of sea horizon (SB-H), natural perception (SB-N) and landscape diversity (SB-D) show a highly significant and positive correlation. This was also observed by Pérez-Hernández et al. [42] in their study on the correlations between these variables: if one rises, the others also raise, and vice versa, since diversity increases when the elements are distributed in a balanced and homogeneous way in space. Finally, it should be noted that the variable water transparency (CA-W) within the Sea-Coastal Area (CA) dimension could not be compared, as it recorded the same score at all sites.

4.4. The Need to Manage Moroccan Coastal Areas

It can be seen that a large part of the Moroccan Mediterranean coastline is affected by three main factors: (i) urbanization through the construction of buildings and tourist infrastructures, (ii) the presence of beach litter, and (iii) wastewaters. The latter two factors especially affect the Substratum and Sea-Coastal Area dimensions, while the former factor affects more the Vegetation and Scenic Background dimensions. In total, 32 sites, i.e., 64% of the study area, were affected by the aforementioned variables.

Table 3. Correlations between the Substratum (S), Sea-Coastal Area (CA), Vegetation (V) and Scenic Background (SB) dimensions' variables and sub-variables.

		Substratum (S)						Sea-Coastal Areas (CA)					Vegetation (V)						Scenic Background (SB)											
		S-N	S-T	S-C	S-S	S-W	S-R	CA- B	CA-C	CA-S	CA-R	CA- J	V-C	V-T	V-S	V-L	V-D	V-A	SB-S	SB-L	SB-P	SB-W	SB-R	SB-E	SB-B	SB-H	SB-N	SB-V	SB-P	SB-D
Substratum	S-N	1																												
	S-T	0.970 **	1																											
	S-C	0.463 **	0.378 **	1																										
	S-S	0.513 **	0.485 **	0.227	1																									
	S-W	−0.279 *	−0.294 *	−0.310 *	−0.089	1																								
	S-R	0.034	0.037	0.168	−0.244	−0.336 *	1																							
S-C. areas	CA-B	−0.124	−0.105	−0.078	−0.317*	0.322*	0.140	1																						
	CA-C	−0.394 **	−0.380 **	0.301 *	−0.441 **	−0.131	0.218	−0.053	1																					
	CA-S	−0.326	−0.341 *	−0.310	−0.323	0.109	0.179	0.120	0.000	1																				
	CA-R	−0.067	−0.094	−0.060	−0.195	0.179	0.108	0.461 **	−0.188	0.101	1																			
	CA-J	−0.265	−0.302 *	−0.409 **	−0.095	0.312 *	0.039	0.060	−0.395 **	0.151	0.483 **	1																		
Vegetation	V-C	−0.049	−0.075	−0.061	−0.227	0.080	0.376 **	0.408 **	0.013	0.051	0.617 **	0.372 **	1																	
	V-T	−0.337 *	−0.361 **	−0.324 *	−0.261	0.149	0.237	0.186	−0.070	0.218	0.572 **	0.544 **	0.716 **	1																
	V-S	0.090	0.073	−0.130	−0.080	−0.075	0.403 **	0.197	−0.077	0.202	0.514 **	0.316 *	0.816 **	0.682 **	1															
	V-L	−0.220	−0.246	−0.243	−0.244	0.037	0.278	0.187	−0.125	0.255	0.634 **	0.526 **	0.761 **	0.895 **	0.705 **	1														
	V-D	0.237	0.197	0.146	0.310 *	0.156	−0.253	−0.134	−0.030	−0.335 *	0.011	−0.087	−0.183	−0.156	−0.106	−0.145	1													
	V-A	−0.314 *	−0.363 **	−0.210	−0.213	0.275	0.019	0.473**	−0.066	0.403 *	0.417 **	0.351 *	0.328 *	0.411 **	0.260	0.342 *	−0.240	1												
Scenic background	SB-S	−0.012	0.000	0.008	0.118	0.144	−0.235	0.217	0.043	−0.235	−0.149	−0.200	−0.177	−0.228	−0.172	−0.280 *	−0.112	0.060	1											
	SB-L	−0.060	−0.082	−0.191	−0.082	0.311 *	−0.287 *	0.192	−0.209	0.287	0.091	−0.106	−0.072	0.086	0.065	0.026	−0.198	0.292 *	0.342 *	1										
	SB-P	0.436 **	0.419 **	0.015	0.534 **	0.084	−0.286 *	−0.289 *	−0.452 **	−0.135	−0.162	0.086	−0.202	−0.262	−0.053	−0.254	0.233	−0.353 *	0.062	0.091	1									
	SB-W	0.299 *	0.244	0.285 *	0.107	0.176	−0.054	0.072	−0.173	−0.014	0.226	0.005	0.188	0.112	0.123	0.261	0.246	0.075	−0.115	0.282 *	0.215	1								
	SB-R	−0.199	−0.247	−0.257	−0.074	0.108	0.337 *	0.093	−0.146	0.120	0.418 **	0.471 **	0.591 **	0.752 **	0.476 **	0.694 **	−0.040	0.234	−0.293 *	−0.238	−0.242	−0.056	1							
	SB-E	0.125	0.091	−0.051	0.211	−0.027	0.123	0.018	−0.031	0.000	−0.144	−0.141	0.029	−0.002	0.192	−0.147	−0.075	0.154	0.233	0.131	0.323*	−0.114	−0.009	1						
	SB-B	−0.355 *	−0.399 **	−0.011	−0.371 **	0.150	0.302 *	0.320 *	0.198	0.169	0.526 **	0.388 **	0.649 **	0.500 **	0.395 **	0.555 **	−0.134	0.315 *	−0.078	−0.052	−0.385 **	0.171	0.402 **	−0.156	1					
	SB-H	−0.302 *	−0.329 *	−0.089	−0.112	0.301 *	0.184	0.437 **	0.102	−0.031	0.414 **	0.252	0.517 **	0.469 **	0.326 *	0.468 **	0.130	0.248	0.053	−0.032	−0.229	0.129	0.447 **	−0.112	0.691 **	1				
	SB-N	−0.232	−0.249	−0.012	−0.182	0.266	0.191	0.361 **	0.114	−0.051	0.452 **	0.315 *	0.527 **	0.353 *	0.266	0.432 **	0.037	0.076	0.028	0.068	−0.078	0.251	0.246	−0.133	0.787 **	0.788 **	1			
	SB-V	0.221	0.247	−0.196	0.146	0.066	−0.158	0.283 *	−0.332 *	−0.009	−0.031	−0.097	−0.056	−0.041	0.041	−0.104	−0.182	0.033	0.540 **	0.475 **	0.167	−0.039	−0.143	0.141	−0.175	−0.008	−0.039	1		
	SB-P	−0.211	−0.187	0.059	−0.207	−0.163	0.468 **	−0.034	0.399 **	0.024	0.244	0.206	0.444 **	0.373 **	0.287 *	0.341 *	0.050	0.061	−0.387 **	−0.584 **	−0.377 **	−0.138	0.513 **	−0.061	0.558 **	0.385 **	0.365 **	−0.534 **	1	
	SB-D	−0.145	−0.179	0.047	−0.190	0.161	0.206	0.332 *	0.060	0.000	0.446 **	0.370**	0.497 **	0.368 **	0.378 **	0.451 **	0.032	0.250	0.070	0.025	−0.150	0.325 *	0.177	−0.078	0.710 **	0.704 **	0.774 **	0.021	0.317*	1

** Correlation is significant at the 0.01 level (bilateral). * Correlation is significant at the 0.05 level (bilateral).

Consequently, the considerable number of sites of medium scenic quality (15 sites, or 30%) reflects the loss of scenic beauty due to the inadequate coastal management and the significance of urban developments. Thus, Moroccan sustainable coastal tourism is excessively threatened by the repeated degradation of coastal landscapes due to extreme urbanization [45]. According to the results of this study, urban and tourist demand has contributed to the deterioration of coastal landscape quality, and especially affected the Scenic Background dimension.

4.4.1. Dune Maintenance and Enhancement

Dunes are infrequent along the Moroccan Mediterranean coast. The low amount of dune systems observed is probably due to several and complex natural processes, but is especially linked to anthropogenic actuations. The construction of tourist infrastructures, e.g., promenades, roads, hotels, restaurants, etc., too close to the shoreline to the detriment of coastal dunes contributes considerably to their scarcity. The emplacement of coastal infrastructures significantly reduces the width of beaches [91], destroys the natural vegetation cover [92], affects biodiversity and leads to the destruction of a large number of coastal habitats [93], ultimately decreasing the ecological and aesthetic value of the coastal landscape [85,86]. This can be observed in a considerable number of the sites studied, e.g., at Martil, Cabo Negro, M'Diq, Marina Smir, Oued Laou, Tangier Municipal, etc. Consequently, these actuations affect the sediment budget of the beach [94], and limit the development and growth of dunes [95], which also provide a protection against natural processes. El Mrini et al. [96], in their study on the morphological evolution of the Tetouan coastline of Morocco (sites No. 15 to 22 in this study), confirmed that the anarchic occupation of the coastal dunes and their degradation are the reason for the past and present coastal retreat.

For the environmental and aesthetic aspects of the landscape, appropriate management actions can comprise beach nourishment works through the restoration of dunes and the implantation of native vegetation [97]. Thus, the reconstruction and stabilization of coastal dunes can be improved through beach nourishment works to increase coastal protection action and beach recreational use, which are within the scope of management plans [98]. Indeed, these mentioned interventions can increase beach width, favor the formation of dunes, prevent the loss of lives and facilities during storms and floods, preserve the natural beauty of the coast, and ensure the protection of coastal ecosystems [28,86]. Furthermore, well-vegetated coastal dunes form a buffer zone between the urban terrestrial area and the beach, thus reducing noise pollution and forming a natural protective system against any negative visual effects on the coastal zone [99]. These interventions can be considered adequate in comparison to the construction of protective structures. Currently, the most important coastal dunes in Morocco are at Saïdia Med-West and Med-East, Ras El Ma, Taourirt, Boqueronesa, Dalya, Cabo Negro and Oued Aliane. Dunes at other beaches have been completely destroyed by the emplacement of public and private settlements/infrastructures.

Furthermore, coastal dunes cannot be replaced by the emplacement of protective structures, as observed along the sites studied (groins, revetments, seawalls, bulkheads, riprap, etc.). These structures damage the natural landscape and coastal ecosystems [100], and disrupt coastal dynamics [93]. Moreover, the ecological functions of dunes cannot be provided by these protective structures, which cannot adapt naturally to changing coastal conditions (extreme wave heights and flooding events, etc.) [101]. In addition to environmental values, coastal dunes require lower capital expenditures and often lower maintenance and care costs, compared to protective structures [102–104].

Recent works on coastal engineering planning and design have highlighted coastal protection systems that integrate both the natural functionality provided by natural coastal environments (e.g., coastal dunes, mangrove swamps, etc.) and artificial protection structures—so-called hybrid infrastructures [105–109], which can be defined as multi-functional coastal protection systems [110] that act against storms, erosion and natural hazards. This type of system combines both natural and built infrastructures [101], i.e., green and grey infrastructures [107], dynamic and static components, and ecological and planning approaches [106] to effectively meet the requirements of coastal areas. This system is important in situations where the width of the beach is narrow or the sand is rare, and can provide an additional line of protection. There are several examples of hybrid protection structures around the world. We could mention hybrid protection structures at Katwijk, Scheveningen and Noordwijk (The Netherlands) [111,112], Dam Neck, Virginia (USA) [102], Bay Head, NJ, USA [113], and Osato, Tokushima (Japan) [109]. Another similar approach seen in Japan is called "Integrated Shore Protection System" [109], which is based on artificial structures such as coastal groins, breakwaters or artificial beaches. This approach to green coastal engineering planning and design could be applied to some of the beaches studied (Martil, M'Diq, Tangier Municipal, Tangier Malabata, Ghandouri, Oued Laou, Stehat 1, etc.), and may represent an effective solution to the silting phenomenon caused by strong winds and storms, which is observed every year, especially at the Martil and M'Diq sites (Figure 8).

Figure 8. Silting of the tourist promenade and coastal road backing the beach of Martil.

4.4.2. Beach Litter and Wastewater Management

The analysis of the Substratum and Sea-Coastal Area dimensions shows that most of the studied sites with low scores are negatively affected by bathing water quality, the presence of rainwater outfalls, sand quality and the presence of beach litter. Indeed, litter and sewage have been defined as the main degradation factors of the Moroccan Mediterranean coasts [45], and the main obstacle influencing beaches to move to a higher class within the CSES (Coastal Scenic Evaluation System) beach classification [114]. By limiting the impact of litter and sewage at the sites studied, it is possible to improve the values of the Substratum and Sea-Coastal Area dimensions (Figure 9).

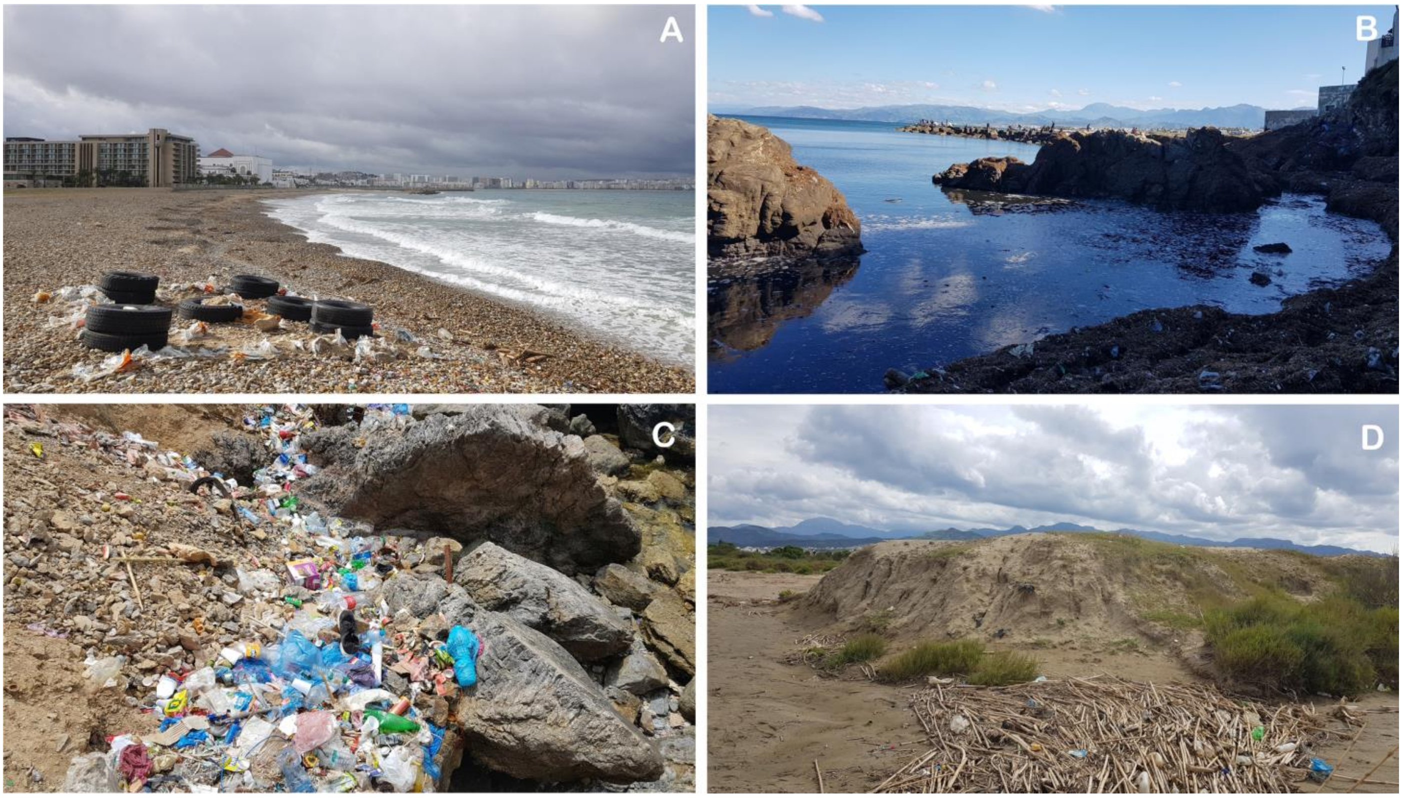

Figure 9. Examples of litter and vegetation debris that affect the natural beauty of coastal landscapes: (**A**) Tangier Malabata; (**B**) Cabo Negro; (**C**) Bades and (**D**) Martil.

The Mediterranean Sea is currently one of the most polluted regions of the world by marine debris [115,116], which mainly threatens bathing water quality, marine biodiversity, ecosystem functionality, human health, and the economy of coastal communities [78,81,117,118]. Beach and marine litter are considered a multidimensional global problem [119–122]. Litter is one of the main factors in beach choice and, therefore, an important issue for coastal zone management. The presence and accumulation of litter in coastal areas greatly affects ecosystems, natural heritage and the aesthetic value of the beach [123]. Therefore, the evaluation of beach litter is mandatory for any landscape assessment.

Based on the results obtained in this study, it is possible to affirm that a considerable number of sites are heavily affected by beach litter. Improvement interventions can be proposed, which are of great help to coastal managers and different actors seeking to mitigate beach degradation. As an example, if regular cleaning operations are carried out at some sites with a "Continuous" frequency, the variable presence of beach litter will improve to at least "Good", the quality of the Substratum dimension will be highly improved, and eventually, the values of the landscape quality will increase considerably. Through these interventions, the sites that can improve their landscape quality values include:

- From 0.5 to 0.6 (medium to high value)—Rifienne, Stehat 1, Zamana, Isli;
- From 0.7 to 0.8 (high to very high value)—Belyounech 2, Bades;
- From 0.8 to 0.9—Oued Aliane.

If the variable presence of rainwater outfalls is improved, the score of this variable will be "4", which directly improves the Sea-Coastal Area dimension and consequently the value of landscape quality, and may also positively and indirectly influence the value of some related variables, such as bathing water quality and sand quality. Examples of sites that could improve their landscape quality values through this intervention include:

- From 0.4 to 0.5—Restinga, Marina Smir, Calabonita, Izdhi, Sabadia, Miami;

- From 0.5 to 0.6 (medium to high value)—Rifienne, Stehat 1.

In Morocco, beach tourism is one of the main income-generating activities, and occupies an important place in the national economy [124]. Tourist activities are strongly threatened by beach litter [125,126] that makes coastal environment unattractive, and therefore significantly reduces the revenue of coastal sites that heavily rely on tourism [78]. In some regions, the presence of a considerable amount of litter can reduce coastal tourism revenues by up to 39%, or USD 8.5 million per year [80]. Another example is the beach of Geoje Island (South Korea), which was exposed to a period of heavy rainfalls and floods in 2011, and this led to the accumulation of a large quantity of marine debris. Revenue loss was estimated between USD 29 and 37 million [125].

Marine litter clean-up operations are carried out along the beaches presented in this study at a daily rate in urban sites only during the summer period. Additional cleaning actions may be carried out in cases of beach litter accumulation due to natural factors (storms, floods, etc.) [127]. Unfortunately, in terms of management, the application of clean-up actions on a few beaches is not enough to solve the problem of litter, and this operation requires maximum collaboration among all stakeholders to address the causes of the problem [128,129], as marine litter comes from many sources [130,131]. In addition, municipalities are responsible for the management of marine litter at institutional and organizational levels; within these municipalities, marine litter sometimes contributes to a huge increase in the financial costs allocated to coastal management, including the direct costs of beach cleaning and the management of environmental impacts on coastal areas [132]. Given this state of affairs, projects and monitoring programs of marine litter are strongly required. Within the framework of the implementation of the Mediterranean Marine Litter Regional Plan (MLRP), in 2018, Morocco initiated two pilot programs for the prevention and management of marine litter: "Adopt a Beach" and "Fishing for litter". In addition, Morocco has signed several regional and international conventions to adequately manage and protect the marine environment. Via the adoption of a specific set of laws, Morocco has largely achieved adequate legal and institutional tools for the appropriate management of coastal areas [127]. Finally, to improve the quality of landscapes, it is necessary to mobilize human and financial resources, be in possession of the legal and institutional tools, desire to protect natural environments, and be open to advanced international experiences.

5. Conclusions

The Moroccan Mediterranean coast, due to its particular geographical location and its privileged climate, constitutes a tourist destination of great attractiveness, and is highly appreciated by many national and international tourists who are interested in the natural beauty of coastal landscapes. An assessment of the Moroccan Mediterranean coasts was carried out using a novel Coastal Scenic Quality Evaluation (CSQE) method. The approach adopted is based on a system of evaluation of coastal landscapes through a set of selected variables and indicators, classified according to the Substratum, Sea-Coastal Area, Vegetation and Scenic Background dimensions. This evaluation system was applied to 50 sites along the Mediterranean coast of Morocco in order to identify the potential for tourism development, to improve the quality of the landscape of each site and to promote the method, which can be easily applied to a great variety of coastal areas.

The results show that Moroccan Mediterranean beaches have a high scenic value (with an average score of 0.6), and constitute a tourist destination of great potential. The Substratum, Sea-Coastal Area and Vegetation dimensions obtained high average quality scores (i.e., 0.6, 0.7), and the Scenic Background dimension obtained a medium quality score (0.5). The presence of urbanized areas, beach litter, and evidence of sewage were the main factors of degradation in Moroccan Mediterranean coastal landscapes, i.e., 15 out of 50 sites (or 30%) presented medium scenic quality, 27 out of 50 (or 54%) presented high scenic quality, and only 8 out of 50 (or 16%) presented very high scenic quality.

Undoubtedly, the maintenance of and increase in such pressures can lead to the degradation of other coastal sites; therefore, adequate and sound planning and management strategies are urgently needed. The results of this study must be taken into account as they represent a powerful tool for the implementation of strategies and management actions from local, regional and national perspectives. In this paper, several sound management interventions have been proposed to improve the landscape quality of the degraded sites, such as the implementation of regular clean-up operations, reductions in rainwater outfalls, the restoration of dunes associated with the implantation of native vegetation, and, last but not least, the use of green engineering solutions versus the emplacement of traditional hard defense structures. These proposed solutions can be of great help to coastal managers and stakeholders in overcoming degradation problems, and in preserving and improving the natural landscapes and favoring a viable mode of integration between tourism activities and natural landscapes along the Moroccan Mediterranean coast.

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