

Chapter 5

AU1

Coastal Scenery Assessment: Definitions and Typology

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Abstract Although scenery is an invaluable asset from any environmental viewpoint, coastal scenery is a lesser-considered aspect of coastal management. Therefore the Coastal Scenic Evaluation System (CSES) technique was developed using fuzzy logic methodology to evaluate the adverse effects of changes to a coastal environment. The CSES can be used not only for landscape preservation and protection, but also as scientific tool for envisaged coastal management and future development based upon plans by an evidence-based approach. This chapter presents a detailed field guide that includes the steps to follow in making a coastal scenery assessment, as well as, key definitions and examples of all parameters required to use the CSES. The Photo-atlas representing all parameters helps in attributing them to the correct grade.

5.1 How to Use the Coastal Scenic Evaluation System (CSES)

The coastal scenery assessment is carried out by means of a five scale attribute rating system that evaluates 18 physical and 8 human parameters defined into the “Coastal Scenic Evaluation System” (Table 5.1; see Chap. 4 for a detailed discussion of this table).

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Table 5.1 Coastal Scenic Evaluation System (Ergin et al. 2004)

N	Physical Parameters		Rating				
			1	2	3	4	5
1	Cliff	Height (<i>H</i>)	Absent	5 m ≤ <i>H</i> < 30 m	30 m ≤ <i>H</i> < 60 m	60 m ≤ <i>H</i> < 90 m	<i>H</i> ≥ 90 m
2		Slope	<45°	45°–60°	60°–75°	75°–85°	Circa vertical
3		Special features ^a	Absent	1 special feature	2 special features	3 special features	Many >3
4	Beach face	Type	Absent	Mud	Cobble/boulder	Pebble/gravel	Sand
5		Width (<i>W</i>)	Absent	<i>W</i> < 5 m or <i>W</i> > 100 m	5 m ≤ <i>W</i> < 25 m	25 m ≤ <i>W</i> < 50 m	50 m ≤ <i>W</i> ≤ 100 m
6		Colour	Absent	Dark	Dark tan	Light tan/bleached	White/gold
7	Rocky shore	Slope	Absent	< 5°	5°–10°	10°–20°	> 20°
8		Extent	Absent	< 5 m	5 m–10 m	10 m–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	Stream (< 1 m)	Stream (1 m–4 m)	>4 m
12	Skyline landforms		Not visible	Flat	Undulating	Highly undulating	Mountainous
13	Tides		Macro (>4 m)		Meso (2 m–4 m)		Micro (<2 m)
14	Coastal landscape features ^b		None	1 feature	2 features	3 features	>3 Features
15	Vistas		Open on one side	Open on two sides		Open on three sides	Open on four sides
16	Water colour & clarity		Muddy Brown/Grey	Milky blue/green; opaque	Green/Grey blue	Clear blue/dark blue	Very clear turquoise
17	Vegetation cover		Bare (< 10% vegetation only)	Scrub/Garigue/grass (marram/ferns, bramble/meadow, etc)	Wetland/meadow	Coppices, Maquis (mature trees bushes)	Variety of mature trees/mature natural cover
18	Vegetation debris		Continuous >50 cm high	Full strand line	Single accumulation	Few scattered items	None

Human parameters						
19	Disturbance factor (noise)	Intolerable	Tolerable		Little	None
20	Litter	Continuous accumulations	Full strand line	Single accumulation	Few scattered items	Virtually absent
21	Sewage (discharge evidence)	Sewage evidence		Some evidence		No evidence of sewage
22	Non-built environment ^c	None		Hedgerow/terracing/monoculture		Field mixed cultivation ± trees/natural
23	Built environment ^d	Heavy industry	Heavy tourism and/or urban	Light tourism and/or urban and/or sensitive industry	Sensitive tourism and/or urban	Historic and/or none
24	Access type	No buffer zone/heavy traffic	Buffer zone/light traffic		Parking lot visible from coastal area	Parking lot not visible from coastal area
25	Skyline	Very unattractive	Unattractive	Sensitively designed high/low	Very sensitively designed	Natural/historic features
26	Utilities ^e	>3 utilities	3 utilities	2 utilities	1 utility	None

^aCliff special features: Indentation, banding, folding, scree, irregular profile, etc.

^bCoastal landscape features: Peninsulas, rock ridges, irregular headlands, arches, windows, caves, waterfalls, deltas, lagoons, islands, stacks, estuaries, reefs, fauna, embayment, tombola, etc.

^cNon-built environment: When there is no agricultural activity.

If the natural vegetation cover parameter (17) has scored a 5, then tick 5 box here.

If the natural vegetation cover parameter (17) has scored 2, 3, 4 then tick 3 box here.

^dBuilt environment: Caravans will come under tourism, grading 2: Large intensive caravan site, grading 3: Light, but still intensive caravan sites, grading 4:

Sensitively designed caravan sites

^eUtilities: Power lines, pipelines, street lamps, groins, seawalls, revetments, etc.

To fill in the scenic evaluation checklist an assessor visits a specific coastal location between 10 am and 3 pm under normal weather conditions for the site and over a 100 m range along the site ticks off relevant parameter boxes given in Table 5.1. This allows determination of the site state according to its current attributes.

As an example, the Valley parameter has five attributes: absent, dry valley, stream (width <1 m), stream (width 1 m–4 m) and river (width >4 m). A coastal site with a dry valley would be scored as 2; a site with a river would be scored as 5. Although some parameters can be easily quantified (such as beach width, number of utilities etc.), several used in this classification are subject to the perception over the coastal site, e.g. water colour, built environment, that is why it is semi –quantitative. The background to Table 5.1 (see Chap. 4) is the key to scenic assessment and given in detail below are definitions and figures corresponding to the parameters given in Table 5.1.

5.2 Parameters, Definition and Scoring

(Numbers identifies parameters both on Table 5.1 and the Photo-atlas in the appendix of this chapter).

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1–3 Cliff

Is a steeply (>45°) sloping surface where elevated land (>5 m) meets the shoreline. These two items are mandatory (>5 m in height and a slope >45°) and may be composed of rock and/or unconsolidated material or boulder clay.

1 Cliff Height is measured from the base or from the water line to the slope break (where slope is <45°).

2 Cliff Slope The slope angle depends on a variety of factors including jointing, bedding and hardness of the cliff materials, as well as the erosional processes.

3 Cliff Special Features Can Include: Banding, when cliffs are composed of various layers e.g. rock sedimentation units (i.e. alternate shale and limestone), or as well as, volcanic basalt layers and all undergo differential erosion.

Various **colours** can differentiate the rock bands.

Faulting. Where Earth movements have displaced individual rock units a line can be seen (fault line) which has shifted layers on either side.

Folding. Where rocks have been under pressure and folded to accommodate the pressure. Folding can be gentle with a long wavelength to very severe with short tight wavelengths.

Gullying. In unconsolidated material rain action can erode material forming deep rills and then gullies.

Indentation. The shape/orientation of the cliff. It could be straight or curved, the greater the curvature the more highly indented is the cliff.

Scree/talus. Accumulation of rock material at the foot of, or mantling cliff slopes.

Tufa. Calcareous material deposits on a limestone cliff face due to water seepage.

Unconformity. A type of discontinuity. It represents a surface between successive strata indicating a missing geological time interval. It could be caused by an interruption in deposition and/or an erosional period followed by renewed deposition.

Dikes. Sheet of rock, usually hard, running across individual strata.

Sill. A tabular intrusion that has intruded between older layers of the cliff.

4–6 Beach Face

A deposit of non-cohesive material sited at the land/water interface and actively worked by waves, currents and sometimes wind.

4 Beach Face Type Type relates to the non-cohesive material composing the beach e.g. **mud, sand, gravel, pebbles**. Mixed sediment beaches (sand + gravel; gravel + pebbles) are frequent; the dominant sediment must be considered.

5 Beach Face Width (W) is the area between the water's edge and the back of a beach. The latter could be a wall, dune, building etc. The dry beach represents the area from high tide to rear of beach; intertidal zone equates to the low to high tide area. Measurement should be from the low **tide** position.

6 Beach Face Color (e.g. **black, tan, white**, etc.) perceived by the human eye under full sun illumination.

7–9 Rocky Shore

Intertidal area in front of a cliff where physical processes (cliff retreat/wave action and/or haloclasty) predominates, usually producing a gentle sloping/horizontal rock platform.

7 Rocky Shore Slope average slope measured from cliff face to the platform edge.

8 Rocky Shore Extent Width is its extent from a cliff face to the platform edge.

9 Rocky Shore Roughness is the degree of pitting on the surface, which varies from rough to smooth.

10 Dunes

An accumulation of wind-blown sand on the backshore, usually as small hummocks and swales, which tend to be stabilized by vegetation or control structures.

Fore-dunes represent the main dune adjacent to the beach frequently termed yellow dunes.

Secondary dune ridges are located behind the foredune and represent old fore-dunes that have been colonised by plants as the dune system extends seawards.

There may be several ridges and these are loosely called grey dunes.

11 Valley

A valley is a V or U shaped landscape feature formed by flowing water. If no water is present, it is termed a **dry valley**. If water is present the valley form can range from a small stream (<1 m) to a large river (<4 m). In fjord areas, glacial activity will have scoured the pre-existing river valley to a U shape.

12 Skyline Landforms

Looking landward the relief form can be estimated, i.e. **flat**, **undulating**, **highly undulating** or **mountainous**.

13 Tides

These are the result of the alternating rise and fall in sea level in oceans and seas produced by the gravitational attraction of the sun and more importantly, the moon. Tidal range refers to the height difference between the highest and lowest spring tide. The range for **Micro** tides is <2 m, **Meso** 2-4 m and **Macro** > 4 m.

14 Some Coastal Landscape Features

Distinctive forms related to erosional and/or depositional processes. A **Peninsula/headland** is an area of land surrounded by water for the majority of its perimeter, but is connected to the **mainland**, i.e. it is land surrounded by water on three sides.

A **bay** is a recessed, **coastal** water body that connects directly to a larger main body of water, such as an **ocean**, **lake**, or another bay, i.e. it is surrounded by land on three sides and can be large or small.

A **cave** is a hollow in a cliff face that is caused usually by combinations of wave action, rock slippage, weathering, faulting, etc. Where a **cave** breaks through a cliff headland it forms an **arch**.

A **lagoon** is a shallow body of salt/fresh water separated from a larger body of water by **barrier islands**, shingle beaches, **reefs** or similar structures with an entrance to the sea.

A **sandbank** is a **raised area** of **sand** below the sea **surface** that can only be **seen** when the **water level** is at low **tide**.

A **sandbar** is permanently under water.

A **stack** is a steep, often vertical, sided column of rock rising from the sea. When part of a headland is **eroded** by **hydraulic action** and weathering, this can cause later collapse, forming free-standing stacks. Collapse of an **arch** can produce the same result.

A **tombolo** is a narrow depositional landform (usually sand or shingle) which connects an island to the mainland.

A **delta** is a low lying coastal plain of alluvial deposit protruding into the sea with a variety of shapes.

An **estuary** is a partially enclosed coastal body area of brackish water that has one or more rivers or streams flowing into it, i.e. it is the transition zone between salt/fresh water.

A **reef** is a hard structure located at or close to sea level. It can be a degraded **stack** or a narrow rock longshore barrier due to erosion and/or biogenic construction (corals, vermetids, etc.).

A **window** occurs if **cave(s)** carves through a headland above the water line resulting in a hole through the cliff.

15 Vistas

Are related to the line of sight to far off views, as a site could be enclosed on 1, 2, or 3 sides – the 4th side is always open to the sea. A far vista is where the foreground hill has another secondary background feature visible, e.g. a higher hill/mountain.

16 Water Colour & Clarity

The colour of the ocean is determined by interactions of incident light with substances or particles present in the water. The most significant constituents are free floating photosynthetic organisms (phyto-plankton) and inorganic particulates, the more there are of these the less the clarity.

17 Vegetation Cover

Is indicative of the flora of the coastal area vicinity close enough to visually affect a visitor's appreciation of the location. The emphasis is **natural**. Vegetation planted by humans, e.g. along promenades for a buffer zone is discounted.

18 Vegetation Debris

Can be brought to any location via land/sea sources. For example, seaweed (macroscopic, multicellular, marine algae) is a green, brown or dark red plant that grows almost exclusively in shallow waters at the ocean/sea edge or in the inter-tidal area. An excessive amount represents unattractive views to beach users. Similarly in the Mediterranean and other areas *Posidonia oceanica* leaves (a phanerogam), are common debris found on beaches. In tropical areas, sizable rivers bring large amounts of vegetation to the coast as a result of the abundant sun and rain in these locations.

19 Disturbance Factor (Noise)

Noise that may harm the activities developed at a coastal location, e.g. playing loud radio/CD music, jet skis, heavy traffic, airport noise, etc.

20 Litter

This is anthropogenic generated discards. Examples are beer cans, sweet wrappers, plastic bags, etc. along the beach, mostly found at the strand line or back of the beach. An accumulation represents these materials found in a mound.

21 Sewage (Discharge Evidence)

Relates to human/animal waste products, as well as its associated accessories, e.g. **sewage pipes** draining to beach, **condoms**, **tampon applicators**, **nappies**, etc.

22 Non-built Environment

The environment as seen minus its buildings. It relates to field patterns, agricultural, practices, etc.

23 Built Environment

Relates to any environment that includes anthropogenic structures, e.g. heavy/light industries, buildings, etc.

24 Access Type

A buffer zone is an area that divides two separate entities. For example, a tree lined promenade, or a natural grass area that separates a beach from a coastal road.

25 Skyline

The skyline silhouette of buildings that are or not in harmony with the environment, e.g. if building lines of the same height and blend into the environment. Discord exists if they stand out from the surroundings. If no buildings can be seen, then the area is in a natural state and attribute 5 is ticked in Table 5.1.

26 Utilities

These include items such as power lines, telephone lines/poles, lighting, communication masts, railways, etc.

5.3 Photo-Atlas

CSES usage needs some training, at least for those parameters whose rating is not sharply numerically delimited. Whereas *e.g.* Cliff slope, Beach width and Tidal range can be easily estimated, other parameters, *e.g.* Vegetation debris amount, Built environment quality and Skyline attractiveness assessment could be more debatable.

To assist surveyors, in the following Appendix photographs of each parameter/value is reported, which may be used as reference cases. Ratings for those sceneries have been assessed on the basis of the experience done during the last few years, when approximately 1000 locations were assessed in different countries/continents by the authors of this book.

5.4 Conclusions

Coastal areas of the world are under threat due to the forcing function of people who flock to the coast for habitation and/or recreation. This squeeze affects an extremely strategic asset – coastal scenery itself.

Coastal managers together with planners need coastal landscape inventories in order to base sound management decisions on ascertained facts. Today, most scenic assessments have been carried out on a subjective basis. Instructions to surveyors are necessary as well, since not all the parameters are numerically measurable and experience helps in obtaining their correct rating.

A Photo-Atlas showing all the 26 considered parameters (comprising physical, and human parameters) on which the CSES is based together with their ratings is provided. This gives surveyors an instrument in which to perform CSES via visual matching with landscapes evaluated by the authors of this book, as a first step in quantifying beautiful coastal scenery. These parameters were obtained by consultation with coastal experts and beach users. Each parameter was rated on a five-point scale, essentially covering presence/absence or poor quality (1), to excellent/outstanding (5).

Although parameter grading maintains a margin of uncertainty, data processing via fuzzy logic produces reliable results and the method has been proved to be robust.

The checklist presented and explained was designed to have a universal applicability with respect to coastal scenery. The goal of defining beauty may be illusory, but the pursuit of quantifying beauty is a worthwhile goal.

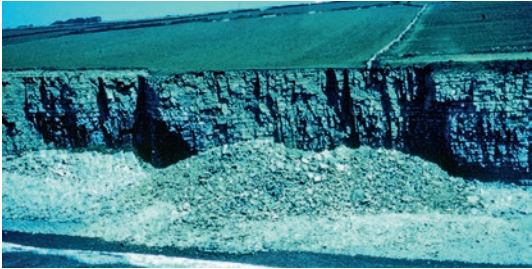
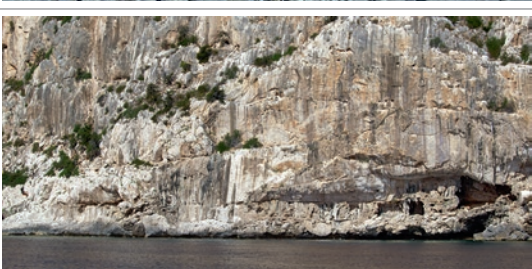
Appendix: Photo Atlas

	1 Cliff height (H) 1: Absent (< 5 m)
	2: $5\text{ m} \leq H < 30\text{ m}$
	3: $30\text{ m} \leq H < 60\text{ m}$
	4: $60\text{ m} \leq H < 90\text{ m}$
	5: $H \geq 90\text{ m}$

(continued)

	2 Cliff slope 1: $< 45^{\circ}$
	2: $45^{\circ}-60^{\circ}$
	3: $60^{\circ}-75^{\circ}$
	4: $75^{\circ}-85^{\circ}$
	5: Circa vertical

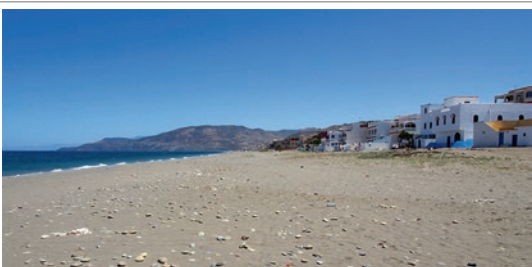
(continued)

	3 Cliff special features 1: Absent
	2: 1 special feature (e.g. rock fall)
	3: 2 special features (e.g. banding and terracing)
	4: 3 special features (e.g. banding, jutting cliff, rock fall)
	5: Many >3 (e.g., irregular profile, notch, banding, folding)

(continued)

	4 Beach type 1: Absent
	2: Mud
	3: Cobble/boulder
	4: Pebble/gravel
	5: Sand

(continued)

	5 Beach face width (<i>W</i>) 1: Absent
	2: < 5 m or > 100 m
	3: $5\text{ m} \leq W < 25\text{ m}$
	4: $25\text{ m} \leq W < 50\text{ m}$
	5: $50\text{ m} \leq W \leq 100\text{ m}$

(continued)

	6 Beach face colour 1: Absent
	2: Dark
	3: Dark tan
	4: Light tan/bleached
	5: White/gold

(continued)

	7 Rocky shore slope
	1: Absent
	2: < 5°
	3: 5°–10°
	4: 10°–20°
	5: > 20°

(continued)

	8 Rocky shore extent 1: Absent
	2: < 5 m
	3: 5 m – 10 m
	4: 10 m – 20 m
	5: > 20 m

(continued)

	9 Rocky shore roughness 1: Absent
	2: Distintly jagged
	3: Deeply pitted and/or irregular (uneven)
	4: Shallow pitted
	5: Smooth

(continued)

	10 Dunes
	1: Absent
	2: Remnants
	3: Fore-dune
	4: Secondary ridge
	5: Several

(continued)

	11 Valley
	1: Absent
	2: Dry
	3: Stream (< 1 m)
	4: Stream (1 m – 4 m)
	5: > 4 m

(continued)

	12 Skyline landforms 1: Not visible
	2: Flat
	3: Undulating
	4: Highly undulating
	5: Mountainous

(continued)

		13 Tide
		1: Macro (> 4 m)
		2: Meso (2 m – 4 m)
		3: Micro (< 2 m)
		14 Coastal landscape feature
		1: None
		2: 1 Feature (e.g. blowhole)

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(continued)

	3: 2 Features (stack and shoals)
	4: 3 Special features (e.g., caves, pinnacles, emayment)
	5: > 3 Features (e.g. irregular headlands, stacks, islands, shoals)
	15 Vista 1: Open on one side
	2: Open on two sides

(continued)

	4: Open on three sides
	5: Open on four sides
	16 Water colour 1: Muddy brown/Grey
	2: Milky blue/green; opaque
	3: Green/Grey blue

(continued)

	4: Clear blue/dark blue
	5: Very clear turquoise
	17 Natural vegetation cover 1: Bare (< 10% vegetation only)
	2: Scrub/Garigue/grass (marram,/ gorse/ferns, bramble/meadow, etc.)
	3: Wetlands/meadow

(continued)

	4: Coppice, Maquis (mature trees bushes)
	5: Varsity of mature trees/mature natural cover
	18 Vegetation debris 1: Continuous >50 cm high
	2: Full strand line
	3: Single accumulation

(continued)

	4: Few scattered items
	5: None
	19 Noise disturbance 1: Intolerable (e.g. loud music from speakers)
	2: Tolerable (e.g. rowded but no speakers)
	4: Little (e.g. not crowded and without speakers; small communication lines)

(continued)

	5: None (e.g. few or scattered people without radios, etc.)
	20 Litter 1: Continuous accumulations
	2: Full strand line
	3: Single accumulation
	4: Few scattered items

(continued)

	5: Virtually absent
	21 Sewage discharge 1: Sewage evident
	3: Some evidence
	5: No evidence of sewage
	22 Non built environment 1: None

(continued)

	3: Hedgerow/terracing/ monoculture
	5: Field mixed cultivation +/- trees/natural
	23 Built environment 1: Heavy industry
	2: Heavy tourism and/or urban
	3: Light tourism and/or urban and/or sensitive sensitive industry

(continued)

	4: Sensitive tourism and/or urban
	5: Historic and/or none
	24 Access 1: No buffer zone/heavy traffic
	2: Buffer zone/light traffic
	4: Parking lot visible from coastal area

(continued)

	5: Parking lot not visible from coastal area
	25 Skyline 1: Very unattractive
	2: Unattractive
	3: Sensitive designed high/low
	4: Very Sensitive designed

(continued)

	5: Natural/historic features
	26 Utilities 1: > 3 Utilities (e.g. slipway, handrails, electricity poles, sewage outfall)
	2: 3 Utilities (e.g. groins, electricity poles, railway)
	3: 2 Utilities (e.g. groin, lifeguard tower)

(continued)

	4: 1 Utility (e.g. tetrapods)
	5: None

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