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COASTAL SCENIC ASSESSMENT IN PANGANDARAN DISTRICT, WEST JAVA PROVINCE, INDONESIA

Ankiq TAOFIQUROHMAN*
Universitas Padjadjaran, Faculty of Fisheries and Marine Sciences, Marine Department, Bandung, Indonesia, e-mail: ankiq@unpad.ac.id,

Sheila ZALLESA
Universitas Padjadjaran, Faculty of Fisheries and Marine Sciences, Marine Department, Bandung, Indonesia, e-mail: sheila.zallesa@unpad.ac.id

Ibnu FAIZAL
Universitas Padjadjaran, Faculty of Fisheries and Marine Sciences, Marine Department, Bandung, Indonesia, e-mail: ibnu.faizal@unpad.ac.id

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Abstract: This study aims to classify the ten coasts of the Pangandaran District using the Coastal Scenic Evaluation System (CSES). The CSES objectively assesses coastal characteristics and is rarely used in Southeast Asia, especially Indonesia. Pangandaran District was chosen in this study because it is part of a National Tourism Strategic Area in Indonesia, especially for marine tourism, which means it is at risk of physical changes to the environment due to the growth of tourism. The study results show that most coasts were classified as natural, but Class 1, as the top natural, was not obtained. The low quality of the scenery is because its physical parameters are lower than its human parameters. In order to improve the quality of the scenery, it can be done by handling garbage and waste, setting up utilities' development, and zoning for tourism types.

Key words: CSES, coastal, coast, beach, scenic, scenery, physical parameter, human parameter, Pangandaran

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INTRODUCTION

The natural scenery along the coast is one factor that attracts tourists. Tourists can get a great impression of coastal areas with white sand beaches, clear water, breezes, and gentle waves (Kenchington, 1993; Nickerson et al., 2016). The natural coastal scenery is the key to tourists' satisfaction and loyalty (Chi and Qu, 2008; Kirillova et al., 2014; Robert, 2018). At first, coastal scenery was judged by how people thought the coasts looked (Morgan, 1999; Morgan and Williams, 1999; Williams and Lavalle, 1990). Ergin et al. (2004) offer a technical evaluation of coastal scenery based on 26 parameters (18 physical and 8 human parameters) and a fuzzy method for determining how much each parameter matters. This method was initiated as the Coastal Scenic Evaluation System (CSES). Physical parameters in CSES include coastal geomorphology and oceanography, while human parameters are anthropogenic impacts. The CSES is a valuable assessment method because it objectively evaluates coastal characteristics (Cristiano et al., 2018). 952 coastal sites have been assessed using the CSES from 2004 to 2018, and most of the coastal sites assessed are in the Americas and Europe. For the Southeast Asia region, the assessment was only carried out on two coasts in Vietnam (Anfuso et al., 2019).

As a tropical country, the beaches in Indonesia have white sand and abundant sunshine. This condition demonstrates the natural value of the coast and is essential for attracting tourists from the middle latitudes (Mestanza-Ramón et al., 2020). The Indonesian tourism industry continues to be developed to become the leading national economic sector based on the development of natural and cultural resources, with the coastal areas being the main tourism resource for Indonesia; therefore, many of Indonesia's coastal areas are developed for tourism (Antara and Sumarniasih, 2017; Bottema and Bush, 2012; Briandana et al., 2018; Hakim et al., 2018; Hengky and Kikvidze, 2021; Kurniawati et al., 2022; Rosadi et al., 2022; Tranter et al., 2022). For example, the southern coast of West Java, which is administratively under the Province of West Java and part of the southern coast of Java, is one of the areas developed as a natural tourist destination because it has the potential for natural resources from its geomorphological diversity, such as mountains, cliffs, caves, waterfalls, and white sand beaches, so that it is also prioritised as an area for environmental protection and cultural conservation (Putri and Supriatna, 2021; Rizal et al., 2020; Syaifudin and Hendarmawan, 2022; Zuvara et al., 2022). On the other hand, the southern coast of West Java, as well as the entire southern coast of Java facing the Indian Ocean, has higher wave energy and steeper shores than the coasts that do not face the Indian Ocean (Aji et al., 2021; Rizal et al., 2019; Wahyudie et al., 2020). This condition causes the coastal area not to be developed into a port city, so it remains in a rural and natural condition.

One of the regions in the south of West Java that is a favourite marine tourism destination and is prioritised to support national tourism is the Pangandaran District. Pangandaran District has also been designated as a National Tourism Strategic Area, a designation given to regions that either have tourism as their primary function or have the potential to develop

* Corresponding author

national tourism. As a result, Pangandaran District has designated it as a "Coastal Tourism City" (Rizal et al., 2021).The economic potential of Pangandaran District is greatly affected by marine and coastal resources like fishing and tourism, especially marine tourism (Putri et al., 2020). Changes in the environment, both social and physical, may result from the development of tourist areas along the coast, and this is possible in the Pangandaran District. In general, studies that discuss the potential and problems of tourism in Pangandaran mostly focus on human parameters and legal aspects, such as information and marketing (Nugraha, 2019; Rudiana, 2018; Sujatna et al., 2019), rural tourism community development (Astuti, 2021; Damayani et al., 2021; Komariah et al., 2018; Subekti et al., 2022), tourism impact on nature reserves (Komsary, 2018; Panuntun, 2020), legal aspects (Kurniati et al., 2019, 2020). In fact, the potential for marine tourism is influenced by the naturalness of the coastal scenery, and conversely, the development of marine tourism affects the coastal scenery.

Several studies have used CSES to determine the level of naturalness of the coasts and the factors that influence the level of naturalness, such as that conducted by Cristiano et al. (2020) in De Noronha Island, Brazil, where the study revealed that some coasts are extremely beautiful, but that this beauty is being diminished by human actions and seasonal changes in physical parameters. Mooser et al. (2021) utilised CSES to conduct research on the Mediterranean Coast in Spain. The results indicated that physical parameters such as waves, tides, sea level, and storms affect the degree of naturalness of the coast, while tourism and urbanisation are examples of human pressure. On the coasts of Bulgaria, Mooser et al. (2022) discovered that natural processes have a greater impact than human influences and that half of the coasts are extremely sensitive to these natural processes. Er-ramy et al. (2022) use CSES to determine how much the Moroccan Mediterranean coast has deteriorated due to human activity. The research using CSES on the Purba Medinipur District in India by Chatterjee et al. (2022) illustrates that the coastlines have lost a significant amount of scenic quality. This is due to the rapid degradation of the physical environment caused by coastal tourism and poor management policies.

Due to its development as a marine tourist destination, the coastal Pangandaran District may lose some of its natural appearance. Therefore, this study aims to measure the natural level of coastal scenery along the coasts of Pangandaran District using CSES. Another objective is to determine which parameters have the most influence on the Pangandaran coastal scenery. Also, because there haven't been many CSES studies on Indonesia's coasts, it is hoped that this research will provide the initial information needed to evaluate the coastal scenic in Indonesia or other coastal areas with similar conditions.

MATERIALS AND METHODS

Areas of Interest (AoI)

The local government has classified some of the coasts in Pangandaran as the main tourist destinations. In this study, AoI focused on ten popular tourist destinations along the coast. The positions and names of the coasts are illustrated in Figure 1. The CSES is a checklist procedure applied to 26 different parameters. Each parameter is assigned a value ranging from the lowest (1) to the highest rating (5), as in Table 1. Ratings 1 and 2 are regarded as poor, rating 3 as medium, and ratings 4 and 5 as excellent (Pranzini et al., 2019). A fuzzy logic assessment method was used in CSES to estimate vagueness, uncertainty, and errors in assessment parameters as well as uncertainties and subjective statements (Williams et al., 2012).

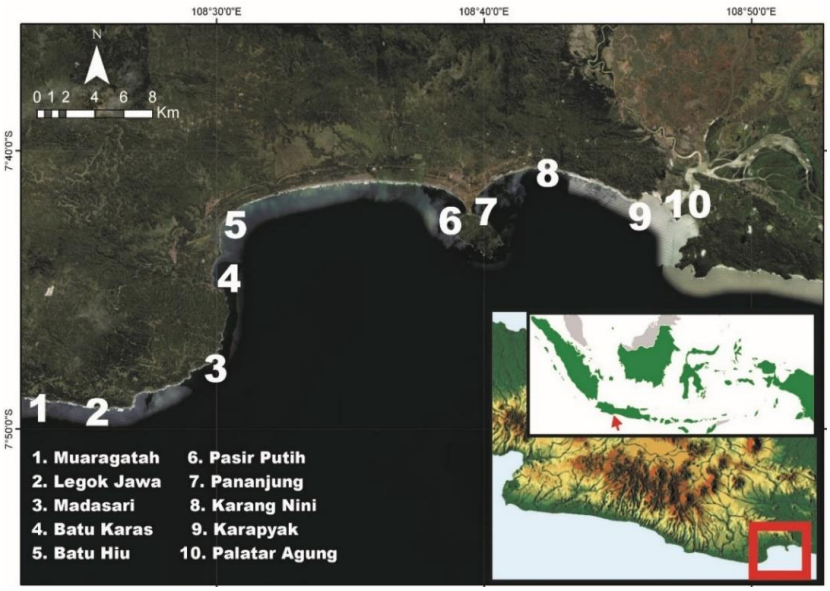


Figure 1. The positions and names of the coasts of the AoI (Source: modified from Google, n.d.)

Method and Analysis

The CSES results are represented by the histograms, the curve, and the evaluation index (D). The first result is a scenic assessment histogram, which gives a visual summary of each of the 26 parameter ratings and is a handy way to compare each parameter. The second histogram shows weighted averages vs. attributes of physical and human parameters. The third is the membership degree vs. attribute curve, which provides a general scenic assessment. The interpretation of the curve is based on the skew. If the membership degree vs. attribute curve displays right-hand skew (RHS), it indicates a high scenic quality, whereas if it demonstrates left-hand skew (LHS), it implies a low scenic quality (Ergin et al., 2004). The final result of the CSES is the evaluation index (D), which categorises the coastal scenery into five different classes (Table 2). The steps of the CSES methodology are depicted in Figure 2 as a flowchart. Examples of histograms and curves are shown in Figure 3. In the CSES, there are ratings and attributes. Rating is the value of each parameter, while an attribute is the overall rating condition for the weighted average and membership degree. For further information and a complete explanation of the CSES theory, see Ergin (2019) and Ergin et al. (2004, 2011).

RESULT AND DISCUSSION

According to the CSES calculation, the coasts in AoI are classified as Classes 2 to 5. To generate Class 1, at least three-

quarters of all parameters, including the top five, must be in excellent condition (4 or 5 ratings), which is not the case on all coasts in AoI. The top five rated parameters from 485 respondents' perception studies were coastal landscape features, water colour and clarity, absence of noise, absence of sewage and litter, and absence of utilities with a natural skyline (Ergin et al., 2004). Observations show that only Karang Nini and Palatar Agung have impressive skylines without utility.

Table 1. Coastal Scenic Evaluation System (Source: Ergin, 2019)

No	Physical Parameters		Rating				
			1	2	3	4	5
1	Cliff	Height (*H*)	Absent (< 5 m)	5 m ≤ *H* < 30 m	30 m ≤ *H* < 60 m	60 m ≤ *H* < 90 m	*H* ≥ 90 m
2		Slope	< 45°	45° – 60°	60° – 75°	75° – 85°	Circa vertical
3		Special features	Absent	1 special feature	2 special features	3 special features	Many >3 special features
4	Beach face	Type	Absent	Mud	Cobble/boulder	Pebble/gravel	Sand
5		Width (*W*)	Absent	*W* < 5 m or *W* > 100 m	5 m ≤ *W* < 25 m	25 m ≤ *W* < 50 m	50 m ≤ *W* ≤ 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	Foredune	Secondary ridge	Several
11	Valley		Absent	Dry	Stream (< 1 m)	Stream (1 m – 4m)	> 4 m
12	Skyline landforms		Not visible	Flat	Undulating	Highly undulating	Mountainous
13	Tides		Macro (> 4 m)		Meso (2 m – 4m)		Micro (< 2 m)
14	Coastal landscape features		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, 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 accumula-tion	Few scattered items	None
No	**Human Parameters**		**Rating**				
			1	**2**	**3**	**4**	**5**
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 sewage evidence		No evidence of sewage
22	Non-built environment		None		Hedgerow/terraci ng/ Monoculture		Field mixed cultivation ± trees/natural
23	Built environment		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	Un-attractive	Sensitively designed	Very sensitively designed	Natural/ historic features
26	Utilities		>3 utilities	3 utilities	2 utilities	1 utilities	None

Table 2. The evaluation index of coastal scenery (Source: Ergin, 2019)

Class	D values	Coastal scenery condition
1	D ≥ 0.85	Top natural: Extremely attractive sites with very high landscape value
2	0.85 > D ≥ 0.65	Natural: Attractive sites with high landscape value
3	0.65 > D ≥ 0.40	Natural: Average sites with medium landscape value
4	0.40 > D ≥ 0.00	Mainly urban: Unattractive sites with medium landscape value and light development
5	D < 0.00	Urban: Poor sites with low landscape value and intensive development

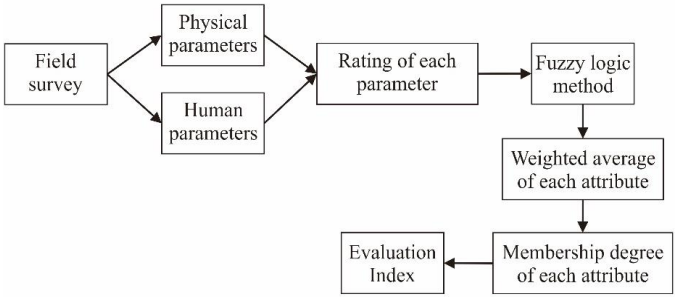
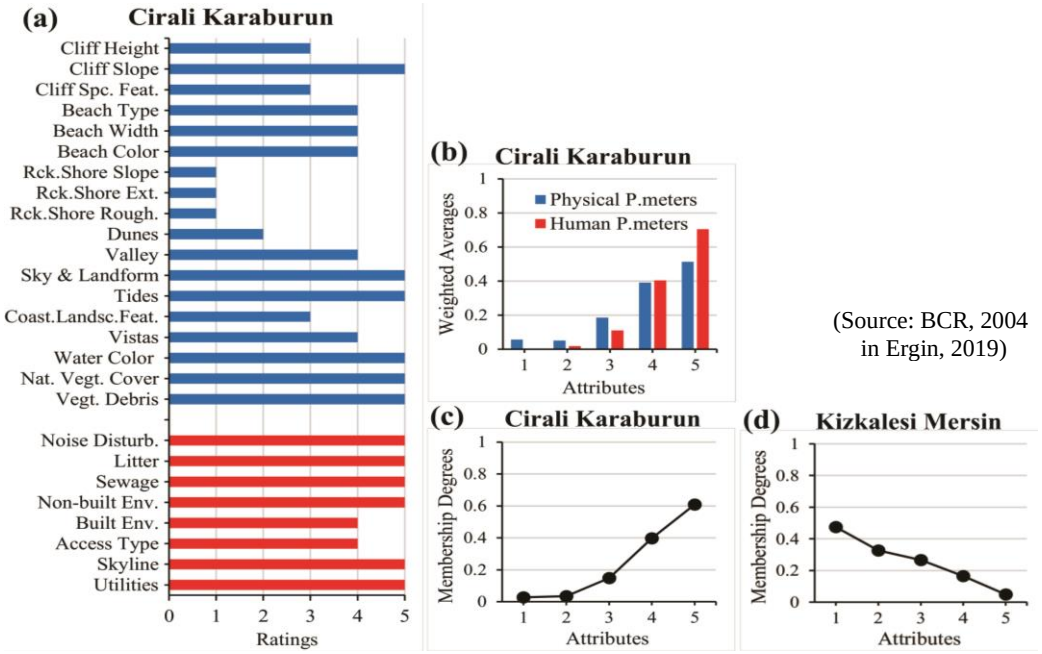


Figure 2. The steps of the CSES methodology



(Source: BCR, 2004 in Ergin, 2019)

Figure 3. The examples of histograms and curves of the CSES result in Karaburun and Mersin, Turkey (a) The histogram of scenic assessment, (b) The histogram weighted averages vs. attributes, (c) The RHS and (d) The LHS of the curve of membership degree vs. attribute

Figure 4. The example of the dominant physical and human parameters in AoI (a) The wide beach is dominated by dark tan sand with mature trees bushes, (b) The water is a greyish blue, (c) The few buildings near the beach (Source: Author, 2022)

Figure 5. The appearance of coastal landscape features in Class 2 (a) The rock ridge in Karang Nini, (b) The tidal pool in Karang Nini, (c) The stacks in Madasari, (d) The wave crashes in Madasari, (d) The reefs in Madasari (Source: Author, 2022)

Pasir Putih, Karapyak, and Muaragatah have the most transparent water in tidal pools where the tides are trapped on reefs. Almost all coasts have no sewage, except for Pananjung. Even though there is no sewage, some coasts still have scattered litter. The daily presence of litter in AoI is classified into a few scattered conditions due to certain officers'

routines of picking up litter. In general, the similarities in the physical parameter ratings of the coasts in AoI are the absence of high cliffs (except in Palatar Agung). The beaches are wide and dominated by dark tan sand. Dunes are only found up to the foredune, mature tree bushes dominate the coastline, the skyline tends to be flat to undulating, the views are open on two or three sides, and almost all the waters are greyish blue or clear blue with meso tidal types. According to human parameter ratings, AoI is predominantly used for light tourism, with few buildings visible from the skyline and rarely apparent litter and sewage. Some of the appearances of physical and human parameters in AoI are shown in Figure 4.

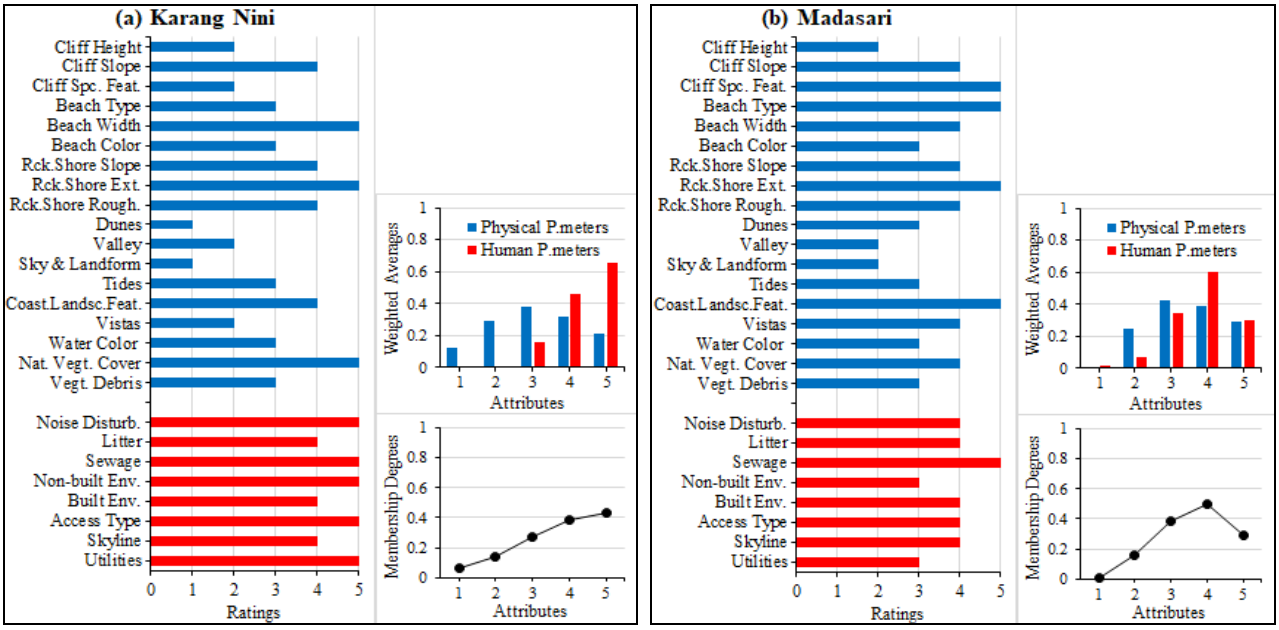


Figure 6. The CSES results for Class 2

Figure 7. The appearance of some physical and human parameters in Class 3 (a) Cloudy brown water in Palatar Agung, (b) Tourists visiting Pasir Putih use small boat engines, (c) The beach near the buffer zone in Karapyak, (d) The small port for non-engine boats in Muaragatah (Source: Author, 2022)

Class 2

The coasts of category Class 2 are Karang Nini (D = 0.7) and Madasari (D = 0.67). The two coasts are classified as natural with attractive sites with high landscape value, especially because they have varied coastal landscape features. These coasts have coastal landscape features, including rock ridges, tidal pools, stacks, wave crashes, and reefs (Figure 5).

The scenic assessment histogram of human parameters shows Karang Nini and Madasari are dominated by ratings of 4 and 5, so the coastal conditions are quiet and clean, with few buildings. This condition exists because the coast's position is far from residential areas. According to the weighted averages vs. attributes graph, both of the coasts have high weighted average values on attributes 4 and 5. The skewness of the membership degrees vs. attribute graphic can be classified as

RHS (high scenic quality), which is indicated by a curve that continues to rise in proportion to the attribute value.

Even though the value of the membership degree from attributes 4 and 5 goes down on Madasari's curve, the high value of attribute 4 increases the curve, so it is still categorised as the RHS. The CSES results for this class are presented in Figure 6.

Class 3

This class is classified as natural with an average site, which has medium landscape value and dominates in AoI. The coasts with this class include Palatar Agung (D = 0.41), Pasir Putih (D = 0.62), Karapyak (D = 0.41), and Muaragatah (D = 0.41). In Class 3, attributes 1 and 2 begin to increase. Among the coasts in Class 3, Palatar Agung and Pasir Putih have lower physical parameters than human parameters, and even Palatar Agung has poor water colour and clarity with cloudy brown water. Palatar Agung's poor colour and clarity are due to its location at the Citanduy watershed outlet, which has long experienced high erosion (Malawani et al., 2020). On the other hand, Pasir Putih, Karapyak, and Muaragatah have excellent water clarity in the reef areas that form tidal pools. Palatar Agung and Pasir Putih are not near the residential areas, but Pasir Putih is a popular tourist destination in Pangandaran District because it has white sand and excellent water clarity. The tourists will come and use a small engine boat to get to Pasir Putih. As a result, the noise and disturbance conditions are tolerable (rating 2). The poor condition of these ratings causes Pasir Putih to be in Class 3.

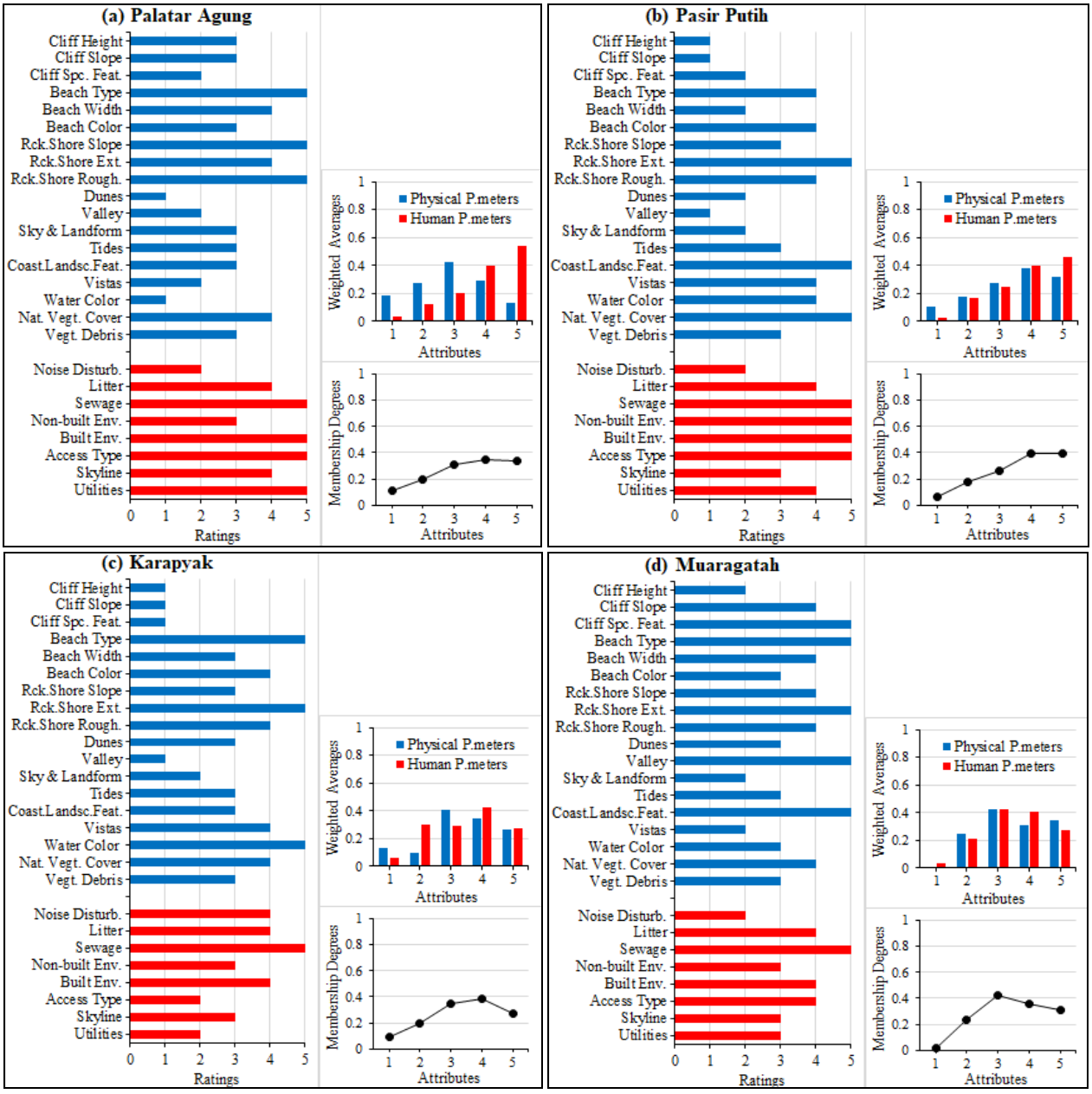


Figure 8. The CSES results for Class 3

Meanwhile, Karapayak and Muaragatah are located near residential areas, and their physical parameter ratings are relatively the same as human parameters. Muaragatah has a wide valley and serves as a small port for non-engined boats. Figure 7 shows the appearance of some physical and human parameters in Class 3. Class 3's weighted averages vs. attributes graph shows decreases in attributes 4 and 5. These coasts have medium scenic quality, but their membership degrees vs.

attribute curves can be divided into two groups. Palatar Agung and Pasir Putih have a gentle and constant curve at attributes 3 to 5. Meanwhile, the curves of Muaragatah and Karapyak are steep at the beginning of the attribute but then decrease for attribute 5. The shape of the Karapyak curve is almost similar to the Madasari curve (Class 2), but Karapyak has a smaller weighted average value on attributes 4 and 5 compared to Madasari. Figure 8 displays the results of the CSES for this class.

Class 4

This class included Batu Hiu (D = 0.17) and Legok Jawa (D = 0.33). These two coasts are mainly urban, with unattractive sites that have medium landscape value and light development. This is because they are close to residential areas, and none of the top five parameters has a maximum rating. At Batu Hiu, rock cliffs have become an icon of this coast, and some of the dunes have been converted into semi-permanent structures for tourism.

Meanwhile, Legok Jawa is the coast that serves as a venue for equestrian sports activities and is close to the buffer zone. However, this area does not have many permanent or semi-permanent buildings. This coast's advantage is the open vistas on all four sides. At the same time, the dunes have been transformed into pedestrian to facilitate sporting activities. Figure 9 represents some of the physical and human parameters in Class 4. When sporting events are held at Legok Jawa, issues such as litter, noise, and disturbances worsen, resulting in a low rating. However, these occurrences are uncommon. Sports and cultural activities are usually carried out two or three times a year, such as on the anniversary of independence or religious holidays, so the daily noise levels are relatively low. The membership degree curve vs. attribute graphic curve can be classified as LHS (low scenic quality). The results of the CSES for this class are shown in Figure 10.

Figure 9. The appearance of some physical and human parameters in Class 4 The rock cliff icon of Batu Hiu, (b) The semi-permanent structures in Batu Hiu's dunes, (c) The pedestrian and buffer zone near Legok Jawa (Source: Author, 2022)

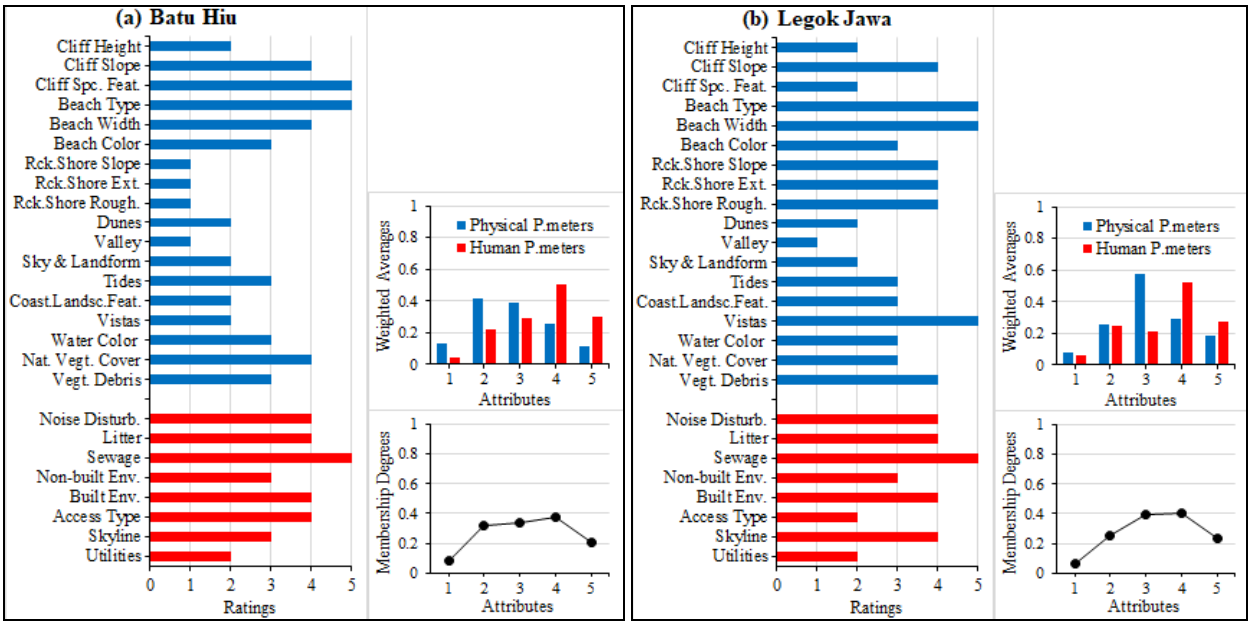


Figure 10. The CSES results for Class 4

Class 5

This class is classified as urban with very unattractive sites with low landscape value and intensive development. Batu Karas (D = -0.08) and Pananjung (D = -0.32) are popular tourist destinations in Indonesia. These two coasts have the lowest wave energy in the AoI due to their sheltered bay location, so many water attractions attract visitors. The local government builds supporting facilities such as parking areas, parks, and commercial areas to support tourism activities.

Some of the commercial areas are directly on the beach. Pananjung and Batu Karas are also intended as fishing ports, so supporting port facilities such as ship moorings, piers, sea dikes, and piers are built. Figure 11 shows the appearance of some physical and human parameters in Class 5. The development on these two coasts has resulted in low ratings for physical and human parameters, which are dominated by poor conditions. As a result, attributes 1 to 3 dominate on the weighted averages vs. attributes graph. The membership degrees vs. graphic attribute curve shows a decrease in attributes 4 and 5, which are classified as LHS. Figure 12 shows the CSES results for this class.

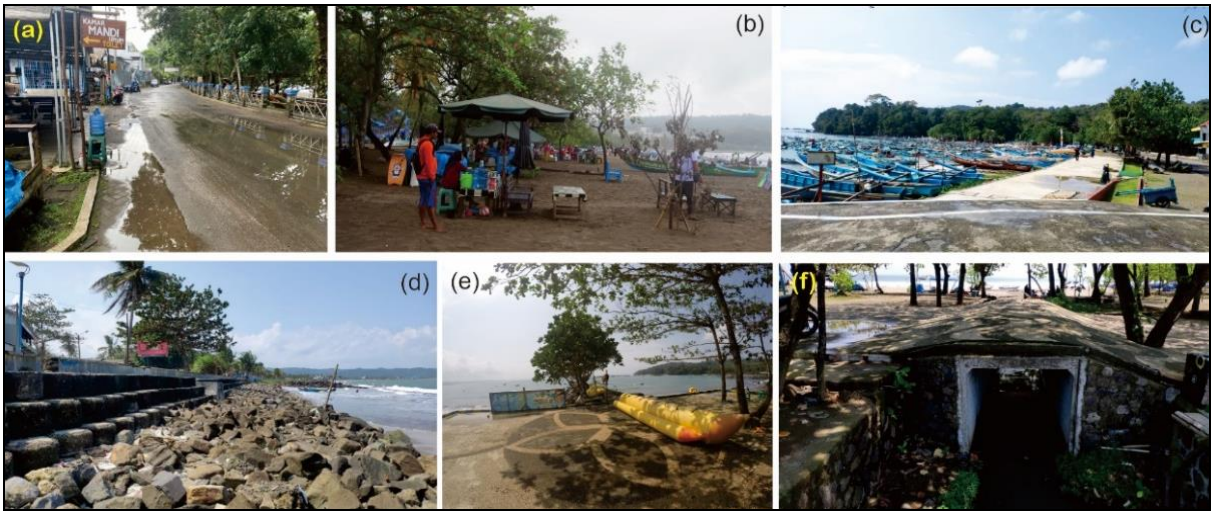


Figure 11. The appearance of some physical and human parameters in Class 5
(a) The buffer zone near Batu Karas beach, (b) The commercial activity in Batu Karas beach, (c) The boat docks in Pananjung, (d) The sea walls in Pananjung, (e) The banana boat for water tourism rides in Pananjung, (f) The sewer in Pananjung (Source: Author, 2022)

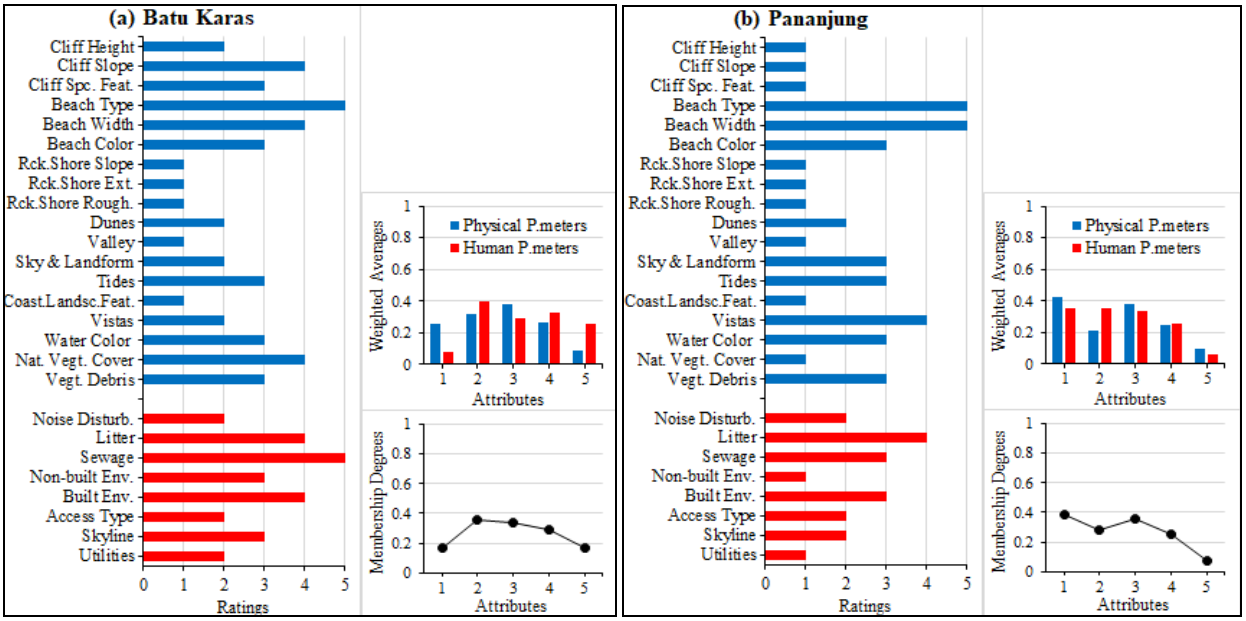


Figure 12. The CSES results for Class 5

DISCUSSION

Six of the ten coasts studied are considered natural with a medium to high scenic quality. Another two coasts have intensive development, while the rest have light development. As determined by histogram analysis, the low quality of AoI's scenic is due to lower physical parameters than human parameters. For example, Batu Hiu and Legok Jawa have weighted averages for attributes 4 and 5 of physical parameters, which are lower than human parameters. However, the highly weighted averages for attributes 4 and 5 of human parameters cannot improve the class of these two coasts. Karang Nini and Madasari are additional examples of coasts with high scenic quality. Compared to other coasts in AoI, these two coasts have highly weighted averages for attributes 4 and 5 of human parameters but relatively low weighted averages for attributes 4 and 5 of physical parameters. Although it has a high human parameter rating, it cannot place these two coasts in Class 1. Studying physical and human parameters along the Pangandaran coast allowed local government or private sector decision-makers to determine and classify which variables may be handled better to boost scenic value at numerous researched sites. From the scenic assessment histogram, the person in charge of deciding will be able to identify where adjustments need to be made instantly. At the same time, vacationers can use the CSES data practically, deciding between natural and urban attractions (Cristiano et al., 2018). In order to improve the quality of the scenery in grades 4 and 5, the rating of human parameters should be improved by handling garbage and waste, setting up utilities' development, and zoning tourism types. Some administrative solutions, like the decentralisation of tourism, could be used to alleviate overcrowding (Rodella et al., 2020). Several physical parameters can be modified to achieve a higher classification, including the maturation of trees, the removal of vegetation debris, and the restoration of the function of dunes. The loss of dunes increases the erosional risk to the coastal landscape. For this reason, it is necessary to build an artificial dune to protect the beach from abrasion (Corbau et al., 2015). Several studies on coastal tourism have also concluded that the scenery along the coast can provide competitive advantages, particularly in more rural and remote areas (Ullah et al., 2010). Rural and remote coastal

locations in the Pangandaran District have an excellent prospect for coastal tourism development. Also, the fact that most of the coasts are natural shows that the coasts in the Pangandaran District still have much potential for nature tourism.

CONCLUSION

According to this study, AoI does not have a coast that is classified as a Class 1, but most of AoI is a natural coast. In addition, not a single coast receives a high rating of excellent for all five of the top five parameters. Class 2 consists of Karang Nini and Muaragatah. The two coasts are in remote areas with excellent coastal landscape features. Class 3 is dominant in AoI. This class has the advantage of excellent watercolour and clarity in Pasir Putih, Karapyak, and Muaragatah, while Palatar Agung has the advantage of being located in a more remote area. The natural category involves classes 2 and 3. However, the tourism development of the two classes should be carefully considered because tourists tend to explore new natural places. If not noticed, too many visitors could damage the coastal scenery. Because Classes 4 and 5 were urban areas and popular spots, their human and physical parameters gradually declined. Class 4 consists of Batu Hiu and Legok Jawa, almost identical to Class 3 but with lower physical parameters. This is because the natural features have turned into tourist facilities. This also occurs in Batu Karas and Pananjung, which are part of Class 5. This area has many water attractions because both coasts are in sheltered bays. The high number of visitors to these two coasts lowers human parameters, while tourism facilities lower physical parameters. The low quality of the scenery in AoI is caused by its physical parameters being lower than its human parameters, and it is impossible to increase the rating of the physical parameters of AoI, whereas human parameters are highly changeable. Simple actions like clearing trash from coasts and improving coastal amenities could enhance the scenic value of coastal areas. Meanwhile, maintaining utilities along the coast and making changes to the beach, like adding sand, is an expensive way to improve the view, but it is worth trying.

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