Coastal Landscape Characterization. The Case of the Sartol Seacoast, Bushehr, Iran

Mahdi Sheibani
Landscape Architecture Department, Faculty of Architecture and Urban Planning, Shahid Beheshti University, Evin, Tehran, Iran m_sheibani@sbu.ac.ir

Niloofar Razavi
Landscape Architecture Department, Faculty of Architecture and Urban Planning, Shahid Beheshti University, Evin, Tehran, Iran n-razavi@sbu.ac.ir - n.s.razavi@gmail.com

Fahimeh Mofrad
Faculty of Architecture and Urban Planning, Shahid Beheshti University, Evin, Tehran, Iran fahimeh.mofrad@gmail.com

Abstract
Lo sviluppo industriale e, più generalmente, le interazioni uomo-ambiente pongono i paesaggi costieri in un costante stato di pressione. La documentazione delle condizioni del paesaggio e dei suoi caratteri rappresenta una strategia importante per la sostenibilità di tutti i paesaggi, compresi quelli costieri. Questo contributo descrive un metodo per la classificazione dei caratteri del paesaggio costiero lungo la costa di Sartol, in Bushehr, Iran, con un'enfasi particolare sui caratteri geomorfologici. Tale strumento è concepito, da una parte, per accrescere la consapevolezza delle comunità locali rispetto a caratteri e valori paesaggistici, dall'altra, per controllare le possibili trasformazioni negative del paesaggio. A partire da una rassegna critica delle principali teorie sulla classificazione del paesaggio, questo contributo riporta i passi necessari per una caratterizzazione del paesaggio e testa il metodo proposto lungo a costa di Sartol, definendo un inventario dei caratteri paesaggistici locali.

Parole chiave
Classificazione del paesaggio, caratteri paesaggistici, caratterizzazione costiera, fascia costiera di Bushehr.

Abstract
The pressures of the industrial development and the interactions of humans and environment constantly strain coastal landscapes. As a resolution, documenting the authentic conditions of landscapes, as well as their changing character, is suggested as a monitoring and safeguarding strategy for sustainability of all landscapes, including coastal landscapes. In that regard, this paper describes a method for classifying coastal landscape characters in Sartol costal area in Bushehr, Iran, with special emphasis on the geomorphological features. The emphasis of geomorphological features of the landscape is meant to raise the awareness in the local community on the one hand, and is a measure to control the possible negative changes imposed by the developments of the site. Starting from a review of relevant theories of landscape classification, this approach examines the important and necessary steps in the documentation of landscape character, and continues to test the method in organizing the inventory and basic characterization of Sartol.

Keywords
Landscape classification, landscape character, coastal characterization, Bushehr coastline.

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Introduction

Landscape architects are constantly challenged with the question of the extent of interventions in any natural landscape. Coastal landscapes, as fragile ecosystems, are one of the most testing of these challenges (Pawlukiewicz et al. 2007). Especially since the issue of intervention, in this case, needs to be measured against the technical resolutions needed to balance the forces of erosion on the shoreline.

A coast is a dynamic place and its dynamism makes it susceptible to stresses and changes in a number of ways (Bird, 2008; Pawlukiewicz et al., 2007). Every so often, these stresses render a coastal landscape as a fragile ecosystem. The coastline is strongly influenced by environmental factors and natural forces besides their economic and social aspects, all of which deserve attention from the primary phases of analysis to the constant sequence of an ongoing management.

Accordingly, landscape character and the classification of its sequences serve as an indispensable frame of reference in the analysis phase. In this respect, using landscape inventories could be a means to prepare a framework for judging a landscape and/or managing its change (Litton & Tetlow, 1978; Tudor, 2014). Classification produces new knowledge by sorting, structuring, and/or weighting datasets into an organized system based upon typical properties, patterns, or themes. It is one of the most fundamental and elastic of research activities, often not recognized as research, yet acknowledged as a necessary condition for all higher levels of analysis. The special value of this type of classification is in the creation of a "reference frame" to describe "landscape character" in the regional, local, or even in site scale (Tudor, 2014).

Some researcher believes that this type of analysis is more relevant to conservation-based considerations in landscape study (Brabyn, 2009), being accepted as the cornerstone of most decisions in planning, design, and management. In addition, identifying physical components of a landscape provides a basic step to component-based landscape assessment techniques.

Landscape characterization methods, in different academic approaches, have been divided by their methodology, which may be differentiated based on their reliance on objective observations or subjective records. Some have labeled these approaches under titles such as 'expert' and 'subjectivist' methods (Lothian, 1999; Tveit et al. 2007; Turner, 1975).

The above distinction is necessary for other reasons too. From a subjective stance, the change and deterioration of a landscape may receive a positive or negative emotional response, which may be documented in a romantic narrative, a phenomenologi-

cal documentation, or even an emotional mapping of the environment. Whereas in an objective approach, the main focus is on finding the 'cause' or the 'causes' in a constant deterioration process, and its management.

With regards to the belief that value-based classification concepts are more tied to the cultural and personal characteristics of the observer, and fit more into an evaluative framework, the authors have consciously shifted their research to less subjective interpretations coastal landscape. The documentation of the most vulnerable physical attributes (geomorphological features) of the site gained first priority in characterization process, since the possible changes inflicted there may be irreversible.

Based on the recommended practice of for the discovery of landscape character and its classification (Tudor, 2014; Tudor, 2012), this research follows three steps, all the way from establishing the theoretical basis in the desk study phase, to implement the method on a real example in a selected stretch of coastal landscape. These steps include: (i) a review of theoretical basis of landscape characterization, methods, and concepts; (ii) a study of satellite images, GIS maps, and topographic maps assembled for the study area; (iii) field sampling of typical landscape elements in the area, using ground photography, along with field notes, as well as organizing the information gathered from the personal experience of one of the researchers (a native resident of Bushehr), and a few other community members.

Landscape Characterization

Swanwick and Land Use Consultants (2002) hold that landscape character can be defined as "a distinct, recognizable and consistent pattern of elements that make one landscape different from another, rather than better or worse" (p. 8). Alternatively, they propose that landscape can be defined as "that which makes an area unique" (Warnock and Griffithes, 2015, p. 263). Accordingly, landscape character is based on an elaborate description of the landscape in terms of important features and does not involve the assigning of value that is a mandatory step in evaluation. Landscape characterization is therefore different from landscape evaluation or Landscape Character Assessment (LCA) and may be compared to the documentation of landscape character types and landscape character areas defined in the LCA guideline (Tudor, 2014). Landscape character types can show that two separate sites are similar or different, depending on the actual character and the components of the characterization system used (Brabyn, 2009), and can create a basis for further assessments of different features (Linton,

1968; Tandy, 1971; Land Use Consultants, 1971; Swanwick and Land Use Consultants, 2002). Accordingly, the special value of this type of classification is in the creation of a 'reference frame' to describe 'landscape character' in the regional, local, or even in a small area of a specified environment, such as a section of a road or a specified part of a long coastline; in other words, the site-scale (Brabyn, 2009).

The Necessity of Characterization

The Environmental Impact Assessment (EIA) provides probabilities to contribute to sustainable development by seeking opportunities to conserve and enhance landscape character (Landscape Institute, 2013). Correspondingly, landscape inventories help in the definition of landscape character and its analysis. In order to analyze the effect of landscape changes, it is important to be able to characterize the landscape as an object before the interpretation of changes, which needs to take the viewer's experience into account (Tveit et al., 2007). The characterization process does not undermine the role of individual experience or preferences; rather, it provides a sound framework to evaluate and classify these environmental preferences in later stages.

In spite of efforts to develop methods that can be accepted throughout the scientific community, none has gained general acceptance. One unfortunate consequence of this can be a common dodging of issues relevant to the visual aspects of the landscape. The lack of an easily accessible methodology to deal with the features of visual landscape frequently hampers the inclusion of visual aspects entirely.

On the other hand, to comply with the general guidance of seeking participatory research for recording distinctive visual resources (Tudor, 2014), the level of local community awareness may pose an obstacle. With the tide of the globalization of scenic values, the tendency to leave out subtle environments such as prairie landscapes as "having little or no aesthetic value" (Hough, 1990, p. 25). In addition, the participatory ratings also show people's low opinion on the absence of 'things', which are usually defined as objects that possess aesthetic interest as defined by popular or contemporary definitions (ibid.). This trait would specifically pose a problem when the distinctive visual resource is a scientific phenomenon such as a unique geomorphological feature.

Likewise, the conservation of valuable features of a landscape would seem impossible without the support of the local community. According to the item c. of Article 1(definitions) in the Chapter I of the European Landscape Convention, "Landscape quality objective" means, for a specific landscape, the

formulation by the competent public authorities of the aspirations of the public with regard to the landscape features of their surroundings (Cultural Heritage, Landscape, and Spatial Planning Division, 2000). This means that unless a community is inherently aware of the value of the landscape elements in their local environment, their preservation would not form or inform the decisions leading to their aspirations. Consequently, all the conservation measures imposed by the authorities may seem oppressive and rejected or at least not respected by the local community.

One possible resolution is to search for indicators of landscape quality that can be derived from data on landscape structure (Dramstad, et al., 2006), and use the relevant concepts as incentives to educate, interest, and engage the public in the local as well as the national scale[1]. Subsequently, the organized data in form of landscape classification could be used as the basis of a landscape evaluation (Unwin, 1975; Blankson & Green, 1991; L.Krause, 2001; Berman, 2002). This scale of documentation facilitates the analysis of landscape change and character in planning and policy evaluation (Tveit, et al., 2007; Brabyn, 2009).

Literature review

Three decades ago, the trends of classifying and characterizing a landscape relied more on the techniques that made generalizations possible and could be widely applied on a comparable basis (Turner, 1975). Likewise, the traditional modes of site analysis, solely offered a limited scope of inquiry (W.Holdsworth, 1997), and, although the inventories were presumed to include the physical elements of the landscape (Tandy, 1971), they usually did not scale down to include distinctive features of a site or even regional aspects. Hence, in order to enhance the awareness on the distinctiveness of regional landscape character types, more efficient and thorough methods of analysis were called for. Landscape architecture now uses a range of classification strategies, including Inventory, Typology, Taxonomy, Indexing, and Literature Reviews (Swaffield and Deming, Spring 2011). In some cases, a combination of these methods can be used. Because of the primacy of specific features of the landscape on the characterization process, the result may vary regionally or with study objective.

Through the years, several frameworks for analyzing and describing visual quality and character of the landscape have been developed. As early as 1977, Blankson and Green defined features, which are more concerned with the landscape as a partic-

ular configuration of topography, land use, vegetation covers and settlement pattern (Blankson and Green, 1991). Brabyn asserted that the classification should now incorporate components of landform and vegetation, as well as naturalness, and water (Brabyn, 2009). In an earlier study by Krause (2001), delimiting landscape units with characteristic configuration of space, structural elements (topography, water, vegetation, colonization), and their landscape mosaic pattern was considered as a methodical frame for analysis.

One other method of classifying landscape is the descriptive inventory. Descriptive inventories are both quantitative and qualitative methods used for the identification and analysis of landscape components (Tveit et al., 2007).

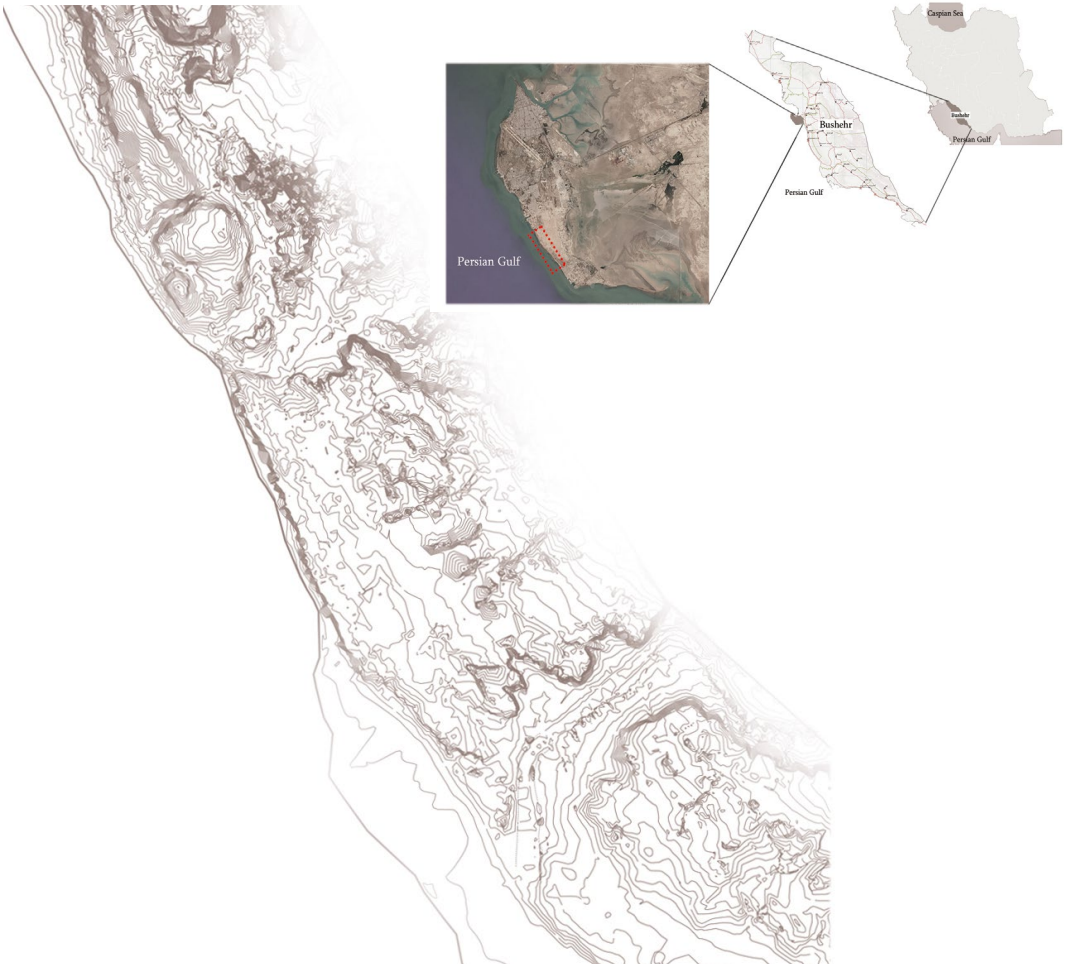
The use of photographs is a common method for illustrating the quality of landscape features. In order to characterize a landscape, the components of the landscape are either surveyed directly in the field or measured from maps and aerial photographs (Cengiz, 2014; Blankson and Green, 1991). Through the years, with the improvement of computer software and hardware, GIS became an efficient digital tool in the planning process (A.Schmid, 2001). Today, a combination of GIS and manual techniques is used for landscape characterization (Brabyn, 2009).

The Study Area

The study presented in this paper was developed in the South of Iran, in Bushehr province during the years 2016-17[2]. Bushehr is known as an arid climate in the Koppen climate classification. The livelihood of people in this small city is dependent on the coastline and the sea. Nowadays, the coastline offers a recreational space on a national scale as well.

In this research, a stretch of the coastline known as Sartol was under study, which lies between 28° 29' - 28° 85' N Latitude and 50° 84' - 50° 85' E longitude. It is approximately 1.5 km in length and stretches between Rishehr and Heleileh (near Bushehr nuclear power plant). Rishehr, on the north of the site, has a historical background dating back to the Elamite[3] period and consists of the remains of an ancient city located near the sea with considerable natural attributes. Heleyleh, in the south, is now hosting the nuclear power plant. All along the south-west seashore, the site is flanked by the Persian Gulf seascape, which is considered a sensitive environment form both ecological and geopolitical point of view.

Although Rishehr and Heleileh coastline has significant natural features and character types, both have suffered human interventions, which have partially destroyed their precious elements. Land use changes in form of growing urbanization, industrial developments as well as military appropri-



ations, seem to be the main cause for the transformation of the landscape. As a result, the natural attributes of these parts, which contributed to their authentic character are now indistinguishable.

To the contrary, Sartol coastline is a relatively untouched coastline stretch, which has not yet been affected by any significant human actions. Its pristine present state, and the threat of future impact form the neighboring developments were the first initiatives for landscape classification of this area.

Furthermore, the geomorphological attributes of this site and the visual diversity of subtle features in this landscape makes a perfect candidate for the classification inquiry.

Material and methods

After the thorough review of existing landscape characterization methods, in order to tailor the available registration methods in an inventory, in a proper scale for a limited stretch of coastline, some juxtaposition of methods seemed necessary. Consequently, a combination of GIS, and field surveys were used for the purpose of this study. The combination was proposed as a more reliable method to record landscape features. Recording information with GIS ensured the integrity of data, while field surveys were means of collecting the detailed data through close encounter.

The proposed method consisted of a study of pres-

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Fig. 1 – The location of the site (source: The National Cartographic Center of Iran)

ent satellite imagery of the site (2017), the GIS maps produced by the Bushehr Cultural Heritage Organization, and the modified topographic maps. A total number of eight comprehensive field visits over a year, and photographic registration of typical landscape elements took place in the course of the research; 200 ground photography were used as supplements for field observations and field notes. The purpose of the field surveys was to locate geomorphological elements and their locations, as well as delineating the behavioral settings and their possible permanent as well as ephemeral impacts on the coast.

For the purpose of this research, the identification and description of the coastal elements were carried out in three areas and marked on a locations map. This process complies with the recommendations of the LCA and comprised of the following steps:

- dividing the three components (nearshore, foreshore, and backshore) of the seascape unit into types or areas of distinct, recognizable and common character;
- mapping the distribution of these units of common landscape character.

In light of the considerable influence of landform and geomorphology on coastal landscape character, the shaping of the coast, and the visual prominence of the land and the coastal characteristics (Tudor, 2014), a special emphasis was placed on technical documentation of these features. The emphasis was an effort to reconnect the identity of this site to the adjacent inland meanders and recognize the integrity of the coastline with the inland territories. It is worthy of note that the integrity is constantly threatened by the development proposals. The available ICZM framework based on 1:250,000 maps provide inconsequential safeguarding against these threats and only recognize the area as a watershed (Maab Consultants, 2008).

In order to survey land elevations, a map of 1: 20,000 scale has been used. Accordingly, the landform was classified into 4 categories. Meanwhile, based on field observation and study of the ground level and satellite images, geomorphological elements of the site were recognized and registered in a table complemented by their names and the description of their distinctive attributes in the site.

Through a classification of each category based on significant differences in geomorphologic elements, the site was classified into 6 distinct characters. The identified landscape character types have distinct and relatively homogenous patterns and composition of natural attributes. They are generic in form and occur in different parts of the coast. Subsequently, for the demonstration of different zones with their significant geomorphological ele-

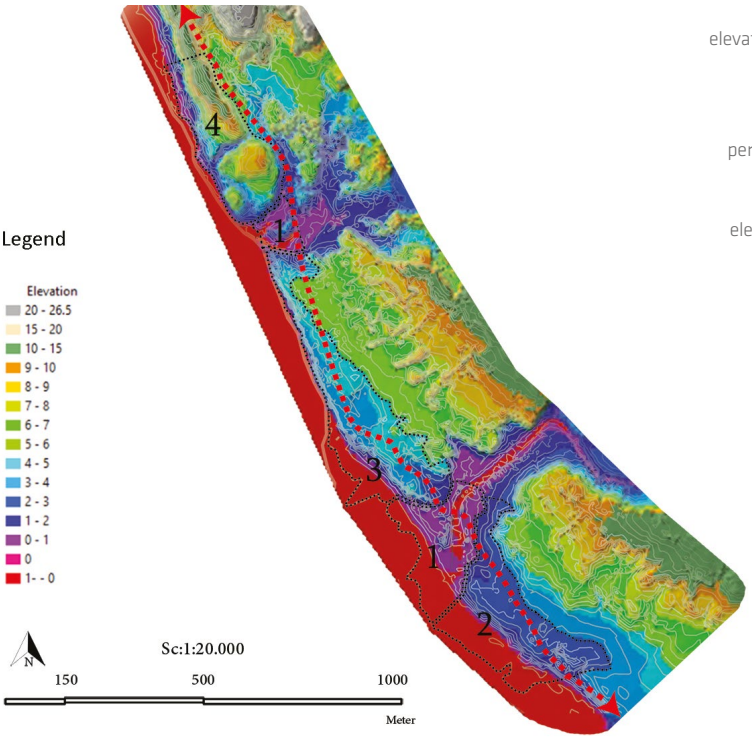

Fig. 2 – Sartol GIS map, categorizing elevation range variations (image elaborated by Fahimeh Mofrad)

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Fig. 3 – Diagram of existing landform percentage (image elaborated by Fahimeh Mofrad)

Tab. 1 – Significant geomorphological elements inventory of the Sartol coastline

ments a map of 1: 10,000 scale was produced, based on which profiles of each zone were prepared. The details on the base maps were enhanced by overlaying the topographic maps on satellite maps.

The process resulted in detailed descriptions of the elements and character type, plus their location marked in maps and complemented with photographs depicting key characteristics. The resulting maps document the character areas where broad types are listed, along with their subdivision into different zones based on variations of the coastal form as recommended by contemporary guidelines (Tudor, 2014).

Results

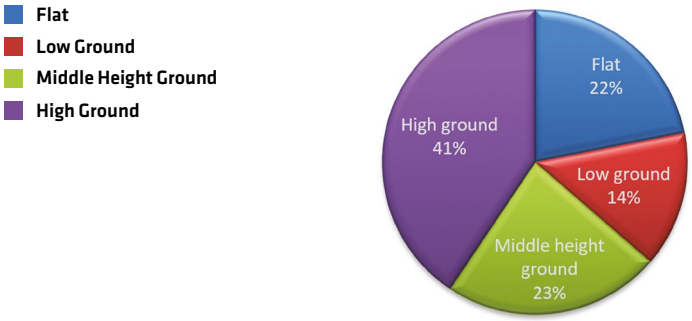
Concerning the general climatic character of Bushehr coastline and the distinctiveness of the landform, special emphasis was placed on an inventory with geomorphologic categories. The choice was also based on the general lack of interest from both the local community and the responsible authorities about these features.

Accordingly, the Sartol landform was divided into 5 polygons on the base of Z axes in the GIS map and the various range of significant elevation's (fig.2). In order to reach a landform classification, the elevation data was registered with Geographic Information System.

Through the GIS elevation data, the site was divided into four categories:

1. Flat: dominantly below sea level (-1) to 1 meter;
2. Low ground: dominantly 1- 3 meters;
3. Middle height ground: dominantly 3- 5 meters;
4. High ground: dominantly 5- 15 meters.

Two areas were assigned to the Flat class according to their common elevation aspect, with first one on the north and the second one on the south. Based on the registered elevations (fig.3), most of the landform is classified in the high ground category. After that, the middle height ground and flat category are



NO	Existing elements	General Characteristics of element	Elements special characteristics in the site	Image
1	**Cliff**	• Placed in backshore* • Bare coastal cliff created by coastal erosion • Regression in stormy conditions	• Made of marl • Occasionally with sand dunes • Often with vegetation • Elevation 1-4 meters	
2	**Estuarine**	• Placed in the foreshore** • Drowned valleys with three parts, marine, marsh, and river • Combination of sea and river water due to tidal action. • Replete with salt deposits • Sometimes with vegetation	• Relatively small in dimensions • Seawater, partly, comes through estuarine and dry meander due to the tide operation. • With salt deposits • Poor vegetation cover • Vegetation cover mostly is scattered-wild- grass	
3	**Sand dune**	• Placed in the backshore • Comprised of gravel or sand • Generally stabilized by vegetation cover • Important protection against waves and storms	• Mostly on cliffs and in some areas near the estuary • Most of the dunes are covered by wild-herbaceous vegetation • In some areas, sand dunes have blocked the sea view because of their height	
4	**Beach**	• Placed in backshore • Coastal sediments moved by wave force	• Include wet and dry beaches	
5	**Sandstone reef**	• Placed in foreshore • Protrusions made of sandstone • level with the sea	• On the edge of the beach, in "flat" category	
6	**Shore platform**	• Placed in the foreshore • Caused by coastal erosion mechanisms on stone blocks separated from the cliffs	• Rigid surfaces between sand dunes and seaside • Provide visitors with a walking or sitting area facing the sea	
7	**Tidal flat**	• Placed in the nearshore*** • The shallow areas of foreshore	• Close to the estuary where the depth of water is low • Mostly out of sea and visible during the day	

* In the supratidal zone. The zone that extends landward from the higher high water line (large tides); the landward limit is variable and may be (a) the top of a coastal cliff or (b) the landward limit of marine process (i.e., storm surge limit).
** In the intertidal zone.
*** In the intertidal zone. The zone between the higher high water line (large tides) and the lower low water line (large tides).

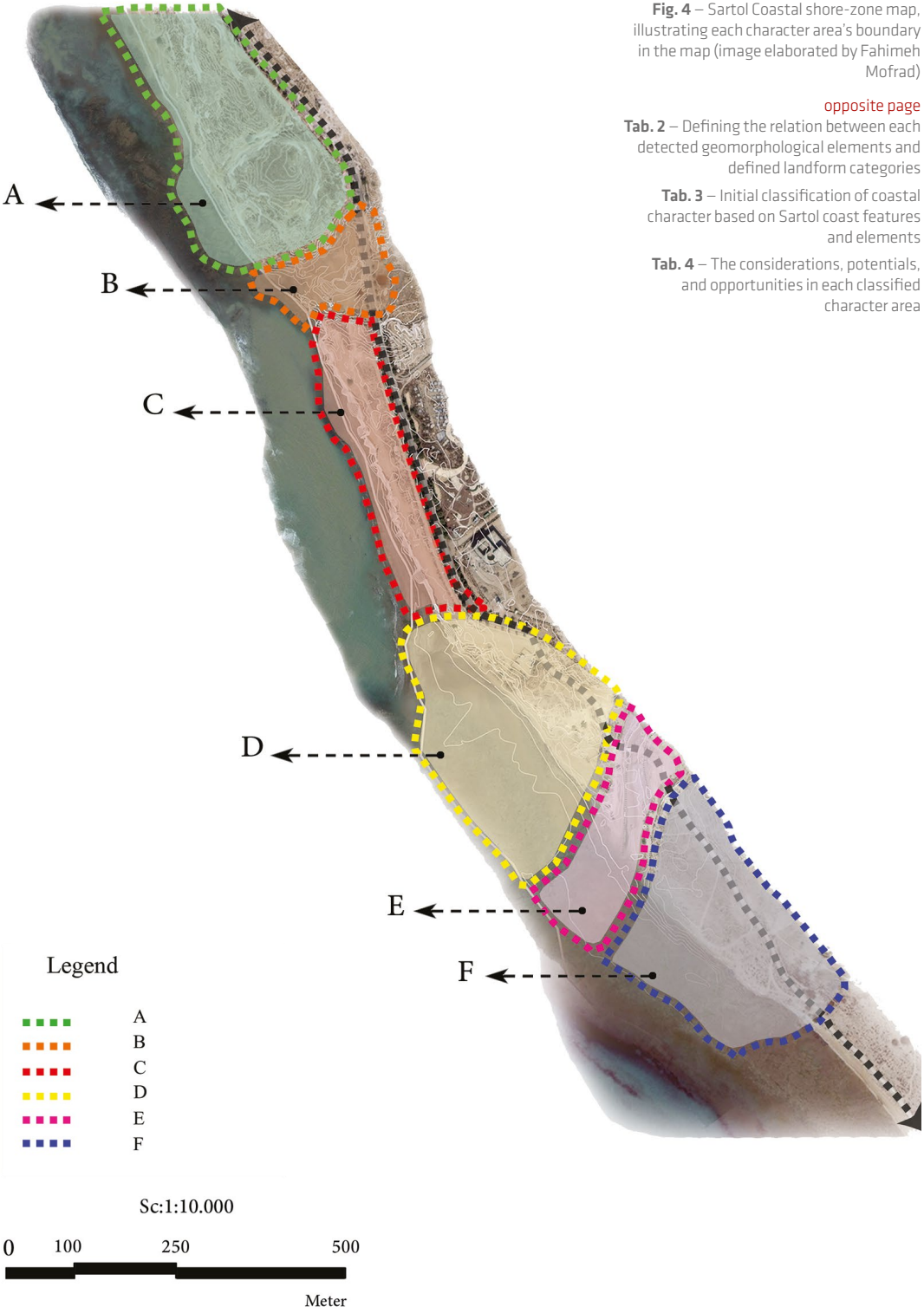


Fig. 4 – Sartol Coastal shore-zone map, illustrating each character area's boundary in the map (image elaborated by Fahimeh Mofrad)

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Tab. 2 – Defining the relation between each detected geomorphological elements and defined landform categories

Tab. 3 – Initial classification of coastal character based on Sartol coast features and elements

Tab. 4 – The considerations, potentials, and opportunities in each classified character area

Landform category	Sartol existing coastal elements						
	Seacliff	Estuarine	Sand Dune	Beach	Sandstone Reef	Shore platform	Tidal flat
Flat		○	○	○	○		○
Low ground			○	○			○
Middle height ground	○			○			○
High ground			○	○		○	

Character area	Centroid X	Centroid Y	Centroid M	Elevation (proximate)	Perceived as	Elements Hinterland	Nearshore	Foreshore	Backshore
A	28.864656	50.850372	370	0-15	Open coast	High ground		Platform	Sand dune
B	28.863299	50.851181	75	-1- 1	Open coast	Low ground		Sandstone reef	Beach
C	28.860640	50.852186	430	0-5	Open coast	High ground		Beach	Cliff
D	28.857542	50.854593	270	0-4	Open coast	High ground	Tidal flat	Beach	Sand dune
E	28.856657	50.855852	150	-1- 1	Estuary	Low ground	Tidal flat	Estuarine	Estuary
F	28.854839	50.857201	190	0- 2	Open coast	High ground	Tidal flat	Beach	Sand dune

Character areas	Essential Considerations	Potentials and Opportunities
A	• Preservation of the sand dunes • Preservation of the land cover • Preservation of the rocky platforms	• Educational observation of coastal sand dunes • Defining viewpoint for platforms • Emphasizing the visual corridors
B	• Maintaining the watershed attached to the seafront • Preservation of the expansive visual field • Preservation of beach sand and decreasing the erosion	• Ease of access to the sea • Appropriate spot to utilize boats and other water-related activities
C	• Preservation of eroding edges on the coastal cliffs • Preservation of the expansive visual field	• Proper for the definition of vistas
D	• Reinforcement of sand dunes	• Possible swimming and relevant facilities • Possible picnic spots and relevant facilities
E	• Reinforcement of estuarine edge • Conservation of the natural estuarine edge and its natural processes	• Possible walking trails on the estuary edge • Possible pausing locations and peaceful rest stops
F	• Maintaining beach edge • Reinforcement of coastal sand dunes • Regulation of vehicle access and transport load	• Possible walking and biking trails

ZONE A

ZONE B

ZONE C

ZONE D

ZONE E

ZONE F

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Fig. 5 – Profiles illustrate the situation of geomorphological elements in each zone and their general physical character (image elaborated by Fahimeh Mofrad)

the most common landforms in the site. Low ground has the least area throughout this coastline.

The classified data gathered in this phase served as a basis for the organization of the framework that accommodated subsequent information from the site. The collection of seven significant elements, which were identified as comprising the small-scale geomorphological texture of the coastline, are listed in table 1. It has been organized based on the minor differences in the physical aspects of every element and their exact location.

Subsequently, the relation of each element to the 4 landform categories which has been defined earlier is surveyed in table 2. Some typical elements like beaches can be found in all landforms, while other elements like cliffs or platforms are limited to one zone.

Based on the dominant geomorphological elements of each landform polygon, located in each component of the coast (nearshore, foreshore, and backshore), the coastline was classified into 6 characters, reflecting both the geomorphological specifications and the distinctive landform features (table 3).

There are further details about specific behavioral territories gathered in the field study, which can be added in the later stages along with the data gathered from the local community about their landscape preferences and behavioral traits. For now, the different character areas are illustrated on the shore-zone map (fig.4).

The across-shore sections represent the basic building blocks of the shore-zone character mapping. It represents different morphological elements in gradual change from sea to land. The profiles prepared to visualize the location of elements in different zones offer a categorized depiction of sequences composing each distinctive character in Sartol coastline (fig.5).

The detailed documentation of these resources under different characters were followed by an analysis of specific considerations and potentials relevant to the composition of elements in each of the six classifications. The analysis may be elementary in the sense that it lacks input about landscape preferences from the local community as well as national visitors to the site. However, as mentioned earlier, marking different territories before involving the public has a twofold benefit. The benefits include the acquisition of structured data on the one hand, and raising the awareness of the community due to their exposure to lexicon and depictions of natural specifications of the site on the other hand. To that end, the information provided in table 4 provides the primary framework and serves as a communicative bridge between the technical spec-

ifications of the site and the planning, design, and management decisions that follow.
In spite of the calibrated load of activities suggested for each area, the propositions are subject to further examinations through EIA and carrying capacity calculations.

Conclusion

Landscape characterization makes it possible to identify the nature of landscape change, and thereby the impact of changes on the physical qualities of the landscape. This research is based on the belief that the assessment and monitoring of both particular aspects, as well as the totality of a landscape character, would provide informed analysis for the primary inquiries of planning, design, and management of the coastal landscape.
In this paper, the characteristics of Sartol coastal stretch, situated on the periphery of Bushehr Province coastline in Iran, were analyzed with a special emphasis on landform and geomorphological features. Sartol is susceptible to the effects of human intervention because of proximity to the urban area, industrial developments, and military sites. In addition, the coastal zone is subject to the erosion damages by natural factors due to topographical and oceanographic characteristics of the seashore.
This research relied on an integration of geospatial tools, landscape characterization principles, and profile modeling. Geospatial tools (GIS) were used to prepare landform maps and to identify the range of elevations and landforms that can be found in the site. An overlying of GIS maps and satellite image (2017) was used to map the characters defined in this research.
Accordingly, detailed landscape character types were identified for the Sartol coastline, which served as a reference point for discussions about landscape values and of changes in the coastline, as well as complementary research involving both the local community and national visitors, alongside more detailed inquiries and calculations in form of EIA and carrying capacity.
Currently, most studies on landscape characterization are on a regional scale and do not include the information needed in a small-scale design. The approach presented here could be used on a small scale and includes specific directions for future development beside managing invasive or anthropogenic activities on the coastline by offering an overall perspective of landscape characters. Moreover, the information can be used to monitor changes in the coastline. Therefore, the information can also be used in delineating potential conservation areas and supports the effective management of fragile coastal landscapes.

Endnotes

[1] The process has been successful in encouraging public support for the conservation of the threatened Urmia Lake as well as the Iranian Chita.

[2] The research was conducted as part of the requirements for a MSc. Degree in Landscape Architecture in form of a Masters Dissertation by F. Mofrad, supervised by M. Sheibani and N.Razavi during 2016 and 2017.

[3] Elam (/ˈiːləm/) was an ancient Pre-Iranian civilization centered in the far West and Southwest of what is now modern-day Iran, dating back to the middle bronze age until the Achaemenid period (3200BC to 540 BC).

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