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Changing ecological environment before and after coastline filling designs

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Abstract
Coastlines are tectonically active places with an impact on physical as well as social and economic restructuring of cities. They play an essential role in the development of urban areas. Furthermore, coastal environments may offer important health benefits. They may also present numerous threats to human health and well-being time to time. With the rapid urbanization in coastal cities, the lack of urban green space and transportation problems have emerged recently, and the cities have grown towards the sea by coastal filling areas as a solution. Especially the construction of highway on the coastline in the Black Sea region of Turkey has adversely impacted relationship between the people and the sea in the city of Trabzon. In this study, initially a literature review was conducted and parameters were specified for coastline usages. A survey study was conducted with 140 individuals who actively use the coastline in the city of Trabzon, in order to specify the past and current coastline usages. The evaluation of the past and current usage shows that people want to meet the sea but feel uncomfortable with the landscape with the fillings. According to the Anova test, the unmodified form of area was chosen to 'have a more natural landscape (5.77)' while the modified form of area was preferred 'to be renovated (4.12)'. This highlights the users' longing for the past. Therefore, authorities need to address the impact of differences between parameters in depth on the usage of the area on the coastal landscape. Coastal ecology solutions should also be produced with the ecological design approaches.

Keywords Coastal environments · Coastal cities · Ecological design · Landscape change

Introduction

Coastlines have an impact on physical as well as social and economic restructuring of cities, and play an essential role in the development of urban areas (Kılıç 1999; Türer 1999; Aktürk and Güneroğlu 2021). Coastal lands are increasingly viewed as important ecological resources that generate significant economic activity associated with tourism and outdoor recreation activities in many coastal communities (Kline and Swallow 1998; Li et al. 2023). Coastlines are transition surfaces comprised of delicate land and marine ecosystems and they have been primarily used for settlement, benefiting from its products and transportation in parallel with the developments in the lifestyles of the society. Later, with the increase in population and technological developments, it was planned for uses as recreation and tourism (Musayev 2003; Muhacir and Özalp 2018). Coastlines are natural borders of cities while they are also an important part of an urban area that affects urban development, defines the role of it, and gives it an identity by integrating with it. Throughout the history, coasts have been valuable places for settlement, and this was highlighted with phrases like "have a coast on" and "overlook the sea" (Özkan et al. 2015).

As is well known, coast is basically defined as the line that separates water and land. Coasts have provided a very favorable environment for human activities from past to present (Bailey and King 2011; Li et al. 2023). At

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the same time, it represents an important threshold (transition) between urban life and natural life with resource value in terms of recreational use and diversity of activities (Kılıç 1999; Özkan et al. 2015; Muhacir and Özalp 2018). Coastlines are utilized for the cases and activities such as settlement, tourism, sea transportation and commercial transportation, sand-gravel quarries, sea products, oil-gas reserves and so on and contributes to the society and country economically and socially (Sesli 2006; Şolt 2018). On the other hand, overuses have put pressure on coastlines and this resulted in abuses (Li et al. 2023). Abuse of coastlines paved the way for significant environmental issues including water pollution, deterioration of sea habitat, disturbing coastal ecosystem and change of coastal morphology (Türer 1999). Within this context, active and free utilization of coastlines by the public and sustainable usage and planning of coastal areas have become the subject of several studies (Muhacir and Özalp 2018).

Coastal landscape

The European Landscape Convention defines "landscape" as a field, whose structure is formed as a result of human and/or natural factors or the interaction of these factors" (URL 1, 2021). In other words, it can be defined as the outlook of natural surroundings from any perspective and the way it is perceived by humans (Motloch 2001). The rich landscape values of the coastal areas consist of natural and cultural landscape elements. Natural landscape elements can be listed as topography, natural cliffs, vegetation, areas where the sea and land meet (bays and capes), dune fields, outfalls and the vast silhouettes formed by the sea (Bailey and King 2011). The cultural landscape elements of the coastal areas are beach facilities, food and beverage facilities, residences, coast protection facilities (revetments), boat docks, ports, roads, filling areas and so on (Kahveci and Acar 2018; Barreiros Proença et al. 2022; Liu et al. 2018).

The coastal areas offer people dynamic landscape views of unique beauty (Acar et al. 2014; Young et al. 2011). Coastal areas are landscape resources with restricted landscape elements, which are difficult to reproduce, and they can give the opportunity to enjoy the beauty of nature to their visitors as they exhibit the combination of land and water (Asur 2019). With the increasing need for the land, many coastal cities are being drained and filled with wetlands, transforming them into urban areas, and hence changing the form and function of coastal ecosystems considerably (Li et al. 2014). In recent years, rapid urbanization and urban area insufficiency have occurred, and as a solution, cities have been expanded towards the sea (Şolt 2018). With the coastal fillings, recreational areas are created, which are expressed that these fillings are for public interest, but the natural balance between land and water is disrupted and the flora and fauna are damaged as a result. Coastal areas with difficult environmental conditions for plants to grow are turning into an unnatural and artificial environment.

Coastal areas and shores are important resources that can meet the ever-increasing recreational needs of urban dwellers. Coastal environment becomes coastal recreational areas by filling. People involve in recreational activities such as sports, walking, fishing, chatting, reading, etc. under favorable conditions of landscape and fresh air. When preparing the physical planning of coastal environments, it is significant to balance the needs of the society with the natural potential, and to highlight the identity of the coastline while protecting the integration of the settlement (Asur 2019). Therefore, protection, conservation and rehabilitation of coastal areas have gained global attention (Acar et al. 2014).

Coastal ecology

Coastlines are delicate areas, where different ecosystems, consisting of geomorphological and topographical components come together and are utilized and shaped by humans in many ways throughout the history (Uzun and Akyüz 2019). The coastal areas are major focus of human habitation and economic activity, as well as being important ecologically and in functioning of the earth. Coastal populations are reported to be growing more rapidly than the global average, as a result of total coastward migration, and urbanizing (Nicholls and Lowe 2004). Thanks to variety of activities such as tourism, fishing and sea transportation, 60% of the world's coasts, which corresponds to 600,000 km, are occupied and hosted approximately the 2/3 of the world population (Nouri et al. 2008; Bekçi 2021).

Coasts have unique beauty but also have ecological conditions that make it difficult for plants to live. The structure of the land-sea line, changes in the dynamic sea-coastline balance, coastlines being exposed to harsh environmental effects and seawater scattering (Ferrante et al. 2011) are the conditions that prevent coastal vegetation from emerging. For example, plants have to overcome unnourishing soil, high salinity and poor water content (Calvao et al. 2013).

General context of the study

The migration from the village to the city, which started in the 1950s in Turkey with a long coastline (8333 km), has also been experienced in the Eastern Black Sea Region, causing intense and anthropogenic pressures in the use of the coast. Increasing population disrupted the natural character of coasts over time, creating an artificial coastline (Kadıoğlu and Güner 2018). Especially since 1970s, serious

improvement activities have been started on the highway, and the old highway passing over the coastal terraces, especially between the cities Rize and Trabzon, was brought down to the coast in many places. This marked the first devastating impacts on fabulously beautiful natural coasts of the Black Sea (Uzun 2000), and these filling activities still continue today. Anthropogenic transformations and other effects on the coastline resulting from the Black Sea coastal highway led to the changes over time, which created problems on the coastal area (Uzun and Özcan 2016).

This study is conducted based on the recreational areas built by filling the shore in the city of Trabzon located in the Eastern Black Sea Region. According to the data of February 2021 Turkish Statistical Institute (URL 2, 2021), there are 330,373 inhabitants in Ortahisar, the central district of Trabzon. In the city of Trabzon, where urbanization is rapidly increasing, there is a need of coastal uses for recreation and open green areas. The recreational areas that were created after long years of coastal filling were planned again and filling activities continue today. Therefore, the coast-human relations in the region have weakened, and the social interaction and recreational activities of the citizens cannot be fulfilled. Furthermore, citizens continuously face with disturbing view of construction and filling materials. Within this context, this study investigates the relationship between the coast and people, and the coast and natural balance in the scope of coastal landscape through meetings and surveys conducted with the users of the coast under construction.

Research aim

Coasts with delicate ecosystems were put under pressure with the developing technology and increasing population, which impaired the ecological balance. Accordingly, our research aims are summarized below,

- To show the change experienced by the coastal recreation area of Trabzon created by filling, from the inhabitant perspective in terms of landscape value, coastal landscape and environmental factors,
- To examine the impact of filling areas on the coastal ecosystem and quality of life,
- To examine the effect of filling areas on the landscape value,
- To reveal the relation between "Filled areas and Ecosystem", and interactions between "Filled areas and human" and "Filled areas and urban landscape",
- To reveal the negative conditions generated by the filled areas for the users of these areas.

Methodology

Selection of the study area

This study was carried out in Gülcemal filling area in Beşirli, Trabzon, which is one of the locations where urban coastal usage is intense. The study area is located at 40° 41×47.0112" north latitude and 40° 41×9.7944" east longitude (GooglePro Earth, 2023). The importance of coast in Trabzon arises from that it provides reference for urban life and urban patterns. For example, ramparts that surround historical city center, city gates, the topographical structure itself and settlement texture are the topographical determinants of the coast-urban relation. On the other hand, the urban texture, itself, is the determinant of this relation in terms of culture, economy and sociology. In this relation system, urban silhouette is defined with low rise, with garden house pattern which is seen as positioned on the top of the other and with religious monuments like church, mosque, prayer rooms with their authentic architecture features. So, for urban patterns, coasts have an important landmark function (Aktürk and Güneroğlu 2021). Recently, a recreational area was designed and opened after the highway construction on the coast of Trabzon (Figs. 1 and 2). With the increasing need and demand, however, the filling areas on the Besirli coast were re-activated and new fillings were started to create a recreational area. The coastal plannings have been projected in a way that the coastline increasingly moves away from the city center.

Considering the urban morphology and the urban development structures of the region, recent urban strategies offer valleys and coastal areas as potential green spaces in the city of Trabzon. Therefore, town parks are considered to be more pragmatic for their convenience in relation with coastal topography, as in the entire Black Sea Region. Starting from 2000s, the fact that the coastal highway overlooked the urban-coastal relationship despite the region's thin coasts has led to inevitable problems (Acar 2015), the coastal area in Besirli, Trabzon was attempted to be reclaimed as a large town park, in order to maximize the urban-coastal relationship. Moreover, in 2010s new recreational facilities including a walking track, bicycle track, sports equipment, food and beverage facilities, boat yards, etc. were opened to the public use on the seaside of the highway. There is a green buffer between the city and highway, and coastal recreational areas between the highway and sea, which reached the sea through coastal defense. A filling construction over 900 acres of land was started with a later decision, which moved the sea view further away from the coast (Figs. 3 and 4).

Trabzon coastline had a natural coastline in 1983, the density of vehicles was low and it was home to the Hagia



Fig. 1 Location of the study area

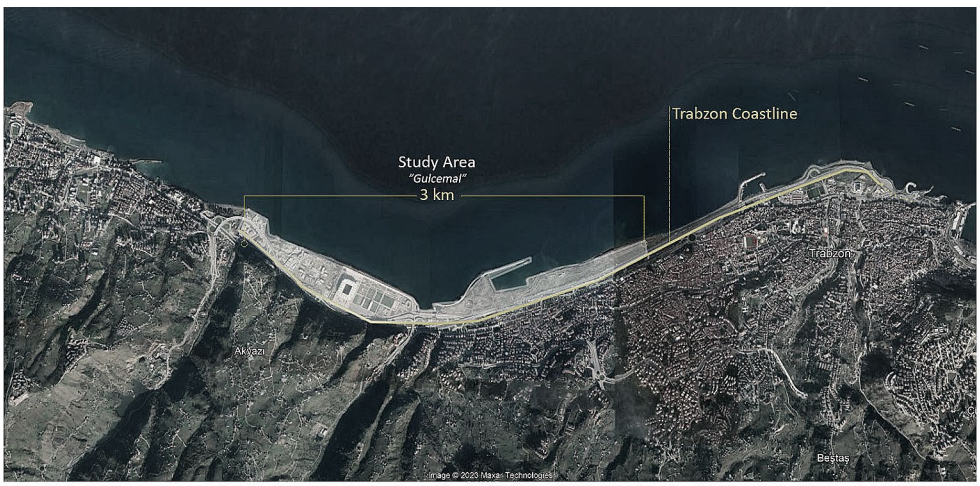


Fig. 2 Gülcemal filling area, Beşirli/Trabzon

Sophia museum, which is an important historical heritage. As a result of the developments in technology over time and migration from villages to the city, the need for the new roads increased and it was decided to fill the sea as a solution. These fillings paved the way for the construction of the Eastern Black Sea coastal highway, which moved the road from the city center and created a green buffer in between. However, while urban dwellers were in close relation with the sea during the 1980's, they moved behind the highway where there was high speed traffic. This marked the break-off of the urban-coast relationship. As a solution to this, walking and bicycle tracks, lounges, cafes and sea viewing platforms were constructed on the seaside of the Eastern Black Sea coastal highway. Later, when local governments decided that the urban population was very high and citizens needed more recreational areas and green spaces, they started filling the coasts again and a new area emerged, which is our study area.

Questionnaire design

The methodology consists of 4 stages. In the first stage, the study area was determined. Next, a literature review on the study topic was conducted to identify the "landscape values criteria". After that, these criteria were used on a survey by comparing the photos newly taken in the area with previous photos. Finally, data derived from the survey was assessed through statistical analysis (Fig. 5). The survey consists of 140 participants and 3 sections. The participants were selected from people who have lived in Trabzon for more than 10 years.

The survey targeted the users who was familiar with the area before filling. Showing the photos of new area to the

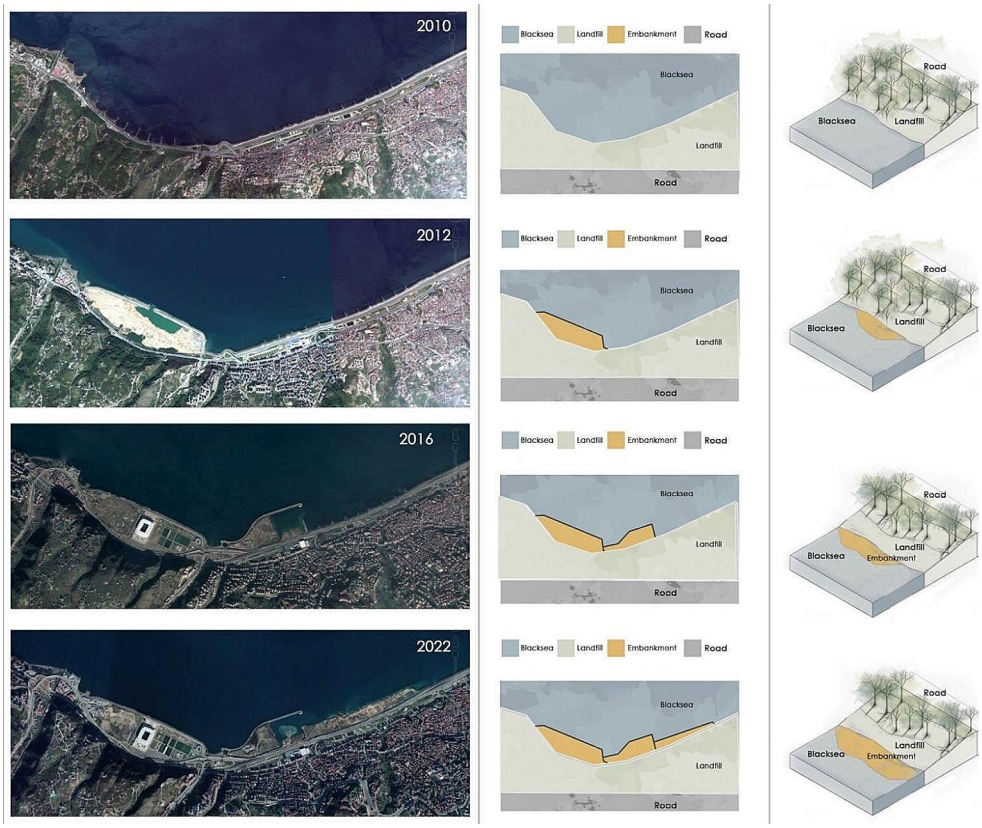


Fig. 3 Change of the coast of Trabzon over time (2021 – 2010)



Fig. 4 Study area drone photographs

users, 21 landscape value parameters (Hunziker and Kienast 1999; Clay and Smidt 2004; Müderrisoğlu and Eroğlu 2006; Acar and Sakıcı 2008; Güneroglu 2017; Li et al. 2022; Wen et al. 2022; Liu et al. 2022) were examined with the Likert scale. The purpose at this stage of the survey was to measure opinions of the users on the previous area and to show the landscape value. Statistical analysis methods were used to assess the data. At this stage of the study, a correlation analysis with significance of 99% was used to define the relationship between the parameters. The One Sample T Test was applied to show whether there was any meaningful difference among these 21 landscape value criteria. Finally, a factor analysis was conducted that reveals the highly related parameters (Table 1). At the third and the final stage, statistical calculations were conducted on the past and current photos of the area. This stage shows the difference between the past and current area from the eyes of the users.

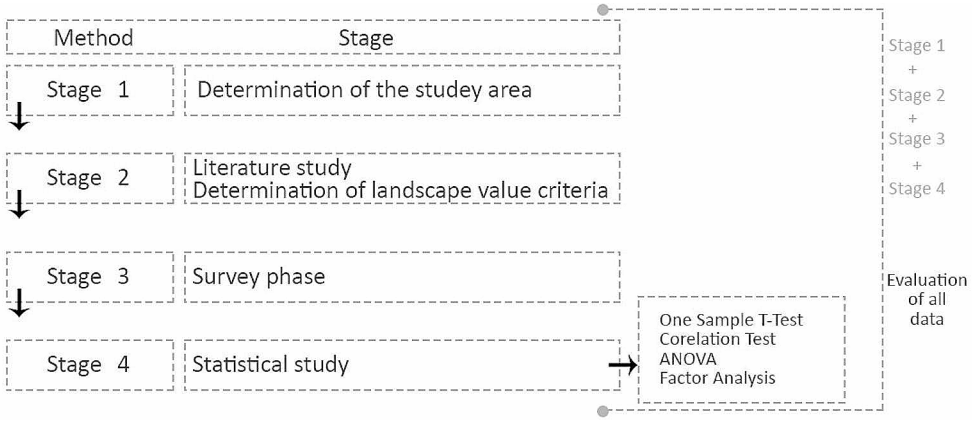


Fig. 5 Methodology flow chart

Table 1 Stages of the study (Hunziker and Kienast 1999; Clay and Smidt 2004; Müderrisoğlu and Eroğlu 2006; Acar and Sakıcı 2008; Güneroglu 2017; Li et al. 2022; Wen et al. 2022; Liu et al. 2022)

	Criteria code	Variables
The Landscape Value Parameters Explored for the Area	C1.	Authentic,
	C2.	Impressive,
	C3	Readable
	C4.	Have a permanent effect
	C5.	Eye-catching
	C6.	Have a panorama effect
	C7.	A feeling of union between the
	C8.	sea and nature
	C9.	The sea and nature are in
	C10.	harmony
	C11.	Have a natural appearance
	C12.	A feeling of diversity between
	C13.	the sea and nature
	C14.	Saves the marine species
	C15.	Have a color effect
	C16.	Interconnected
	C17.	Effective in biodiversity
	C18.	Comfortable
	C19.	Relaxing
	C20.	Accessible
	C21.	Needs restoration
		Enables socializing
		Recreative
		I would go there more frequently in the past/new form

Data analysis

The demography of the participants is presented in Fig. 3. 60.7% of the participants are female and 39.3% are male. When it comes to the working status of the participants, 26.7% of the 140 participants are employee. 52.2% of the participants are university graduates, 28.8% of them are over 40 years old (Fig. 6).

Based on the past and current area, user opinions were gathered, and statistical analyses were conducted. At this stage, a correlation analysis was made to define the relationship among all parameters (linear statistical relationship between two random variables). This analysis was conducted in order to find out how users evaluate the past area and which landscape values were at the forefront. The results show that there is a strong correlation between "C13, C12 *(0,808**-The past area has a color effect-Interconnected)*, C6 - C5 *(Have a panorama effect-Eye-catching)*, C7-C6 *(0,775**-A feeling of union between the sea and nature-Have a panorama effect)*, C4-C2 *(0,746**-Have a permanent effect-Impressive)* and C9-C8 *(0,720**-Have a natural appearance-The sea and nature are in harmony*) parameters. Other parameters and their correlation are given below (Table 2).

The One Sample T-Test was applied for the survey in order to decide if there was a meaningful difference among 21 criteria of the past area. The data derived from the analysis are shown in Table 3. The data show that p (sig.) < 0.05, which means that there is a meaningful difference among

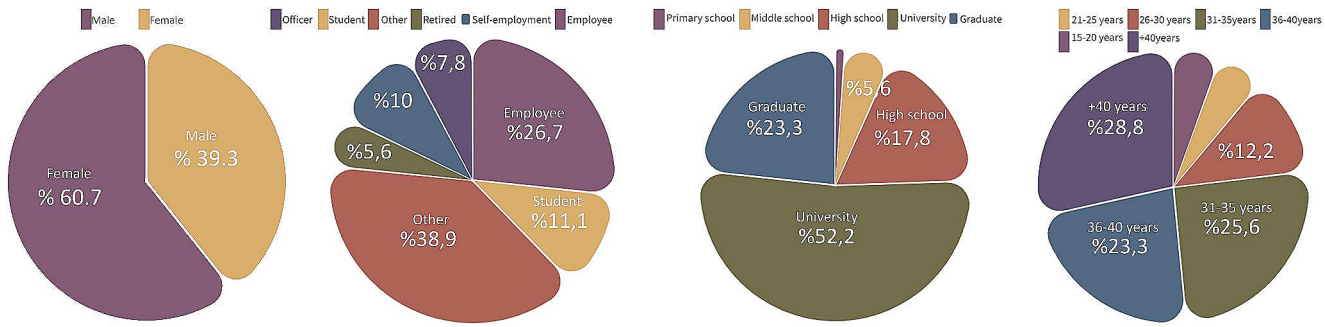


Fig. 6 Demographic findings

Table 2 Correlation with the past area

PAST	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	C21
C1	1																				
C2	,584**	**1**																			
C3	,416**	,587**	**1**																		
C4	,441**	,746**	,625**	**1**																	
C5	,426**	,696**	,613**	,639**	**1**																
C6	,516**	,637**	,637**	,651**	,775**	**1**															
C7	,606**	,660**	,645**	,618**	,669**	,752**	**1**														
C8	,097	,175	,238*	,233*	,348**	,373**	,284**	**1**													
C9	,096	,092	,244*	,139	,208*	,283**	,283**	,720**	**1**												
C10	,032	-,055	,167	,020	-,105	-,053	,137	,450**	,604**	**1**											
C11	-,113	-,077	,066	,054	,172	,123	,024	,619**	,578**	,509**	**1**										
C12	-,078	-,037	,125	,043	,205*	,138	,040	,659**	,657**	,616**	,872**	**1**									
C13	,012	,016	,189	,101	,190	,172	,161	,679**	,684**	,586**	**,717****	**,808****	**1**								
C14	-,019	-,021	,090	-,037	-,038	,016	,136	,248*	,135	,447**	,408**	,426**	,430**	**1**							
C15	-,021	-,044	,095	-,018	,104	,024	,083	,461**	,491**	,539**	,644**	,707**	,718**	,483**	**1**						
C16	,002	,070	,181	,096	,120	,150	,255**	,176	,220*	,321**	,303**	,408**	,379**	,331**	,338**	**1**					
C17	-,080	-,059	,067	-,034	,050	-,021	-,084	-,015	,054	,015	,130	,179	,141	,204*	,132	,116	**1**				
C18	,204*	,266**	,205*	,244*	,360**	,257**	-,147	-,173	,014	,253**	,066	,010	,031	,246*	,154	,187	,017	**1**			
C19	-,043	,070	,162	-,026	,162	,189	,143	,240*	,233*	,245*	,394**	,445**	,380**	,438**	,479**	,345**	,129	,314**	**1**		
C20	-,106	-,058	,011	-,084	-,029	-,096	-,002	,220*	,207*	,280**	,464**	,352**	,311**	,307**	,371**	,229*	,096	,356**	,661**	**1**	
C21	,188	,167	,177	,097	,332**	,253**	,102	,062	,021	,212*	,171	,126	,159	,123	,026	,078	,426**	,219*	,177	,161	**1**

**(p < 0,01), *(p < 0,05)

C1. Authentic,
C2. Impressive,
C3. Readable
C4. Have a permanent effect
C5. Eye-catching
C6. Have a panorama effect
C7. A feeling of union between the sea and nature
C8. The sea and nature are in harmony
C9. Have a natural appearance
C10. A feeling of diversity between the sea and nature
C11. Saves the marine species
C12. Have a color effect
C13. Interconnected
C14. Effective in biodiversity
C15. Comfortable
C16. Relaxing
C17. Accessible
C18. Needs restoration
C19. Enables socializing
C20. Recreative
C21. I would go there more frequently in the past/new form

Table 3 The One Sample T-test for the past form of the area

					95% Confidence Interval	
PAST	t	Sig. (2-tailed)	Std. Deviation	Mean Difference	Lower	Upper
C1	17,434		1,09078	1,8738	1,6606	2,0870
C2	19,222	0,000	1,06624	2,0194	1,8110	2,2278
C3	24,478	0,000	0,87349	2,1068	1,9361	2,2775
C4	22,845	0,000	0,95750	2,1553	1,9682	2,3425
C5	15,177	0,000	1,18159	1,7670	1,5361	1,9979
C6	16,497	0,000	0,93771	1,5243	1,3410	1,7075
C7	19,968	0,000	0,91239	1,8039	1,6247	1,9831
C8	17,187	0,000	0,80262	1,3592	1,2024	1,5161
C9	19,023	0,000	0,80286	1,5049	1,3479	1,6618
C10	23,351	0,000	0,72156	1,6602	1,5192	1,8012
C11	19,618	0,000	0,66299	1,2816	1,1520	1,4111
C12	20,513	0,000	0,62926	1,2718	1,1489	1,3948
C13	19,938	0,000	0,70177	1,3786	1,2415	1,5158
C14	16,122	0,000	1,10008	2,7476	1,5326	1,9626
C15	18,272	0,000	0,81428	1,4660	1,3069	1,6252
C16	18,954	0,000	0,79019	1,4757	1,3213	1,6302
C17	16,699	0,000	0,95591	1,5728	1,3860	1,7596
C18	17,619	0,000	1,25829	2,1845	1,9385	2,4304
C19	19,760	0,000	0,69810	1,3592	1,2228	1,4957
C20	18,611	0,000	0,75710	1,3883	1,2404	1,5363
C21	15,335	0,000	1,60637	2,4272	2,1132	2,7411

C1. Authentic,
C2. Impressive,
C3. Readable
C4. Have a permanent effect
C5. Eye-catching
C6. Have a panorama effect
C7. A feeling of union between the sea and nature
C8. The sea and nature are in harmony
C9. Have a natural appearance
C10. A feeling of diversity between the sea and nature
C11. Saves the marine species
C12. Have a color effect
C13. Interconnected
C14. Effective in biodiversity
C15. Comfortable
C16. Relaxing
C17. Accessible
C18. Needs restoration
C19. Enables socializing
C20. Recreative
C21. I would go there more frequently in the past/new form

the set criteria. The highest results obtained for the past form was that; A14: Had biodiversity (2.7476), A21: I would go there more frequently in the past form (2.4272), A4: Permanent effect (2.1553) and A3: Readable (2.1068) (Table 3).

When the parameters for landscape quality of the past and current area were examined using the results of the ANOVA test, the new area only received a high score for the *"needs restoration (4,12)"* parameter while the past area got higher scores than the current area for the rest of parameters. The highest-score parameters include *"The sea and nature are in harmony, have a natural appearance (3.93), A feeling of diversity between the sea and nature (4.38), Saves the marine species (4.23) and I would go there more frequently in the past (4,77)"*. Users find the past area more effective for almost all criteria selected based on the results obtained (Table 4).

From the factor analysis (principal components analysis) conducted at the assessment stage, 5 important components representing 21 criteria for the "new area" were identified. The 5 important components identified constitutes of about 72% of the total variance. Based on the factor analysis results, the factor load and common variance values are shown in Tables 5 and 6 and graphical distributions are shown in Figs. 4 and 5. In the analysis, the factor loads were found to be between 0.810 and 0.577.

The analysis showed that *"The sea and nature are in harmony", "The new area saves the marine species", The new area enables socializing"* parameters of the first factor load were significant, counting for 29.355% of the total variance. The second factor load's *"impressive"* and *"have permanent effect"* parameters were found to be significant and constituted 51.832% of the total variance. The third factor load's *"biodiversity"* and *"accessible"* parameters were found to be significant and constituted 60.190% of the total variance. The fourth factor load's *"A feeling of union between the sea and nature"* and *"accessible"* parameters were found to be significant and constituted 67.604% of the total variance. As seen in this analysis, the fifth factor load

Table 4 The ANOVA test results for the landscape quality parameters

Variables	1(PastI) 2(new)	N	Mean	Std. Deviation	Lower Bound	Upper Bound	F	Sig.
C1.Authentic	1	140	2.54	0.97	3.93	4.22	857.5	0.000
	2	140	1.06	0.45	1.62	3.00		
	Total	280	3.54	2.54	3.43	4.08		
C2.Impressive	1	140	2.89	1.48	1.35	1.47	579.1	0.000
	2	140	2.46	1.82	6.51	5.35		
	Total	280	3.04	1.68	1.58	3.68		
C3.Readable	1	140	4.86	2.23	1.46	1.56	478.8	0.000
	2	140	2.55	0.56	2.47	2.54		
	Total	280	3.47	1.45	3.33	3.61		
C4.Have a permanent effect	1	140	2.46	1.46	2.36	2.51	357.9	0.000
	2	140	1.46	2.57	2.47	2.57		
	Total	280	3.13	1.45	2.99	3.27		
C5.Eye-catching	1	140	3.65	1.46	1.66	1.38	469.2	0.000
	2	140	2.58	2.61	4.37	4.54		
	Total	280	3.67	2.49	3.00	3.29		
C6.Have a panorama effect	1	140	2.29	1.06	2.57	1.34	864.9	0.000
	2	140	0.57	2.46	4.34	4.54		
	Total	280	3.37	1.41	3.23	3.50		
C7.A feeling of union between the sea and nature	1	140	1.87	1.34	1.35	2.57	457.6	0.000
	2	140	0.55	2.64	1.24	2.45		
	Total	280	2.67	2.67	3.22	2.30		
C8.The sea and nature are in harmony	1	140	3.93	1.28	2.76	3.11	5.9	0.000
	2	140	4.45	0.72	4.35	4.55		
	Total	280	3.69	1.28	3.57	3.81		
C9.Have a natural appearance	1	140	5.77	0.90	1.64	1.89	1042.9	0.000
	2	140	4.40	0.75	4.29	4.50		
	Total	280	3.08	1.55	2.93	3.23		
C10. A feeling of diversity between the sea and nature	1	140	4.38	0.66	1.29	1.47	3200.0	0.000
	2	140	3.71	0.53	4.63	4.78		
	Total	280	3.04	1.77	2.87	3.21		
C11. Saves the marine species	1	140	4.23	1.11	2.08	2.38	722.3	0.000
	2	140	0.10	0.60	3.67	4.66		
	Total	280	3.40	1.48	3.26	3.55		
C12. Have a color effect	1	140	2.56	0.69	1.53	1.72	2584.2	0.000
	2	140	4.67	0.51	4.60	4.74		
	Total	280	3.15	1.64	2.99	3.31		
C13. Interconnected	1	140	3.44	0.67	1.35	1.54	3969.3	0.000
	2	140	2.96	0.38	4.77	4.88		
	Total	280	3.14	1.78	2.96	3.31		
C14. Effective in biodiversity	1	140	2.99	1.64	0.99	2.65	463.6	0.000
	2	140	1.95	0.98	0.64	1.97		
	Total	280	3.97	2.64	1.47	2.84		
C15. Comfortable	1	140	2.86	2.00	3.07	3.07	643.5	0.000
	2	140	2.17	1.98	2.89	2.07		
	Total	280	2.07	1.97	1.75	2.97		
C16. Relaxing	1	140	2.86	1.35	2.47	3.64	537.4	0.000
	2	140	0.95	1.32	2.64	3.74		
	Total	280	1.67	2.95	2.86	2.96		
C17. Accessible	1	140	1.84	2.85	2.75	3.74	136.6	0.000
	2	140	1.81	1.85	2.46	2.96		
	Total	280	2.84	3.97	2.04	3.74		
C18. Needs restoration	1	140	3.96	2.98	1.98	2.96	579.8	0.000
	2	140	4.12	3.03	2.97	4.22		
	Total	280	3.68	2.87	2.99	4.22		

Table 4 (continued)

Variables	1(PastI) 2(new)	N	Mean	Std. Deviation	Lower Bound	Upper Bound	F	Sig.
C19. Enables socializing	1	140	3.67	3.85	3.75	3.89	464.4	0.000
	2	140	1.67	2.74	2.85	3.75		
	Total	280	2.68	1.96	2.53	2.86		
C20. Recreative	1	140	2.68	0.90	1.64	1.89	734.7	0.000
	2	140	1.76	0.61	4.47	4.63		
	Total	280	2.76	1.59	3.01	3.31		
C21. I would go there more frequently in the past/new form	1	140	4.77	2.85	2.01	3.75	1352.7	0.000
	2	140	1.55	1.74	1.92	2.85		
	Total	280	3.16	2.83	1.54	1.78		

Table 5 Factor analysis of the criteria for the "new area"

NEW	Factor				
	1	2	3	4	5
C1. Authentic	0,232	0,627	0,006	0,177	0,163
C2. Impressive	0,338	**0,776**	0,075	0,152	-0,034
C3. Readable	0,506	0,617	0,063	0,097	0,118
C4. Have a permanent effect	0,380	**0,712**	-0,051	0,108	0,025
C5. Eye-catching	0,504	0,695	0,094	-0,170	-0,179
C6. Have a panorama effect	0,502	0,716	0,040	0,001	-0,103
C7. A feeling of union between the sea and nature	0,511	0,679	0,007	0,*276*	0,088
C8. The sea and nature are in harmony	**0,747**	-0,048	-0,381	-0,206	-0,179
C9. Have a natural appearance	0,726	-0,140	-0,406	-0,094	-0,031
C10. A feeling of diversity between the sea and nature	0,605	-0,390	-0,304	0,300	0,303
C11. Saves the marine species	**0,746**	-0,412	-0,072	-0,210	-0,154
C12. Have a color effect	0,345	-0,404	-0,131	-0,206	-0,005
C13. Interconnected	0,813	-0,314	-0,159	-0,156	0,070
C14. Effective in biodiversity	0,492	-0,324	**0,314**	0,199	0,**350**
C15. Comfortable	0,312	-0,412	-0,017	0,027	0,054
C16. Relaxing	0,492	-0,117	0,224	0,228	0,306
C17. Accessible	0,164	-0,109	**0,505**	-0,480	**0,444**
C18. Needs restoration	0,013	-0,458	0,278	**0,610**	0,019
C19. Enables socializing	**0,561**	-0,236	0,510	0,233	**-0,355**
C20. Recreative	0,429	-0,379	0,438	0,207	**0,810**
C21. I would go there more frequently in the past/later form	0,216	0,170	0,591	-0,577	0,009
% of Variance	29,535	22,297	8,358	7,414	4,793
Cumulative %	29,535	51,832	60,190	67,604	72,397

has the highest load among others. Therefore, it was established that the parameters *"Effective in biodiversity", "The new area is accessible", "The new area enables socializing"* and *"The new area is Recreative"* were significant factors (Table 5; Fig. 7).

At the assessment stage, 3 parameters accounting for about 70% of the total variances were identified in the factor analysis of data consisting of 21 criteria, which was conducted to obtain findings for the ***"past area"***. Based on the factor analysis results, the factor load and common variance values are shown in Fig. 8. The factor loads were found to be between 0.001 and 0.794. As a result of the analysis, the parameters *"Interconnected"* and *"Effective in biodiversity"* of the first factor load were found to be significant, corresponding to 19.583% of the total variance. The second factor load's *"The past area enables socializing"* and *"The past area needs restoration"* parameters, accounting for 41.322%, were found to be significant. Among the third factor load's parameters accounting for 70.140% of total variance, *"interconnected"* and *"the past area is recreative"* were found to be significant (Table 6; Fig. 8).

Discussion and suggestions

Contact with nature has numerous positive effects on humans (Atik 2010; Bratman et al. 2012). There are a great number of studies exploring the positive effects of green spaces in the literature, and there is an increasing interest in the healing effects of the sea and coasts (Bernadine 2019). Spending a few hours with recreational activities in natural spaces, urban dwellers would feel refreshed. In this context, coastlines offer abundance of natural habitats and recreational opportunities for people. Sandifer et al. (2021) expressed that the closer one is to the coast, either for residence or visitation, the stronger the positive health effects. Al-Monsoori and Al-Morzouqi (2016) stated that the coastline is a vitally important characteristic of the environment and affects many different aspects of civilization. Globally it becomes extremely essential to monitor the coastline zones,

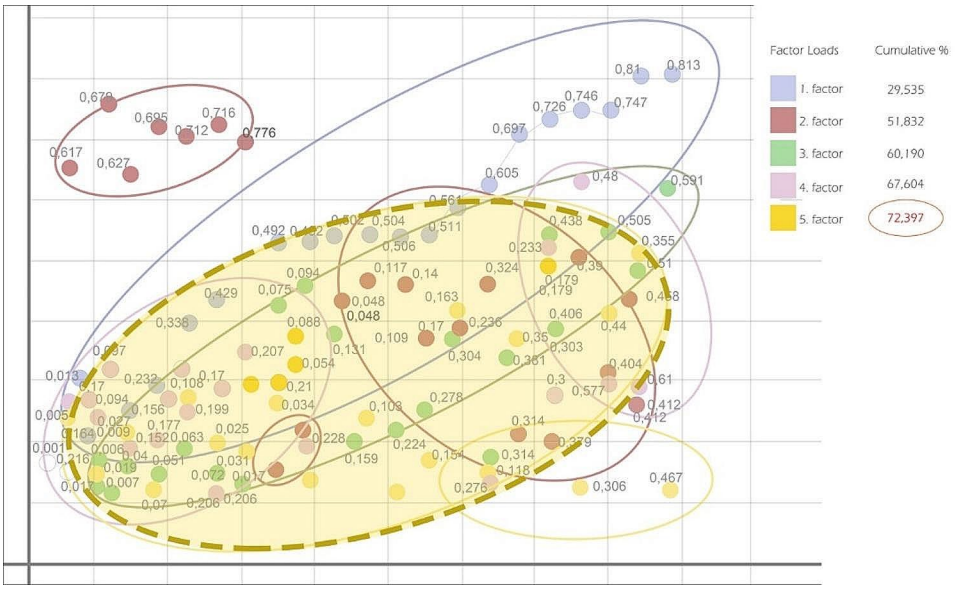


Fig. 7 Factor analysis chart of the criteria for the new area

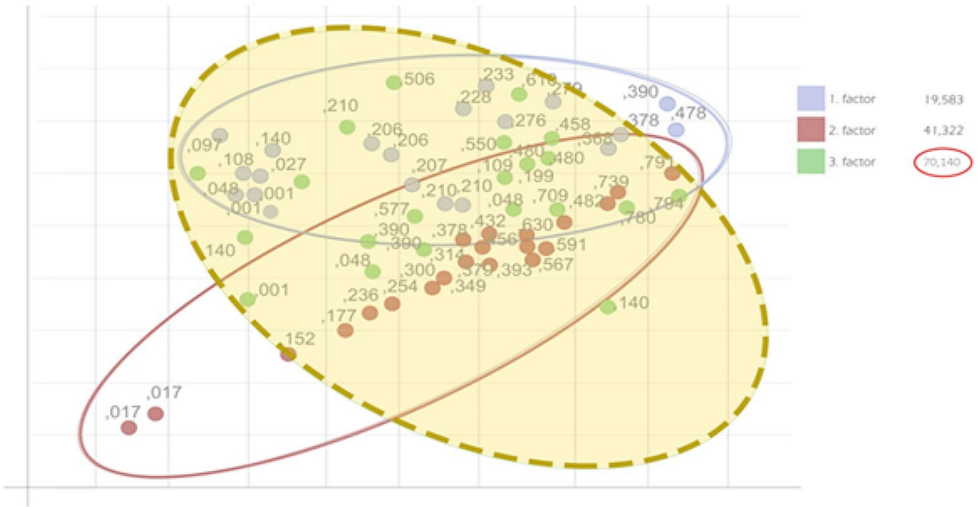


Fig. 8 Factor analysis chart of the criteria for the past area

as it reflects on economic development, environmental protection and infrastructure of the country. The coastline was defined as the segment of the earth where the sea or ocean meets the land. In Turkey, however, coastlines are filled as a result of urban development and new recreational spaces are constructed, while citizens could not utilize the coasts for long years in this process. Filling activities conducted for the purpose of earning space from the sea in Turkey after 1984 have brought significant impacts on the coastal ecosystems (Alpay 2011). Starting with the breakwaters in the coasts of Trabzon, the filling process now continues in large filling areas. This study examines the attitude of users in Besirli, Trabzon towards the filling activities on the coasts in the past and today. Accordingly, a strong correlation was found in that the past area had more color effect and was richer in biodiversity. Huang and Lin (2020) stated that colors were an important factor in the choice of place. In the past area, blue color of the sea and color effect of biodiversity elements such as leaves, flowers and fruits (Ma et al. 2020) attracted the attention of people. The result of correlation analysis showing that the past area was impressive and had a permanent effect demonstrates its relationship with the highway. Linearity of the Black Sea coastal highway from east to west and the start of the border of a new city before the other ends creates a single city until the Sarp border gate (Yılmaz 2008). The relentless urban development destroys the natural coastal formations, which leads to environmental problems.

Coastlines host the interaction between the air, water and land, have a remarkable beauty of natural resources, and are therefore always exposed to overuse. These secondary ecosystems that emerge with human pressure have an impact on natural processes as well as natural balance of numerous species (Tağıl and Cürebal 2005). Parallel to this,

Table 6 Factor analysis of the criteria for the "past area"

PAST	Factor		
	1	2	3
1. C1. Authentic,	300	,097	,001
2. C2. Impressive,	,177	,108	,048
3. C3. Readable	,152	,001	,140
4. C4. Have a permanent effect	,630	-,048	,390
5. C5. Eye-catching	,236	,001	,506
6. C6. Have a panorama effect	,349	,276	,109
7. C7. A feeling of union between the sea and nature	,254	-,206	,458
8. C8. The sea and nature are in harmony	,378	-,140	,048
9. C9. Have a natural appearance	,456	-,390	,140
10. C10. A feeling of diversity between the sea and nature	,017	-,210	,390
11. C11. Saves the marine species	,567	,206	,210
12. C12. Have a color effect	,432	,210	,199
13. C13. Interconnected	,**791**	,027	,**794**
14. C14. Effective in biodiversity	,**739**	,228	,780
15. C15. Comfortable	,482	,233	-,480
16. C16. Relaxing	,314	,207	-,480
17. C17. Accessible	,017	,368	,550
18. C18. Needs restoration	,393	,**478**	,610
19. C19. Enables socializing	,379	,**378**	,577
20. C20. Recreative	,591	,279	,**709**
Cumulative %	19,583	41,322	70,140

The C21 parameter is used when querying the new area.
The C21 parameter was not used when querying the old version.

people in this study supported the approaches that protect the coastal ecosystem. According to the ANOVA analysis conducted with the survey results evaluated by the users of the coastline of Beşirli, Trabzon, there is an overwhelming opinion for the need to restore the new form of the area. Current appearance of the filling area and distance from the sea gives an idea about people's negative opinions on the form of the area. It was also revealed that the users would like to get rid of the current form of the area as soon as possible. Their preference for the past form of the coasts seems to be the primary indication of this fact.

In any part of the world, the coastal character changes with the fillings, harming the image of the city, and the use of the coast is differentiated. Kurt (2013) highlights that the coastal utilization is differentiated in the Black Sea region with urbanization. He stated that this differentiation would continue and there was a need to make quick sustainable coastal plannings. Maintaining the integrity of natural spaces has gained importance in the context of ecological design criteria and sustainability. For example, Hsieh et al. (2004) provided a green road planning in their study for the protection of wet areas where coastlines meet the land.

Conclusion

Coastal cities can be considered as luckier than other cities in terms of ecological and cosmetic aspects (Sandifer et al. 2021). Trabzon has become a city that contributes to the development of several industries including transportation, agriculture and tourism not only with its rich natural resources but also as a coastal city. However, with the increase in population and urbanization, the demands/needs have increased, and along with it, coastal fillings have been built on the coast of Trabzon and these fillings have been expanded over time. As a result of these pressures, coastline violations have also become more common. The coastal recreational areas constructed by filling were re-filled and became unusable (Bekci 2021, Aktürk and Güneroğlu 2021). Accordingly, the study examined the evaluations of coastal users of the past and current area with analysis methods based on the 21 parameters defined.

The coasts have a meaning for the people of Trabzon, who lived together with the sea in the past. Although the fillings made as a solution to the transportation issues, the city-coast-sea relationship could not be recovered despite recreational solutions offered through a green buffer between the fillings and the highway. One of the primary reasons of this problem is the failure to implement planning and design decisions properly to serve the ecosystem for the public benefit.

Currently, the users have unpleasant experiences with the walking track, bicycle track, food&beverage facilities, sports equipment and parking area remaining between the highway and filling area. Construction vehicles, piles of soil, debris and most importantly the inability to access the sea are among these negative experiences. A new design route may be specified by especially examining the coastal utilization in developed countries. The coasts can serve to the public benefit again with nature-friendly, environmentally conscious designs that are susceptible to ecological balance, take into consideration the climate of region, use natural and renewable resources and prioritize the use of recycled materials on the coasts with delicate ecosystems.

In this study, the ongoing coastal filling area in Beşirli, Trabzon was evaluated with a user-oriented study. The filling projects started in the 1980's with the planning of the Eastern Black Sea Highway, and they still continue today. The filling process should be completed as soon as possible and the coastal areas should be left for public use by ensuring the sustainability of protection-utilization balance. The relation between the land and marine ecosystem should be supported with a holistic planning approach, addressing the ecological design criteria. The coastal planning decisions should be revised, and new sustainable adjustments have to be made at the micro and macro scale.

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