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Study on Shoreline Ecological Environment and Protection Countermeasures-combined with 30 years of image changes of busan coastline as the center

Zhang Wu, Pu Zemin, Li Baitong, Yang Huimin, kim Chul soo

Pukyong National University

ABSTRACT. *The development focus of sea-dependent countries is gradually shifting to coastal areas with the rapid development of global economy and trade. In more than 220 countries and regions around the world, there are about 180 coastal areas where about half of the world's population live within 100km of the coastline. With the rapid expansion of coastal cities and the excessive development of coastline, the spatial shape of coastline has undergone tremendous changes, leading a series of environmental problems.*

KEYWORD: *Ecological environment; Spatial morphology; Armor blocks; Ecological restoration coastline*

1. A Survey of Coastline Ecological Environment

Rapid population growth and rapid development of the shipbuilding industry have resulted in less and less land available, and the Busan coastline has rapidly extended to the sea over the past 30 years. The bay is filled by means of reclamation. The main construction contents include trade ports, shipyards, road facilities, residential areas, markets and tourist attractions. Coastline environmental problems are serious so that the environmental protection and ecological restoration work is imminent. This paper compares and analyzes the changes of Busan coastline in the past 30 years by using modern advanced technology and image processing methods, and sorts out the environmental problems and change characteristics of the coastline. Ways and means of coastline environmental protection are found through the conclusions and data of the study to make the shoreline greener, the beaches cleaner, the banks greener and the scenery more beautiful.

Over-exploitation of coastal space leads to the destruction of plant landscape along the coastline, the reduction of sea-friendly space, the degradation of sandy beaches, the damage of terrestrial morphology, the increase of pollution sources, the safety incidents caused by artificial environment and other environmental problems. The land has expanded rapidly towards the sea, and most of the gentler bays have now been filled, moving from natural arcs to broken or straight coastlines (see figure 1). With the rapid development of coastline tourism, the human activity trajectory appears more and more frequently in coastal environment. From a short-time point of view, the establishment of artificial sites and human activities on the environment is far greater than the impact of natural changes.

2. Morphological Analysis and Comparison of Busan Coastline Space

2.1 Morphological analysis of breakwater protective lumps

The Busan coastline is dominated by three different types of protective lumps (see Table 2). Researchers have been focusing on the effect of morphology of protective lumps on waves, but neglected the accidental effects of human activities along the coastline. The number of safety accidents caused by protective lumps in various countries is increasing year by year.

A large number of protective lumps are used for Busan coastline to form a grey concrete junction between the city and the sea. The sea level, which could have been extended indefinitely, is limited, while urban and marine spaces are cut off by a barrier. Although the space is more limited, many people look through the dam every day and stand on the protective lumps for fishing. According to South Korean data, the number of accidents on protective lumps in 2017 has doubled compared with 2012.

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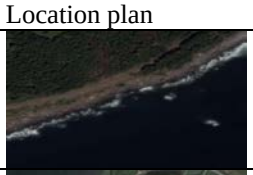
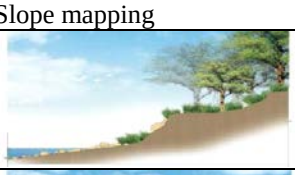
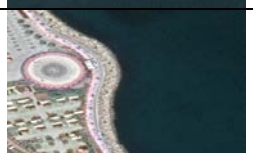
2.2 Morphological analysis of coastline space

Because of the shortage of coastal land resources and the accelerated extension of land to marine space, reclamation has become the main way to solve the land contradiction and marine resources utilization. The original ecological environment of the coastline has gradually evolved into an artificial environment, and the original spatial elements have been replaced by reinforced concrete. Investigate and analyze the spatial pattern of Busan coastline (Table 3) to find out the causes of ecosystem deterioration and coastal accidents in essence.

Table 3 Morphological analysis of Busan Coastline

Classification	Type	Location plan	Slope mapping	Components
Nature Shoreline	Category A			Naturally growing plants, mountains, rocks, sandstones, seawater, etc;
	Category B			Naturally growing plants, silt, sand, seawater, etc;
Artificial Shoreline	Category C			Buildings, viewing platforms, fences, roads, silt, sand, seawater, etc;
	Category D			Buildings, fences, roads, artificial plants, silt, sand, seawater, etc;
	Class E			Buildings, roads, breakwaters, protective lumps, artificial plants, silt, sand, seawater, etc;
	Class F			Buildings, roads, breakwaters, protective lumps, sand, seawater, etc;
Ecological restoration shoreline	Class G			Sand, sea water, artificial plants, etc;

2.3 Analysis conclusion

The graphic production and analysis are conducted in view of the various spatial types of Busan coastline. The natural shoreline is simple in spatial form and mainly exists in the steep hills or near the estuary of Gangneung so that the land cannot be used well. The artificial shoreline is complicated in spatial form and mainly exists in the flat hills and areas where human activities are concentrated. It is easy to form a series of dead corners and threaten human security and ecological environment.

In order to analyze the spatial relationship of Busan coastline more accurately and meticulously, five concepts of influence space are introduced. This paper emphasizes whether people living in the coastline environment are obscured by buildings or artificial facilities. Through these specific spatial relations and data differences, the paper makes a comparative analysis of spatial attributes, summarizes and analyzes a series of problems in the development process of Busan coastline space.

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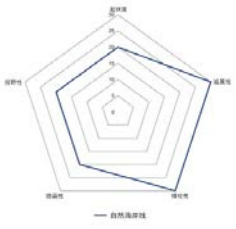
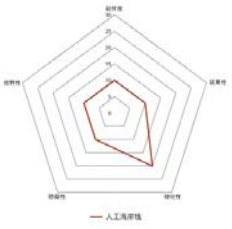
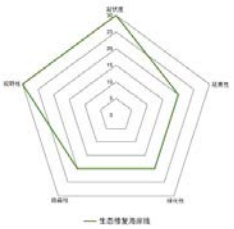
Table 4 Spatial Characteristics of Busan Coastline

Comparison and Analysis of Spatial Features															
Spatial attributes	Undulation degree			Ductility			Greening property			Concealment			Visibility		
Spatial action	Small	Medium	Big	Small	Medium	Big	Small	Medium	Big	Small	Medium	Big	Small	Medium	Big
Natural shoreline		·				·			·		·				·
Artificial shoreline	·			·				·		·			·		
Ecological restoration shoreline			·		·			·			·				·

According to the analysis (Table 4), the main problems of artificial shoreline space are as follows: (1) The fluctuation of space is large, and it is easy to lead to safety accidents; (2) The color of coastline is mainly cement ash, and the recognition degree is poor; (3) The straightness of the artificial shoreline limits the extensibility of the ocean; (4) There are many dead corners in the space formed by the protective lumps, which is easy to accumulate rubbish and threaten the safety of human activities; (5) The material of reinforced concrete is not easy to attach and grow to marine organisms; (6) Large area of reinforced concrete is not easy for plants growing on the land; and (7) The dam is closed and the visibility of city and space is poor. (8) There is little hydrophilic space so that it is difficult to form waterfront landscape.

Table 5 Analysis Map Spatial Characteristics of Busan Coastline

Coastline type	Natural coastline	Artificial coastline	Ecological restoration of coastline
Radar analysis chart			
Spatial Attributes	Good	Poor	Good

As can be seen from the attribute analysis map of the three types of coastline (see table 5), the natural coastline and the ecological restoration coastline have fuller spatial attributes, while the artificial coastline has poorer spatial attributes. The purpose of artificial coastline construction only emphasizes the use of functional space, but ignores a series of environmental problems caused by artificial materials, colors and space. In recent years, the restoration of coastline in the form of sand beaches has been favored, not only to play a role in dissipating waves, but also to filter the seawater and improve the ecological environment.

3. Environmental Analysis and Protection Strategy of Busan Coastline

3.1 Analysis of coastline environment problems

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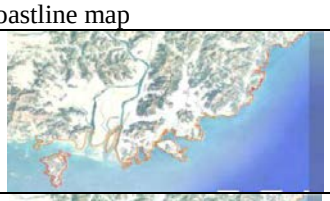
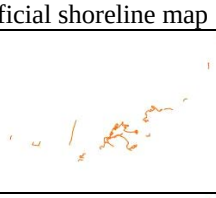
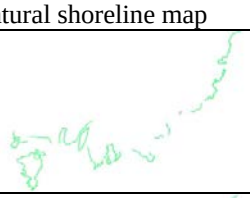
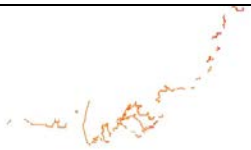
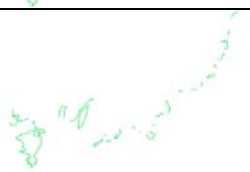
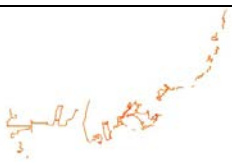
The coastline path of satellite images is analyzed by image processing software CorelDRAW, Photoshop and AutoCAD, and the coastline path is decomposed into natural coastline map and artificial coastline map according to the image characteristics.

A comparison of high-definition satellite maps and shoreline type maps for the four stages from 1988 to 2018 (see table 6) reveals the following characteristics. (1) The color of the whole coastline is approaching from dark green to grayish white and khaki. (2) The line pattern of the coastline changes from natural bay to linear one. (3) The artificial shoreline length increases rapidly and the natural shoreline shortens gradually. Busan is superior in geographical position so that the shipping and shipbuilding industry is growing stronger and stronger. A large number of ports and docks have been added around the bay, and the large-scale construction of trade and manufacturing industry is the main factor of changes in Busan coastline.

Table 6 Comparative Analysis of Busan Coastline

Time	Coastline map	Artificial shoreline map	Natural shoreline map
1988			
1998			
2008			
2018			

3.2 Environmental Protection Strategy of Busan Coastline

A coastline-land change map was produced based on electronic satellite maps for the four periods of 1988, 1998, 2008 and 2018 (see figure 8). Through the analysis, it can be concluded that the speed of digging and reclamation is faster in 1988-1998 and 1998-2008. In 2008-2018, the land area increased slowly. Combining with the data of Busan coastline change and spatial form analysis, the following strategies of coastline environmental protection are summarized.

3.2.1 Regulate and control the volume of coastline space tourism properly to alleviate the environmental problems caused by tourism.

With the rapid development of marine cultural tourism, the number of tourists increases rapidly, and a large number of abandoned pollutants penetrate into the seawater, resulting in environmental problems arising from tourism. Carry out in-depth study of the coastline landscape environment, analysis of the environment and space that can accommodate tourists, and ultimately develop the coastline scenic area reception indicators. If the capacity exceeds the standard in the peak season of tourism, it is necessary to do well in advance the publicity or drainage measures of the reception quota of scenic area. In order to make the tourism area sustainable development, the shoreline landscape must adopt the ecological and pollution-free management mode, and

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expand and increase the tourist capacity properly without destroying the coastline structure and affecting the natural environment.

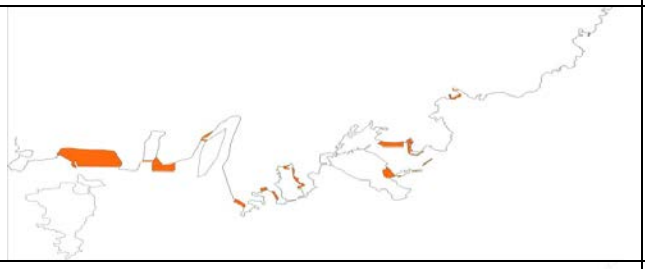
3.2.2 Control the dangerous behaviors related to the coastline and reduce the accidents.

The Busan coastline is mostly artificial shoreline. It is mainly composed of the protective lumps, docks or Fort-like ridge. The coastline accidents increase year by year because of the large spatial fluctuation and the existence of more hidden space. Although the shape of the protective lumps fluctuates greatly and is not easy to walk and stay for a long time, many fishermen gather on the protective lumps every day. In the case analysis table of accident case of protective lumps, the proportion of falling is large, and the main causes of falling are fishing and drunken walking. Understand the location of fishing along Busan coastline and the wishes of fishermen, the best location along Busan coastline should be chosen for the design of fishing park.

3.2.3 Control the development of the coastline and the ecological environment, and coordinate the relationship between development and protection.

Through the analysis of the changes of Busan coastline in the past 30 years, it is shown that the coastline length is reduced and the land area is expanded rapidly. Although the speed of coastline development has slowed down and the ecological environment has improved in recent years, there are still many reclamation and ecological environment problems. Strengthen the management of enterprises, residential areas, tourism services and commerce along the coastline, and prohibit all acts that can cause environmental pollution. Increasing the development of new marine energy and using waves for power generation device design, not only can dissipate waves, but also can carry out the conversion of electric energy, to provide convenience for residents living and landscape lighting.

Table 7 Analysis Map of Changes in Coastline Land change (1988-1998, 1998-2008, 2008-2018)

Time	Artificial reclamation area	Construction purpose	Feature
1988-1998		Trading port, Residential areas, Shipbuilding enterprises, Wharf, Breakwater dam,	New
1998-2008		Trading port, Coastal roads, Trading market, Other enterprises, public environment, breakwaters and dams	New
2008-2018		Enterprise expansion, Public environment, Tourist attractions	Expansion

3.2.4 Create a harmonious atmosphere between mankind and nature through the local reconstruction design of the coastline space.

Process of design practice emphasizes the sustainable development and constantly optimizes the coastline

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environment from ecology, environmental protection, economy and sociality and other prospects. Through the investigation and data analysis of the coastline space in the early stage, the local coastline space with prominent problems is selected. The main contents of the reconstruction include: (1) The reconstruction design of the protective lumps: reduce or avoid accidents by changing the shapes, materials and colors of the protective lumps; (2) Lighting retrofit design: change the lighting mode and adding lighting facilities to avoid corresponding accidents caused by blurred vision at night; (3) Rebuild and design the guidance system, provide additional safety warning signs and relevant accident rescue information; (4) The design of ecological improvement: use the methods of sand restoration or vegetation restoration to change the spatial shape of shoreline and increase the harmony between human activities and nature; (5) The design of space and environment reconstruction: weaken the boundary and obstacle between the city and the sea, and construct the public environment space on the idle or low-utilization land.

4. Conclusion

Busan has a long coastline, and the topography and construction involved are more complicated, and it is difficult for investigation and study. This paper uses the historical image overlapping method to analyze the overall environment, look for the characteristics of changes in coastline and the reasons for the change of human settlements.

Facing the reduction of natural coastline, the depression of manufacturing industry, the increase of idle land and the prominent ecological problems, it is necessary to conduct in-depth research and excavate the root causes of the problems. In the future research, we will focus on the solution of specific problems, and plan to carry out the coastline reconstruction design practice.

Coastline environment reconstruction and ecological management practice should start from the site attributes, spatial environment and time axis, etc. In the local reconstruction of the coastline, the functional organization and layout of the space are mainly considered in order to enhance the accessibility and continuity of the space. Appropriately increase the representative sculptures, guides, buildings or scenes, strengthen the regional characteristics and highlight the cultural attributes of marine culture.

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References

[1] Qiao Jiguo, Xu Dong, Liang Hao, Gong Shaojun, et al (2018). Analysis of the Influence of Landform Environment Evolution on Land Reclamation in Binhai New Area [J]. Ocean Development and Management, no.5, pp.12-13.
[2] Song Shuqin (2018). Disappearing Coastal Wetlands [J]. Ecological Economics, no.3, pp.12-13.
[3] Fang Cheng, Wang Xiaodan, Yang Jinxia, et al (2014). Analysis of Coastline Change Characteristics and Environmental Impact Effect in Tangshan City [J]. Ocean Bulletin, no.4, pp.12-13.
[4] Song Wenjie, Yu Sisi, Chen Meihua, Wu Tao (2017). Spatio-temporal Variation and Anthropogenic Disturbance Analysis of Sanmen Bay Coastline in Recent 30 Years [J]. Journal of Zhejiang Normal University, no.3, pp.12-13.
[5] Li Liangcai, Dengsheng L U, Zhang Xiaoli (2017). Study on Coastline Change of Beibu Gulf from 1987 to 2013 Based on Remote Sensing [J]. Marine Limnology Bulletin, no.4, pp.12-13.
[6] Gao Yi, Su Enzhen, Sun Xiaoyu (2011). Analysis on Change in Land Use and Driving Forces of Island Coastal Zone in Guangdong Province in Recent 20 Years [J]. Journal of Ocean, no.4, pp.12-13.
[7] Xian Xianbo, Chen Dong (2004). Discussion on Environmental Problems of Zhanjiang Bay [J] Ocean Development and Management.
[8] Li Fei, Jin Ru, Zhao Jianhua, Song Derui (2018). Study on Classification of Jiangsu Coastline Types Based on Attribute Features [J]. Development and Management, no.3, pp.12-13.