A New Proposal for Environmental Safeguarding of the Coastal Zone

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Abstract
This paper considers the problems of the evolution of coastal areas and safeguarding their environment, utilising the control of some parameters to prevent the erosive phenomena. It is quite evident, from the studies made, the possibility of a preventive action to avoid erosive phenomena which, to day, are very dangerous and very difficult to solve. In many countries coastal protective structures are built only after the setting in motion of the erosive process, and in many cases when it is irreversible. A tardy intervention is, of course, more expensive and more difficult. The comparison among changes of bathymetry and consequently shoreline regression shows that it would have been possible to predict the present situation and a correct protective action, made some years ago, could have had better chances of maintaining the environmental equilibrium.

Key Words: Coastal geomorphology, human impact, erosive phenomena.

Introduction

Since the beginning of the 20th century, everywhere in the world, the coastal areas have been affected by a widespread regression which reached the critical stage after 1950. This situation is in contrast with the general trend of accretion that has affected the coastal zone in the XIX century.

The Mediterranean Sea coast shows a large variety of shoreline. Today about forty percent of the Mediterranean coast is threatened by a progressive and general degradation which mainly is manifested as beach erosion. This phenomenon seemed to worsen in the '50s after a long period of general beach stability.

If one considers the intense interventions of man on its coasts for touristic purposes, by demolishing the dunes to create beach areas, summer residential and marine areas; the diminished fluvial sediment load to the sea by haphazard removal of riverbed material; the increased subsidence caused by groundwater, gas and oil extractions in areas too close to the sea; one obtains a picture which easily explains the rapid instability of this coastal environment. This situation is present not only along the Mediterranean Sea coast but, in a greater or lesser degree, includes the coastlines of many other countries.

This increased economic development, without worrying about what would be the future impact on the environment, tends to worsen the already precarious situation even more. From the end of the 1950s, up to the present day, the coastal area was used as an inexhaustible and indestructible property on which it would be possible to burden an infinite number of works without this feeling. An improper exploitation was used in this fragile region, without taking into account the consequences, instead of managing it as a precious commodity which must last in time to permit better economic management.

The consequences of the concentration of economic activity in the coastal zone involve not only the shoreline area but even the territory on the back for a band of 50 Km wide. This event is evidenced by a continuing migration and increasing of the population during the last 50 years every where in the world.

The irrational overuse, considering the coastal area as an endless commodity, has made the construction of massive defence works more and more necessary. Many interventions were made as an emergency solution without prevention of the phenomena to face. This is a great error depending from the absence of prediction to permit prevention. The comparison of the geomorphologic parameters, mainly the changes of bathymetry, during the past 60 years in the Adriatic Sea (Italy) permits to point out a very simple methodology with the possibility of a preventive action based on the prediction of the regression of the shoreline.

The Adriatic Coast Situation

The upper Adriatic coast of Italy, from the Venice Lagoon to the Ancona promontory, is a good example of the above mentioned state of environment destabilization. Going from North to South, one first meets the thin Venetian littoral, with the lagoon at its back; the Po River Delta follows, continuously developing into the sea. From here to the Gabicce promontory a continuous shallow littoral, with the Po Plain at its back, extends.

The only factor common to such a morphologically diverse coast is erosion. To make up for the increasing erosive processes, many kinds of defence works have been put into operation. The sea walls («Murazzi») associated with groins to protect the Venice lagoon; dikes to defend the lowland behind the shoreline and longard tubes in the River Delta; breakwaters from the Po Delta to the Ancona promontory lie here and there along coastal stretches mainly protected by groins, or star-shaped concrete elements established on piles or by underwater barriers, constructed of synthetic sacks filled with sand and laid down in a cell-like system where cell is artificially replenished with sand.

All these protective works, constructed at different times and impelled by necessity, involve the coast without guaranteeing its future stability. Moreover, since they were built in the course of erosive process, their cost was astronomical.

If one considers the evolutional trend of the whole Northern Adriatic coastal area, it is possible to show some significant parameters derived from the numerous' preceding studies. Along the Venetian littoral, both an apparent stability of the shoreline and anomalous accretions near the jetties have been occurring. The former situation is due to the «Murazzi» that, from ancient times, have protected the beach stopping any shoreline change, but did not prevent the sea bottom slope from increasing. An increase in bottom slope is also noted in the Po delta area from the 1960s on, in connection with the diminished fluvial sediment yield to the sea which allowed the submersion of the more external sandy barriers of the deltaic system. The same situation of a continuing increase of the bottom slope between the shoreline up to the 5 m isobaths is also noted along the coastal area between the Po river delta and the Gabicce promontory from the 1960s up to the present time.

From the comparison among the diagrams plotted utilising the adopted parameters one can see that erosion gradually developed in time through a continual increase in the near shore bottom slope which in turn led to a shoreline regression, often achieving irreversible situations.

In particular, if the bottom slope from shoreline to 5m isobaths is % <0,50, the littoral is stable, the interval % 0,50-0,75 shows an unstable situation, the; interval % 0,75-1 means a danger situation for the shoreline stability and with a bottom slope % >1we are sure that the storms waves attack the backshore with regression of the shoreline. These parameters have validity, of course, only for the considered coastal area. This fact clearly demonstrated how it would be possible to predict beforehand the final step of the general degrading of the coastal strip (present situation).

Conclusions

It is quite evident, from the studies made, the possibility of a preventive action to avoid erosive phenomena which, to day, are very dangerous and very difficult to solve. Not only in Italy, but even in many countries coastal protective structures are built only after the setting in motion of the erosive process, and in many cases when it is irreversible. A tardy intervention is, of course, more expensive and more difficult. The comparison among changes of bathymetry and consequently shoreline regression shows that it would have been possible to predict the present situation and a correct protective action, made years ago, could have had better chances of maintaining the environmental equilibrium.

It is incomprehensible why this obvious principle is never used in the coastal environment defence. Based on past experience, it is recommended to establish a continuous and systematic survey of those environmental parameters capable of showing evolutional variation in coastal areas. Management in this way will avoid being taken by surprise when erosive processes develop. It would be opportune if coastal town officials would take on this responsibility. Briefly, it should be remembered that for a basic survey for possible future interventions, it is sufficient to measure very simple parameters as those described previously, which should serve not to quantify the interventions but to indicate when the situation is developing into dangerous levels for the equilibrium of a coastal environment. The cost of such a service is relatively low, but it would save in the future, guaranteeing at the same time greater possibilities of success in protecting our coasts.

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