

UPDATE OF THE VULNERABILITY ANALYSIS AND MANAGEMENT STRATEGY FOR THE COAST OF THE VENETO REGION

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INTRODUCTION

The high urbanization and the increasingly high percentage of people living in coastal areas (in Italy around 30% of the population lives in the 645 coastal municipalities) increase the value exposed to the risk of coastal erosion and flooding. In fact, the beaches have a clear tourist, productive and environmental interest, but more importantly represent the first "natural defense" of the hinterland from the sea. The correct management of the coasts is therefore essential to mitigate the risk of economic losses, damage to the artistic/cultural heritage and the environment and to avoid hazards to the safety of the people present in these territories.

AIMS

The present study aims to establish an updated coastal plan for the Veneto Region (Italy) based on a balanced combination of a scientific rigorous approach and expert, discussion-based, assumptions. In fact, the analysis of the coast requires periodic updates that take into account the effects of the recent mitigation actions undertaken, the variation of the drivers (e.g. sea level rise, wave climate) and the morphological evolutions undergone, based on systematic monitoring.

INVESTIGATED AREA

The investigated area is the coast of the Veneto Region which extends for approximately 160 km (Figure 1), between the mouth of the Tagliamento river and the most southern mouth of the Po river Delta (Po di Goro). This area belongs to the provinces of Venice and Rovigo and is administratively subdivided into 11 municipalities.

The coastal area is characterized by a variability of land uses (touristic, productive and environmental), ecosystems and includes the mouths of 7 rivers (Tagliamento, Livenza, Piave, Sile, Brenta, Adige and Po) and several lagoons (Baseleghe, Caorle, Venice and the lagoons of the Po Delta).

The northern coastal stretch belonging to the province of Venice is bound by the mouth of the Tagliamento river and the mouth of the Adige river and extends for approximately 100 km. Due to the presence of several urban and tourist settlements, the position of the shoreline is stabilized through coastal structures, such as groins and sea walls, considering of major importance the touristic value.

The southern stretch of coast belonging to the province

of Rovigo is bound by the mouth of the Adige river and the mouth of the Po di Goro river (about 60 km). It corresponds to the Po Delta area and is formed by low sandy barrier islands that protect the lagoons behind. This area has a unique environmental value to be preserved.

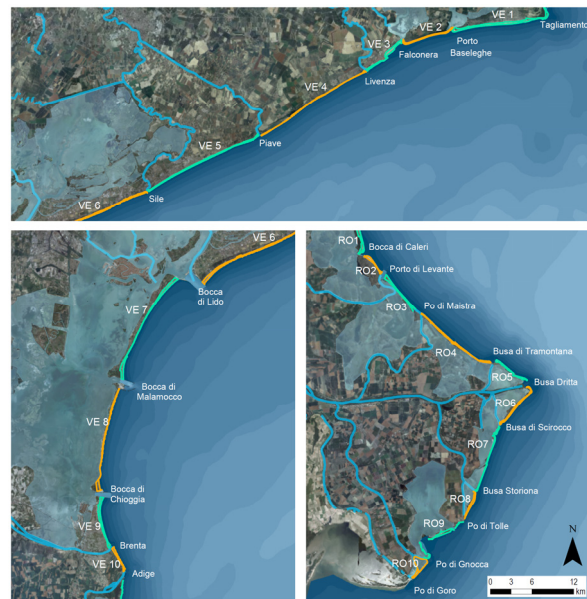


Figure 1. Coast of the Veneto region with the littoral cells name and bounds highlighted

METHODOLOGY

The vulnerability analysis follows the procedure presented by Ruol et al. (2018) for the previous coastal plan of the Veneto Region. The coast is subdivided into homogeneous littoral cells (shown in Figure 1) that allow a better understanding of the coastal dynamics.

The methodology consists of two phases: 1) a descriptive phase and 2) a design phase. The first phase includes the update of the description of the entire coastline, in multidisciplinary terms, and the estimation of the sediment balance based on recent bathymetric surveys and data. The second phase highlights the criticalities by providing indications for planning coastal defense interventions and strategies in the medium time scale.

All available and recent information and data are collected and stored in a Coastal GIS. These data comprise, among others, a new bathymetry survey (2022) of the entire coast and a database of all the

nourishments and dredging operations in the last 7 years (2016-2022)

The main novelty introduced is related to a more reliable set of wave data, i.e. the basis for the estimation of the coastal sediment transports and consequently the sediment balance. The new wave climate dataset was produced in the framework of the “Venezia 2021” project and includes the results of numerical modeling (Benetazzo et al. 2022, Ruol et al. 2022) extracted in 33 “virtual buoys” placed along the Veneto coastline (5 km from the shoreline) at a depth between -10m and -30m. Figure 2 shows the positions of the 33 wave buoys and 7 wave roses.

Based on the analysis of coastal sediment balance and on the peculiarities of each cell, a priority index is computed. This index is obtained from the product between the morphological vulnerability V_M (that considers the erosive trend and the coastal flooding hazard) and the socio-economic vulnerability V_{SE} (that takes into account the touristic value, the environmental value, the productive value, the cultural heritage, etc.).

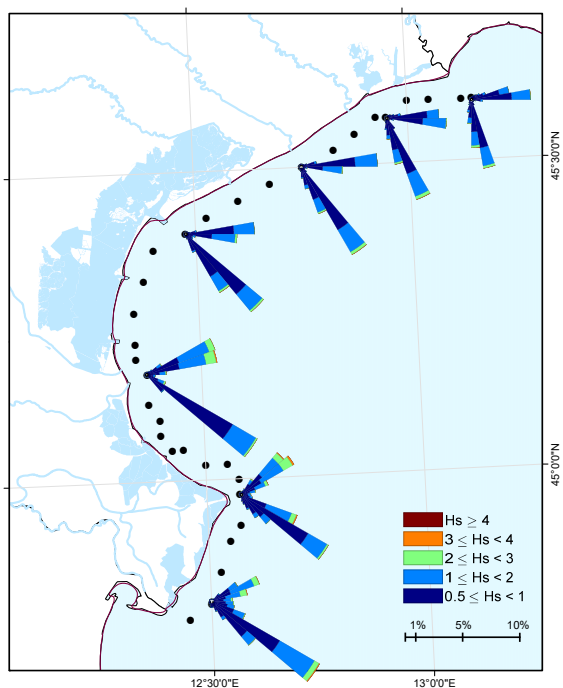


Figure 2. Positions of the 33 “virtual” wave buoys together with 7 wave roses.

MAIN RESULTS

The sediment balance analysis provides the erosive and accretive trends of the Veneto coast and of the effect of the management implemented. For the coast of the Venice province, the numerous dredging and nourishment operations, of the order of 200,000 m³/year are essential to maintain the stability on the coast. The highest erosive trends are localized in 3 stretches, namely the cells VE1, VE2 and VE5. For the coast of the Rovigo province, a very high dynamism is observed, which is related to high longshore sediment transport

and to subsidence. This leads to a generalized erosion that could affect the role of the low sandy barrier island in protecting the inland areas.

Based on the sediment balance results, a list of defense strategies is proposed and prioritized with the index shown in Figure 3 (from green to red classifies from low to very high priority).

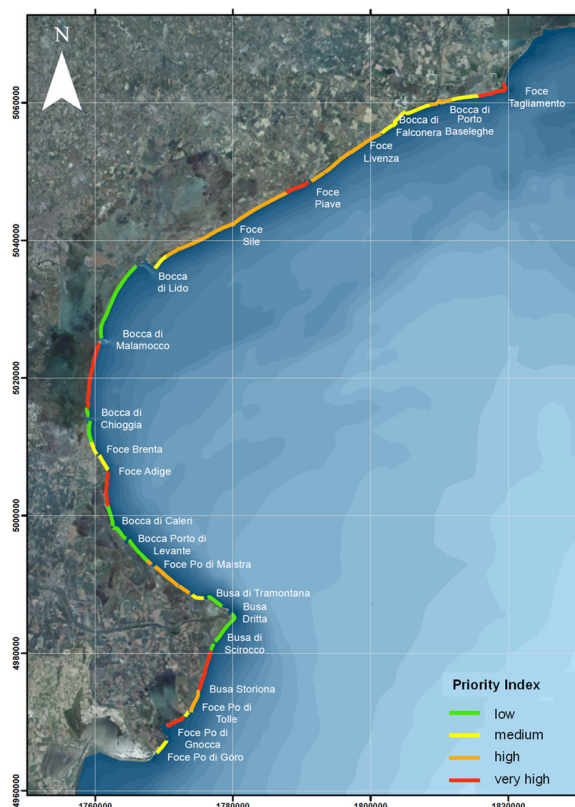


Figure 3. Priority index along the coast of the Veneto Region.

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