VULNERABILITY ANALYSIS OF LAZIO REGION COASTS FOR AN INTEGRATED PROTECTION PLAN

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INTRODUCTION

Medium-term planning of coastal protection at a regional scale is essential for a sustainable expenditure of public resources. In 2020-22 the Land Defense Department of the Lazio Region appointed the Coastal Engineering Group of Roma TRE University to perform a comprehensive set of studies to support such a Coastal Plan and provide a Priority List of interventions on the regional shoreline to be funded to the 22 coastal municipalities within the 3-year programme. The 300 km coastline (60 km of which are inerodible rocky coasts) has been subdivided in 8 main "independent" Physiographic Units (fig.1) and in shorter secondary cells with a discretization of 815 transects of 300 m length.

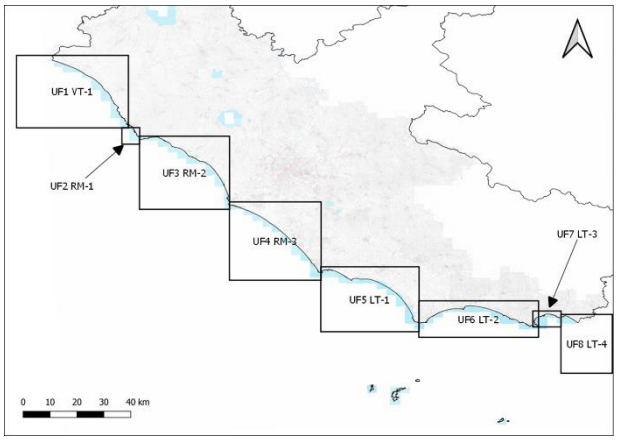

Figure 1. Union framework of the 8 main physiographic units of Lazio Region labeled with the acronyms of the province to which they belong

CONTENT OF THE STUDY

The work was divided in 3 phases: 1) organization of existing datasets; 2) analysis of the present situation; 3) definition of most critical coastal areas and protection strategies and guidelines.
The analyses included all geomorphological and hydrometeoceanographical parameters based on historical topo-bathymetric surveys and satellite imagery; the environmental and landscaping asset; the socio-economic conditions; the inventory of existing defense works; the vulnerability analysis of each coastal portion. Of course the analysis was based on a systematic digitalization and homogeneization of morphologic data (eg. shoreline position surveyed over a 25 year period).
The fundamental analysis of the wave climates (and related sediment transport capacity) off the whole coastline (at a depth of -10 m MSL) was carried out with a resolution of about 3 km, by means of downscaling with SWAN model the 42-year hindcasted Copernicus ERA5 hourly dataset (Bellotti et al. 2021). The modeled sea states are well compared against the multiple wave records available in the area to calibrate and validate the model. Typical results are reported in the Figure 2 in terms of polar diagrams.

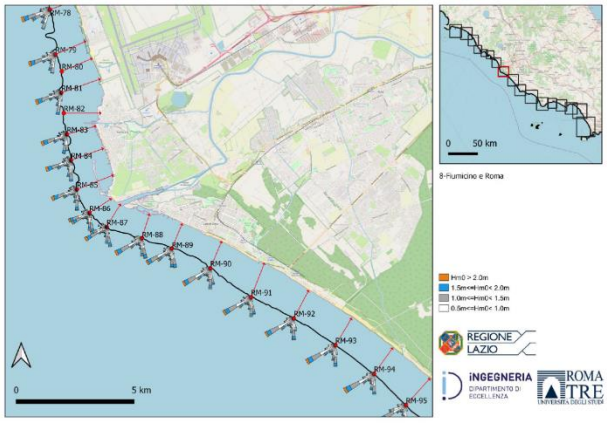

Figure 2. Representation of the wave climates along a portion of the Lazio coast around the Tiber delta

The activities related to Phase 1 and Phase 2 are therefore aimed at identifying areas subject to greater vulnerability by applying the analyses for each transect. The vulnerability analysis for each transect was performed with a method based on the use of indices, defined as a combination of the susceptibility and the exposed value. The latter was considered as the summation of the Environmental Asset (EA) and the Anthropic Pressure (AP), while the former was the combination of five significant parameters: Shoreline Average Annual Evolution Rate (SAAER); Emerged Beach Width (EBW); Beach Slope (BS); Wave Climate (WC); Coastal Protection (CP). The assessment was then made with a suitably weighted summation of the above factors. Each factor varied within a representative range to define positive or negative trends (eg. +/-1 m/yr for SAAER). Some example output maps representative of

indices and total vulnerability (divided in 5 mark classes) are shown in Figure 3 and Figure 4.

Figure 3. Thematic map representing the SAAER index for a part of the cell RM-3.2

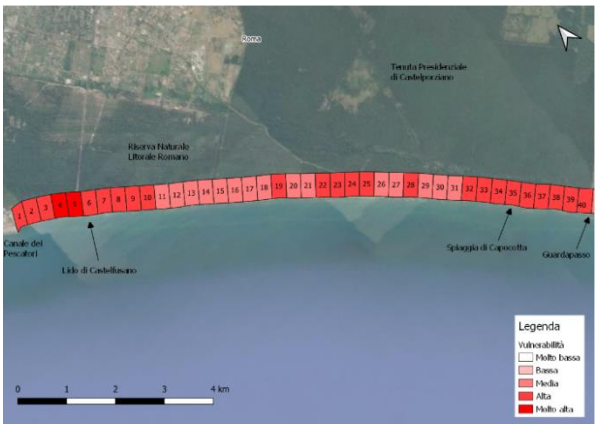

Figure 4. Thematic map representing the total vulnerability for a part of the cell RM-3.2

The results highlight that a large portion of the sandy coast is retreating, especially in the central-northern part of the Region. Almost half of the sandy coast (about 113 km) has a high vulnerability, due to the presence of anthropic pressure and environmental heritage and the absence of adequate coastal defense works.

The systematic analysis of coastal vulnerability has led to a classification of the most critical portions which need priority interventions. Then, for each area, a general protection strategy has been proposed according to the specific context and based on some general guidelines: the actual local designs should then follow the recommended criteria.

At the Conference the vulnerability analysis of the whole coast of Lazio Region will be presented in detail, also describing the proposed methodology for an integrated coastal protection plan.

REFERENCES

Bellotti, Franco, Cecioni (2021). Regional Downscaling of Copernicus ERA5 Wave Data for Coastal Engineering Activities and Operational Coastal Services, Special Issue Coastal Sediment Management: From Theory to Practice, water-1151027.