OPERATIONal Plans and Tools for **Cli**mate **C**hange Adaptation in **EUROPE** – OPERATION CLIC EUROPE

Case Study 6b: The Portuguese NW Coast.

The Portuguese NW coastline is exposed to very strong Atlantic wave/tide actions and is characterized by its dense urban occupation. This case study focuses on the 100 km coastal stretch delimited by the Minho river (border with Spain) and the Furadouro village (northern limit of the Aveiro lagoon) (Figure 1).

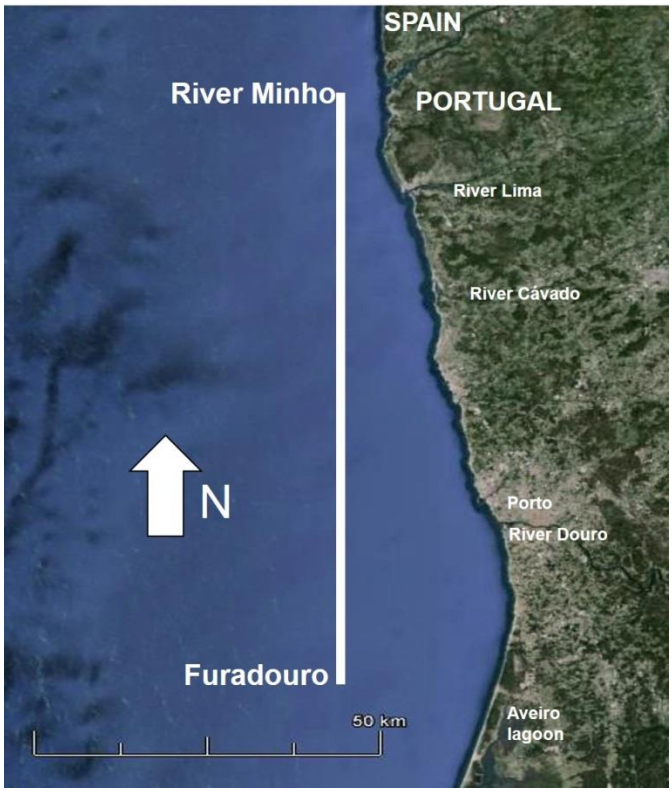

Figure 1: Portuguese NW coast.

Besides being under intense urban pressure, some locations along this coast are also subject to severe erosion and wave flood events. Consequently in light of the climate change projections and impacts, this indicates an increased risk of exposure to the coastal population and properties, which will result in significant economic impacts. Most of the built settlements along this coast were developed on low-lying open sandy shores that are vulnerable to high wave action and backed by partially destroyed dunes and submerged natural rocks. Several waterfronts are protected by coastal defense structures and have a short or nonexistent beach area. Despite the longitudinal revetments and implemented groins, wave overtopping and flooding events over urban waterfronts and coastal structures damages are still frequent and coastal interventions are common. Some of the interventions were planned and structured in anticipation of future risks, while some are carried out as emergency measures to protect the population, sites and assets at risk.

In recognition of increasing vulnerabilities of coastlines and associated public assets and populations (Hoepffner N. et al 2006), the Portuguese Integrated Coastal Zone Management policies (Veloso-Gomes F. et al 2008, INAG 2009, Veloso-Gomes F. 2011) identified three critical intervention areas on coastal erosion mitigation: 1) the importance of land/sea interactions; 2) the human dimension in the coastal process; and 3) the need to integrate the different actors operating in coastal regions in order to avoid conflicts and unsustainable development. Clearly, flood risks during ocean storms cannot be completely eliminated nor precisely predicted, however the identification of greatest risk hot spots where people live and the prioritization of flood and erosion risk management measures can help to minimize the impacts. Additionally, the prevention of flood and erosion risks is important in reconciling social, cultural heritage, environmental, and ecological values with economic opportunities.

Managed retreat is one of the intervention policies considered for some coastal communities at risk from extreme events. In governmental management plans for the Portuguese NW coast, planned retreat is one of the options considered for these areas: Bartolomeu do Mar, Bonança, Pedrinhas and Cedovém in Esposende municipality; Paramos in Espinho municipality; Esmoriz and Cortegaça in Ovar municipality. Although managed retreat is one course of action among the options available for coastal communities facing long-term risks from sea effects, it has not been well-received by residents and its implementation is very slow and difficult. To date, only one case has been successful: Bartolomeu do Mar. Therefore, one goal of this case study is to develop a methodology for facilitating the interpretation and understanding of how the social and legal constraints and environmental monitoring solutions affect a planned retreat, and also provide a methodology proposal for choosing alternative coastal interventions. Concerning a planned retreat, a new set of measures based on a 3R policy proposal (Remove, Relocate and Readapt) regarded as acceptable policy for mitigation of sea level rise, extreme storm events and erosion risks, has been designed to better manage and adapt different types of coastal sites while creating the lowest possible impact for local populations and properties. Another goal of this case study aims to develop a multi-criteria methodology to support the decision-making process to achieve the most favorable solutions. This is achieved by considering the range of possible shoreline evolution scenarios (Baptista P et al 2014), and different existing and potential future adaptation options for each location (hard structures, artificial nourishment, soft structures, planned retreat, mixed options), along with the economic, social and environmental impacts and costs considerations.

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