

The resource valuation and the challenge of coastal ecosystem-based management implementation

José Carlos Ferreira¹, Susana Ferreira Silva², Leandro Seixas²; António Mota Lopes³, Conceição Juana Fortes⁴, Maria Teresa Reis⁴, Pedro Poseiro⁴, Rui Capitão⁴, Gonzalo Carlos Malvarez⁵, José António Tenedorio⁶

¹ Centre for Environmental and Sustainability Research (CENSE), Faculty of Science & Technology of NOVA University of Lisbon (FCT/UNL), Caparica, Portugal jcrf@fct.unl.pt

² Depart. of Environmental Sciences and Engineering (DCEA), Faculty of Science & Technology of NOVA University of Lisbon (FCT/UNL), Caparica, Portugal s.silva@campus.fct.unl.pt, ls.silva@campus.fct.unl.pt

³ APA – Portuguese Environmental Agency, mota.lopes@apambiente.pt

⁴ National Laboratory of Civil Engineering (LNEC), Lisbon, Portugal, jfortes@lnec.pt, treis@lnec.pt, pposeiro@lnec.pt, rcapitao@lnec.pt

⁵ Area of Physical Geography, Universidad Pablo de Olavide, Sevilla, Spain gcmalgar@upo.es

⁶ Faculty of Social Sciences and Humanities of NOVA University of Lisbon (FCSH/UNL) Lisbon, Portugal ja.tenedorio@fct.unl.pt

Overview

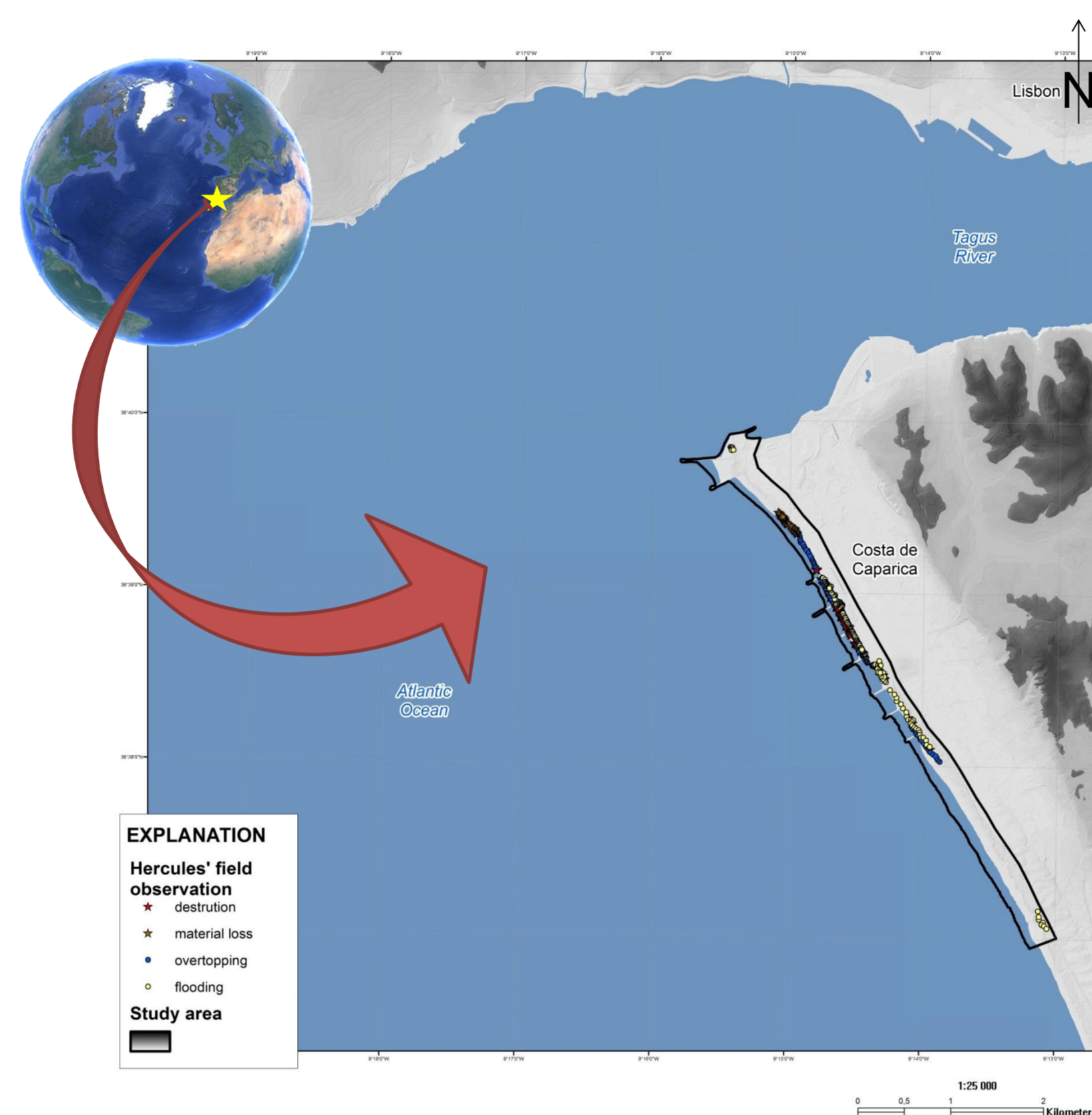
The implementation of ecosystem-based management approach is a challenging process due to the complexity of ecosystems and inherent management decisions affecting a multitude of groups. In the role of coastal ecosystems, the services played by diverse resources interaction can provide benefits and damages at the same time depending on the season and climate change intensification.

In Costa de Caparica beaches (Portugal) the waves recognized as an important resource for the local community and local government, also carry an intrinsic social and economic value. The benefits of this coastal resource mainly to tourism and local population are being affected by the inevitable sea level rise, sand balance, storms intensification and consequent flooding coastal areas, translating into quick solutions of coastal planning, particularly in heavy engineering with high economic costs and poor durability. The emergency to which management alternatives can be applied is dependent on the analyzes of pros and cons of resource valuation and an integrated ecosystem assessment gathering public participation, coastal risk analyses, economic balance and resource preservation.

This assessment aims to emphasize the principles constraints in the present ecosystem management, revelling coastal zones under risk and which gains an ecosystem based-management could give.

Study Area

- Costa de Caparica is a coastal city covered by 13km of sandy beaches in the front Atlantic and is located south of the Tagus River approximately 17km from the capital of Portugal (Lisbon).
- Since the 30's the city represents an important relevance in tourism and urban area occupation, specially during the summer. Back to the 60's, Caparica was specially attractive for surfing due to the waves quality, keeping the statement until nowadays.
- However, in the final of XIX century, was registered an important physiographic transformations (sand balance between river-land-ocean) and coastline retreat, leaving the urban front exposed to direct actions of the sea. Consequently, the adoption for hard engineering solutions in the front of the urban area have been materialized, where the periods between 1959-1963 and 1968-1971 were the most significant with an introduction of a seawall of 2.5 km length and 7 jetties (180m of length each).



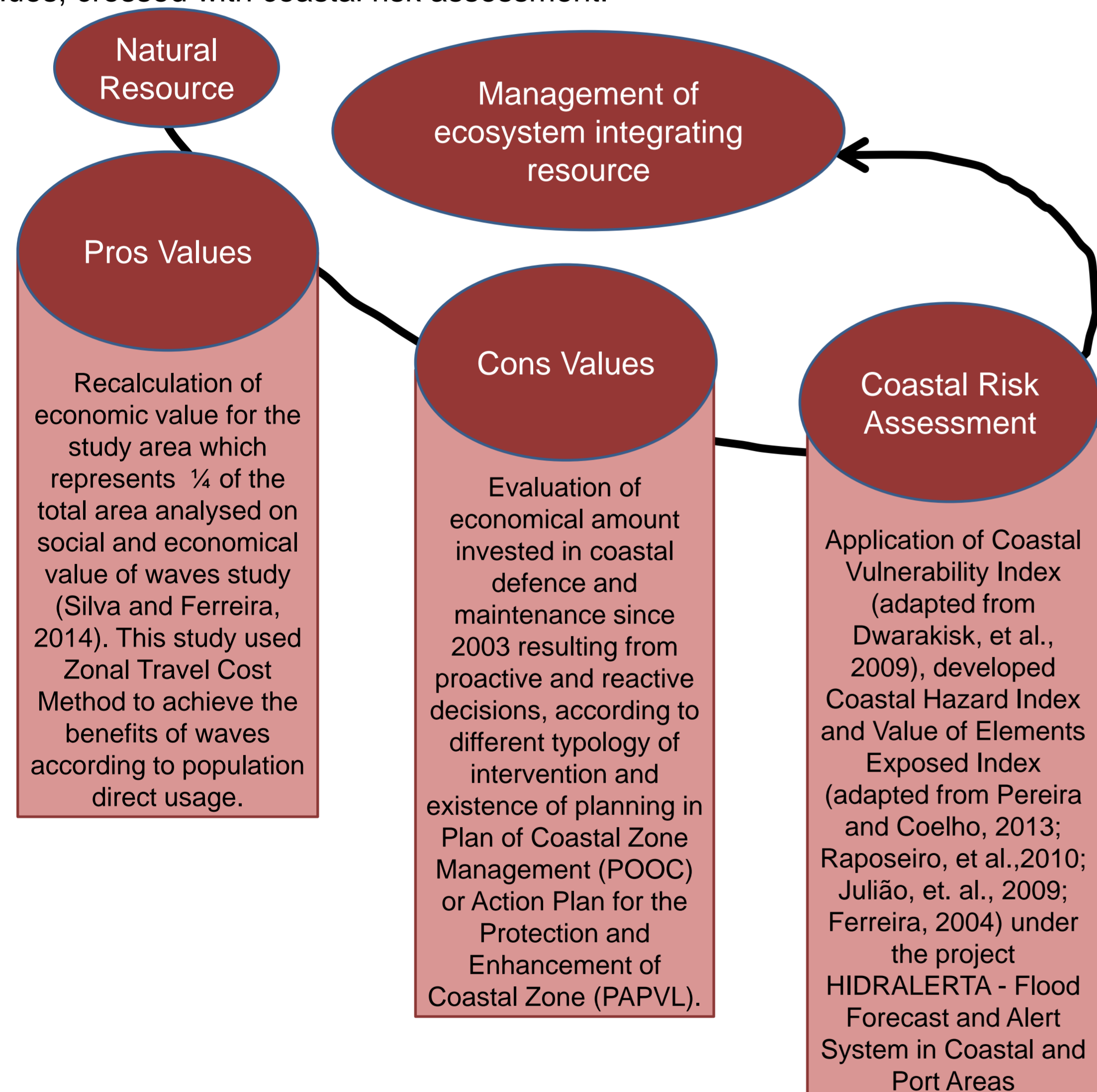
Main events in Costa de Caparica

Season	Cause	Consequence
Winter 2001/2002	Waves > 6m	Intensive coastline retreat causing erosion and overtopping in dune system on the north beaches
March 2007	Waves > 5m	Seawall broken in the south of São João da Caparica beach and flooding 70m of campsites located less than a 5km from the beach
January 2014	Waves > 7m Direction WNW Period > 20s (storm : Hercules)	Massive flooding and overtopping in the urban central area and erosion through the south of natural beaches



Methodology

The valuation of the natural coastal resource (waves) was based in pros and cons values, crossed with coastal risk assessment:



Soft and Hard engineering strategies and impacts in Costa de Caparica:

Impacts	Strategies	Beach nourishment or "recycling"	Dunes restoration	Seawall (blocks with/without concrete)	Groins (breakwater)
Integration in previous natural landscape		●	●	○	○
Attractiveness		●	●	○	○
Provide space to users		●	◇	●	○
Minimize the risk to flooding and overtopping		○	●	●	●
Durability		○	●	●	●
Interference with natural coastal dynamic		○	●	○	○
Ecological impacts		○	●	○	○
Local defence		●	●	●	●
Regional defence		●	●	○	○
Monitoring and Repair		○	○	○	○
Economical investment		●	●	○	○

● Positive impacts, ○ Negative impacts, ○ Positive and negative impacts, ◇ Not applied

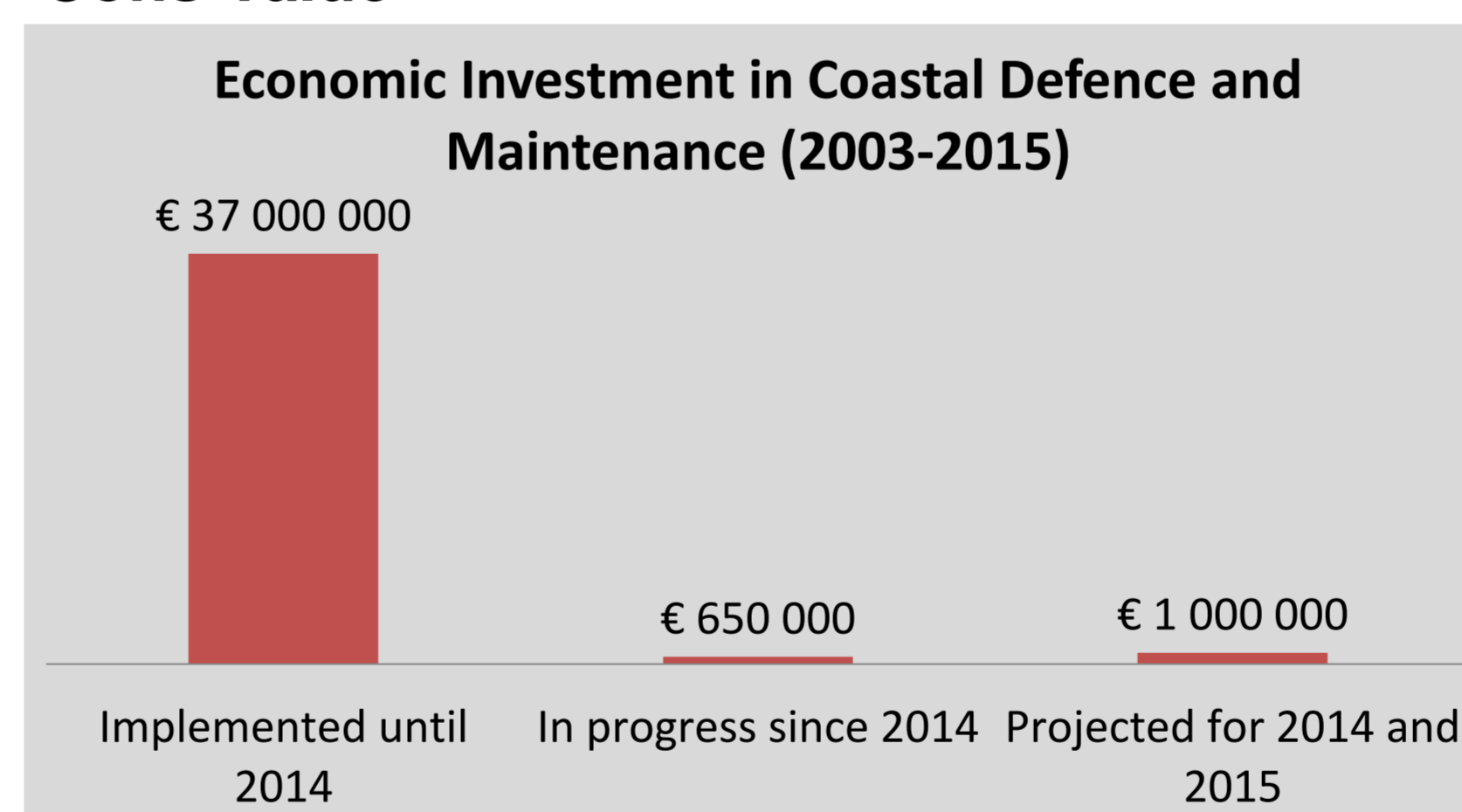
Acknowledgement: FCT projects: HIDRALERTA (PTDC/AAC/120702/2010)

Preliminary Results

Pros Value

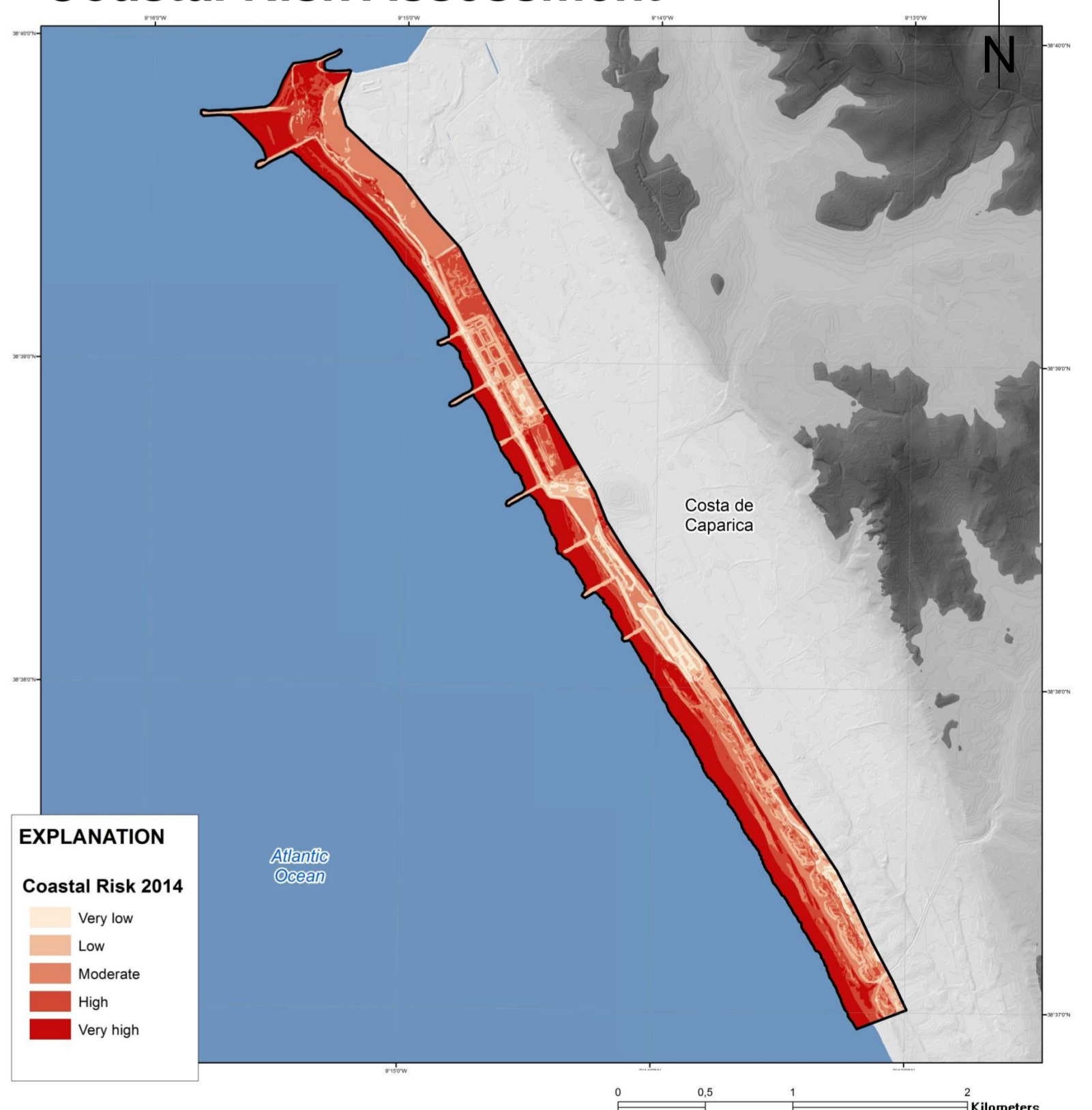
- Silva and Ferreira (2014) established with Zonal Travel cost Method the minimum economic value of waves in €1 022 789,52 associated to €47 of additional cost per trip to use the natural resource.
- This study of non-market values considered the population of users for 2011, who expressed direct usage of the resource, by counting and estimating the annual population for the total length of Costa de Caparica beaches.
- Due to the different characteristics of waves in terms of quantity and quality, the amount of users for the study area was recalculated for the same year of reference (i.e. 2011). In this evaluation the minimum economic value of waves was valued in € 665 000 (corresponding to an estimation of 14 000 direct users who accessed to Caparica beaches in 2011).

Cons Value



- Between 2003-2014 the interventions on coastline corresponded to 76% of beach nourishment, 23% defence structures on coast (seawall and groins) and 1% for others (supervision, methodologies studies);
- From the interventions above, only 9% corresponded to emergency status. However, none were included in the POOC or PAPVL, being classified as reactive decisions (mainly to storms);
- From 2014-2015, proximally € 5 360 000 were planned. Although, due to Hercules 21% of the total amount spent in emergency interventions consisted in repairing jetties and seawall. The remain 79% was related to the third part of beach nourishment established for 2007-2010, where the final phase was not performed due to the positive results of previous stages.

Coastal Risk Assessment



- Despite the interventions in the ecosystem being in artificial structures in order to preserve and retain the previous scenario, the risk classified as "very high" and "high" represents 31.5% and 19.8% of the total area in risk and is situated in natural system (mainly beach and frontal dune).

Future developments

Costa de Caparica ecosystem management is not taking in consideration the balance between benefits and harms of major resources, such as waves. By evaluating coastal risk and measuring the volume spend in order to protected urban area and human activities, the results shows a negative trend where positive value of waves in 2011 was four times lower comparing to the damages cause for the same resource under different and unchangeable conditions. Knowing this negative balance between pros and cons, further developments are focused in access the main difficulties to ecosystem-based management implementation in Costa de Caparica and develop new strategies to reverse the trend by using sustainable solutions working with natural coastal process.

