

Coastal erosion and flood management strategies: social-welfare analysis

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POCTI
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Ciência Tecnologia Inovação



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Outline presentation

- **Introduction**
- **Objective**
- **Methodology**
- **Results**
- **Discussion & Conclusions**



Introduction

- **Coastal erosion/flood management strategies:**
 - Retreat → accept natural processes and re-locate
 - Adapt → accept natural processes and live with them
 - Protect → don't accept natural process and (try to) stop them
- **Costs and benefits of RAP-strategies:**
 - Private: costs/benefits that accrue to individuals
 - Social: costs/benefits that accrue to the wider community
- **Values under threat:**
 - Built capital
 - Natural capital
 - Social capital
 - Human capital
- **Need to take into account probabilities of events from happening (expected values)**



Introduction

- **To warrant sustainable economic development of coastal regions, we need to balance the marginal costs and associated marginal benefits from coastal management strategies S_t**
- **The social welfare maximization problem becomes:**

$$\underset{S_t}{\text{Max}} W = \int_0^{\infty} [B(S_t) - C(S_t)] e^{-rt} dt$$

subject to: $C(S_t) \leq b_t$

where $B(S_t)$ = management strategy benefits

$C(S_t)$ = management strategy costs

b_t = available annual budget

r = time discount rate

Objective

- **The objective of this research is:**

Develop a spatially-explicit approach that allows us to explore the social welfare maximizing types, sizes and locations of coastal management strategies in coastal socio-ecological systems

**COMIDST
(COastal Management Investment Decision Support Tool)**

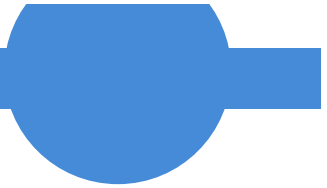


Methodology

- **The methodology combines:**

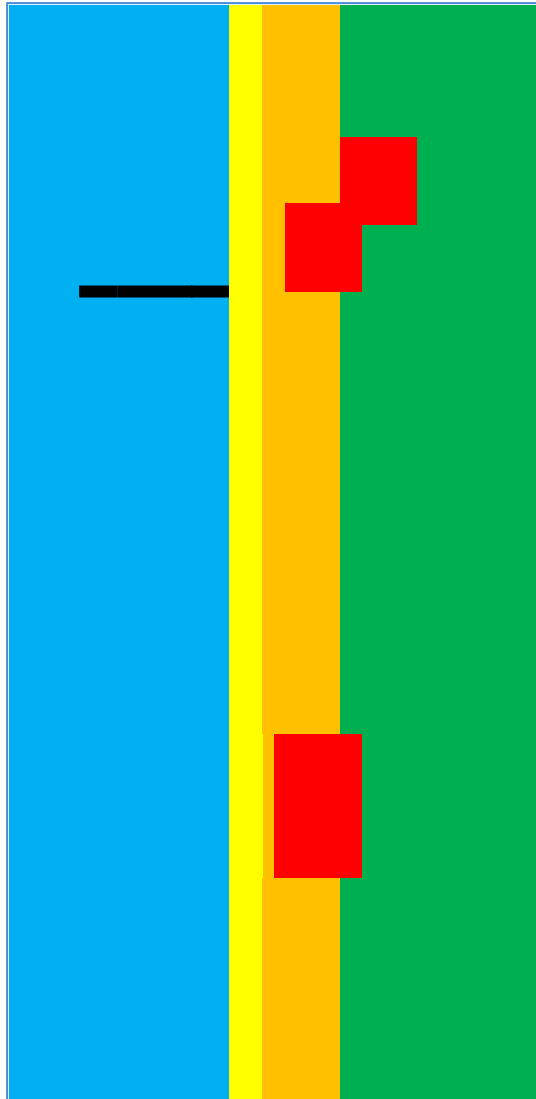
- shoreline evolution model LTC (Long-Term Configuration; [Coelho, 2005](#)), for spatial assessment land losses given management strategies
- benefits transfer approaches (BTA; [Brouwer, 2000](#)), for the valuation of coastal ecosystems and management strategies ([Roebeling et al., 2011a](#))
- cost-benefit, non-linear programming and optimal control approaches, for identification of optimal locations for coastal management strategies ([Roebeling et al., 2011b](#))



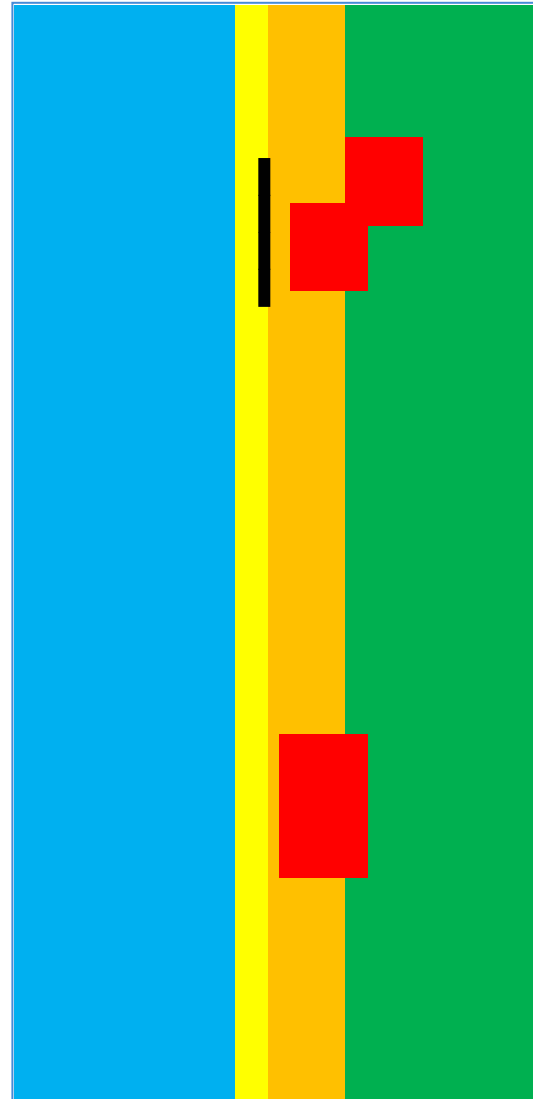


Methodology

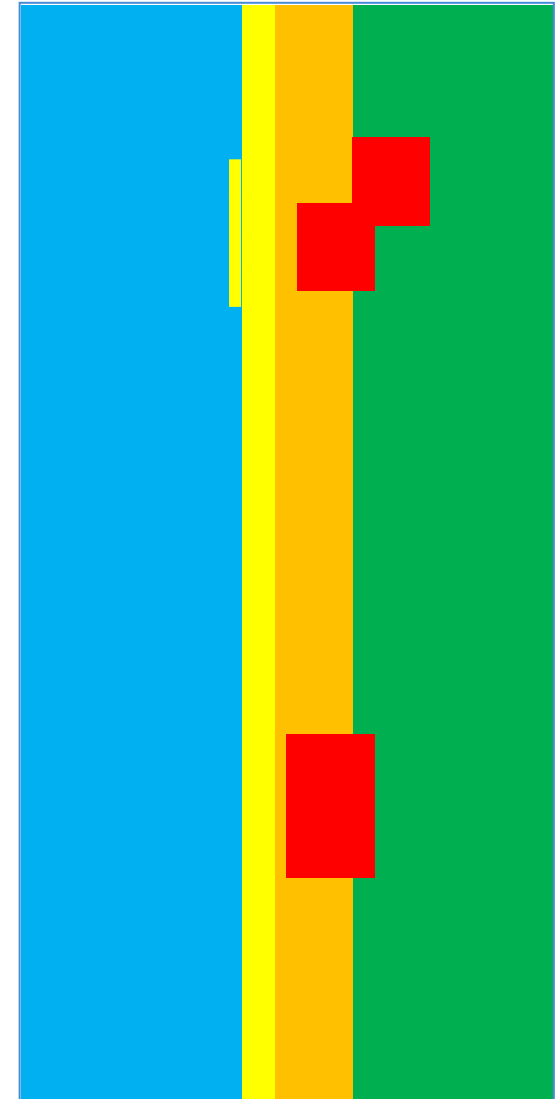
Groins



Long. revetment

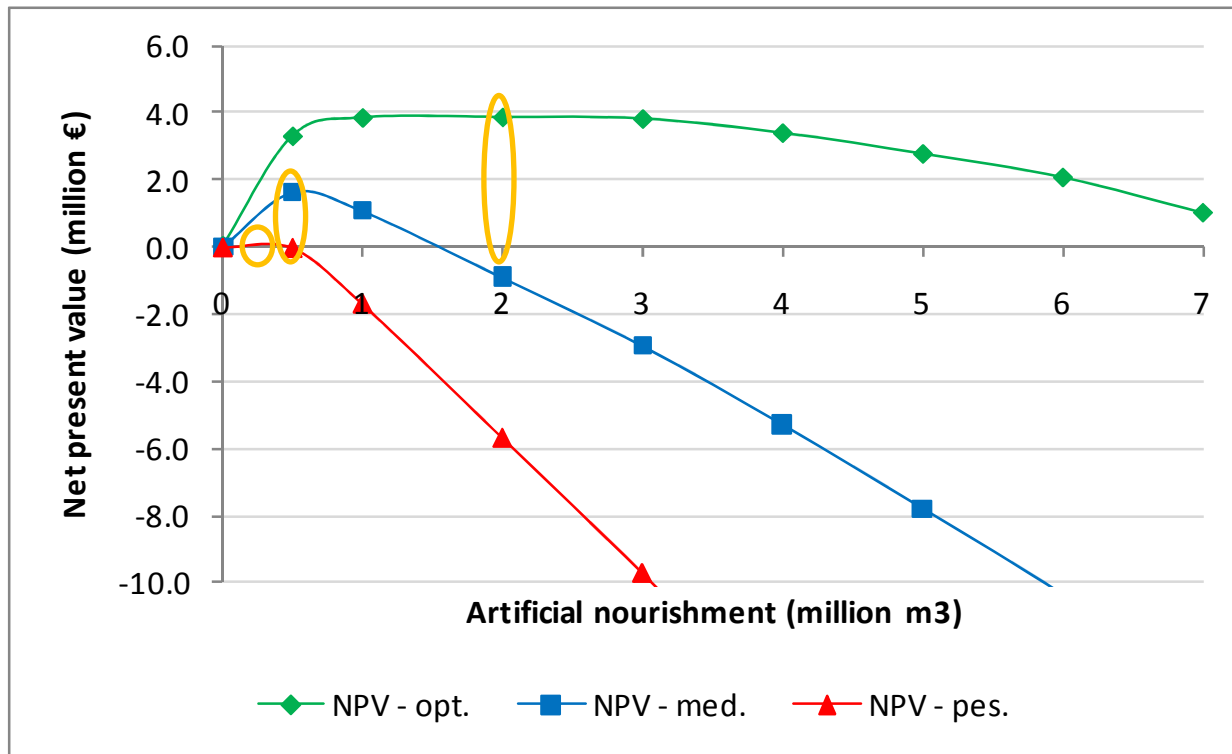


Art. nourishment



Results (preliminary)

Expected NPVs (10^6€) for artificial nourishment scenarios (0.0 to $7.0 \cdot 10^6 \text{ m}^3$) along natural (100%) coastal stretch

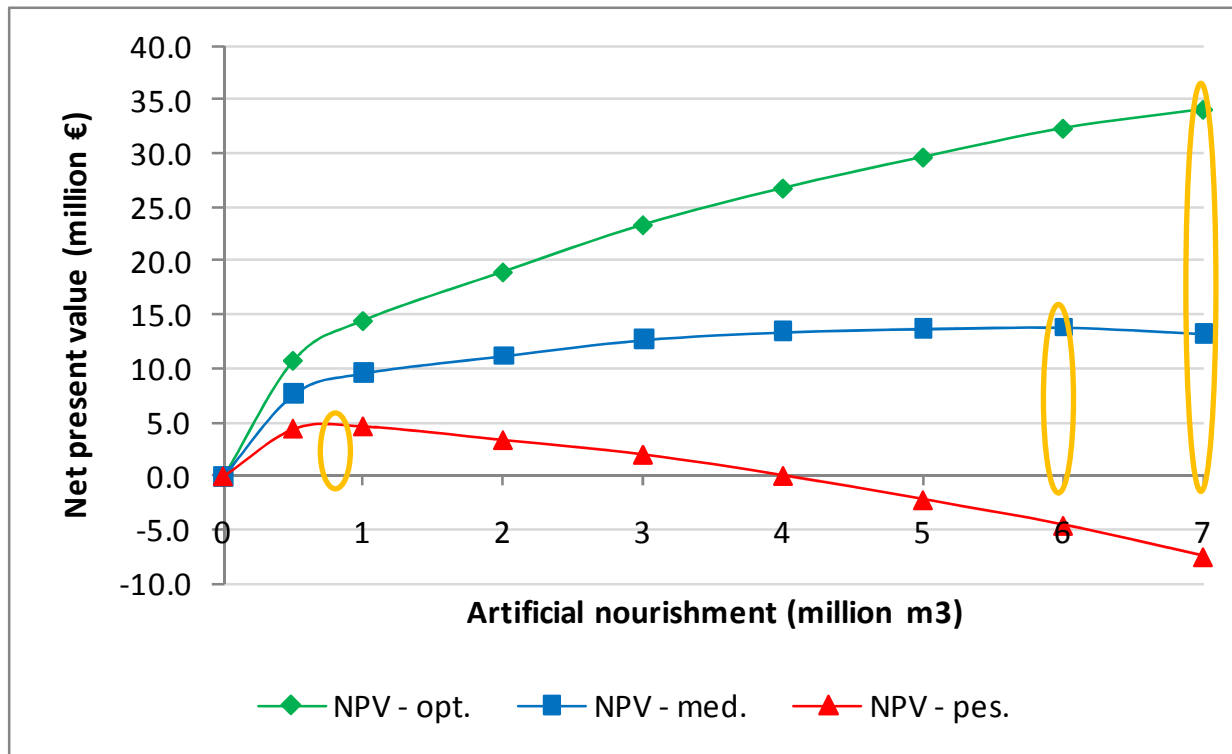


→ Social welfare maximizing rates of artificial nourishment for optimistic (opt.), medium (med.) and pessimistic (pes.) conditions



Results (preliminary)

Expected NPVs (10^6€) for artificial nourishment scenarios (0.0 to $7.0 \cdot 10^6 \text{ m}^3$) along natural (90%) + urban (10%) coastal stretch



→ Social welfare maximizing rates of artificial nourishment for optimistic (opt.), medium (med.) and pessimistic (pes.) conditions





Discussion and conclusions

- **It is shown that both protection and retreat strategies can be viable from a social welfare perspective**

... depends on ...

- **Location and value of coastal capital resources (built, natural, social and human)**

... , ...

coastal management strategy costs and effectiveness

... as well as ...

available budget!!!





Obrigado!

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