COASTAL HAZARD MAPPING AS A PLANNING TOOL IN CLIMATE CHANGE ADAPTATION
THE CASE OF FONTE DA TELHA, PORTUGAL

Rui Taborda  Tanya M. Silveira  Catarina Freitas  Nuno Lopes  César Andrade  Maria C. Freitas  Ana N. Silva
Cristina Lira  Patrícia Silva  Sara Dionísio
Climate change poses significant risks to our coastal areas prone to flooding and erosion

http://photography.nationalgeographic.com/photography/photo-of-the-day/eastern-screech-owlets/
Study area: Fonte da Telha
Fonte da Telha

Occupation evolution
Fonte da Telha

Source: SIARL, october 2011
In order to requalify the area a Detailed Plan was promoted by Almada Municipality

Including

Demolition of illegal buildings
Renaturalization of the area
Resettlement of fishermen within the city
Reformulation of buildings and activities that remain on site...

...
Risk reduction

<table>
<thead>
<tr>
<th>Sources</th>
<th>Pathways</th>
<th>Receptors</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Wave" /></td>
<td><img src="image2.png" alt="Dune" /></td>
<td><img src="image3.png" alt="Houses" /></td>
</tr>
</tbody>
</table>
Legal constrains

- Spatial Planning of the Coastal Zone POOC
- Domínio Público Marítimo;
- Reserva Ecológica Nacional;
- Paisagem Protegida da Arriba Fóssil da Costa da Caparica;
- Regime florestal;
- Mata Nacional dos Medos (integra a Reserva Botânica);
- Mata Nacional das Dunas da Trafaria e da Costa da Caparica;
- Sítio arqueológico CNS 364 — Fonte da Telha;
- Área de servidão de estradas e caminhos municipais;
- Área de servidão militar

Does not account for Climate Change
It is very likely that Coastal Hazard Zones change over the next 50 and 100 years.
Hazards – Shoreline retreat and coastal flood

Processes

- Storm Wave Beach Erosion
- Maximum Wave Runup
- Beach Erosion Related with Sea Level Rise
- Sedimentary Budget
STORM WAVE BEACH EROSION

\[ R_\infty = (S + 0.068 H_b) \frac{W_b}{B + d_b} \]

Depends:
- beach profile
- nearshore waves

Kriebel & Dean model
Storm waves

Modelling nearshore wave

*Spatial variability*
**Storm waves**  
Ratio between storm wave climate in reference and 2100 scenarios

**Climate change**

**Invariant**

Matulla et al. (2007)  
Micore EU Project  
Andrade et al. (2007)
Hazard Sources – Shoreline retreat and inundation

Processes

- Storm Wave Beach Erosion
  - 24 (m)

- Maximum Wave Runup
  - ?

- Beach Erosion Related with Sea Level Rise
  - ?

- Sedimentary Budget
  - ?
**Sedimentary Budget**

**Shoreline evolution**

*For a 52 year period (1958 to 2010)*

→ *stable shoreline with no retreat*
Hazard Sources – Shoreline retreat and inundation

Processes

- Storm Wave Beach Erosion: 24 (m)
- Maximum Wave Runup: ?
- Beach Erosion Related with Sea Level Rise: ?
- Sedimentary Budget: 0 (m)
Shoreline retreat related with sea level rise

\[ R_{MSL} = \Delta MSL \frac{W_c}{B + d_c} \]

Challenge - define sea level rise scenario
Sea Level Rise

Sea Level Rise (m) - 2100

1. IPCC 2001
2. IPCC 2007
3. Rahmstorf, 2007
4. Grinsted et al., 2008
5. Vermeer and Rahmstorf, 2009
6. Jevrejeva et al., 2012
7. IPCC, 2013
Hazard Sources – Shoreline retreat and inundation

Processes

- **Storm Wave Beach Erosion**: 24 (m)
- **Maximum Wave Runup**: ?
- **Beach Erosion Related with Sea Level Rise**: 50 (m)
- **Sedimentary Budget**: 0 (m)
Inundation levels

Maximum wave run-up elevation

\[ R = k \times \tan \beta \times \sqrt{H'_0 1.56 T^2} = k' \times \sqrt{H'_0 1.56 T^2} \]

\[ WL = (T + S) + (\eta + u) = SL + R \]
Hazard Sources – Shoreline retreat and inundation

Processes

- **Storm Wave Beach Erosion**: 24 (m)
- **Maximum Wave Runup**: 10.9 (m)
- **Sea Level Rise**: 50 (m)
- **Sedimentary Budget**: 0 (m)
COASTAL HAZARD MAPPING
• Setback lines
  
  - Retreat – (from the dune base)
  - Elevation (from MSL)
Results
Results
Present occupation
The adopted solution

Adaptation measures

- **REMOVE**
  - Establish building setback codes

- **ACCOMMODATE**
  - Regulate building development

- **PROTECT**
  - Protect coastal development

- Urban perimeter reconfiguration with retreat from the risk areas
- Define a new construction base level building on stilts
- Dune reinforcement