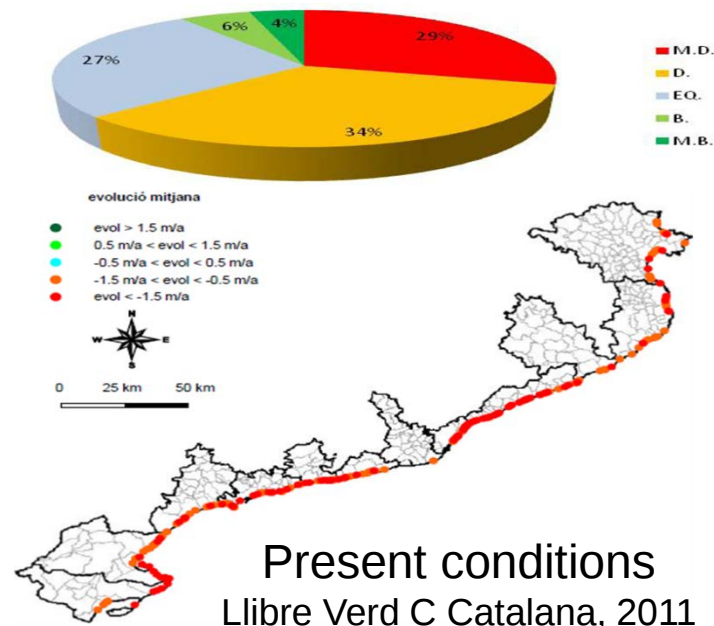


# Sea-level rise impacts in the Med. The Catalan coast case

A. Sánchez-Arcilla, J. Jimenez, S. Samitier, G. Borràs, X. Quintana, J. Montaner, J. Solà



ESA S3 data, 2016



## Highest vulnerability (SLR) stretches: tourism and protection functions

Barcelona beaches



Ebro delta spit



Pineda de mar gener 2017



Malgrat de mar gener 2017

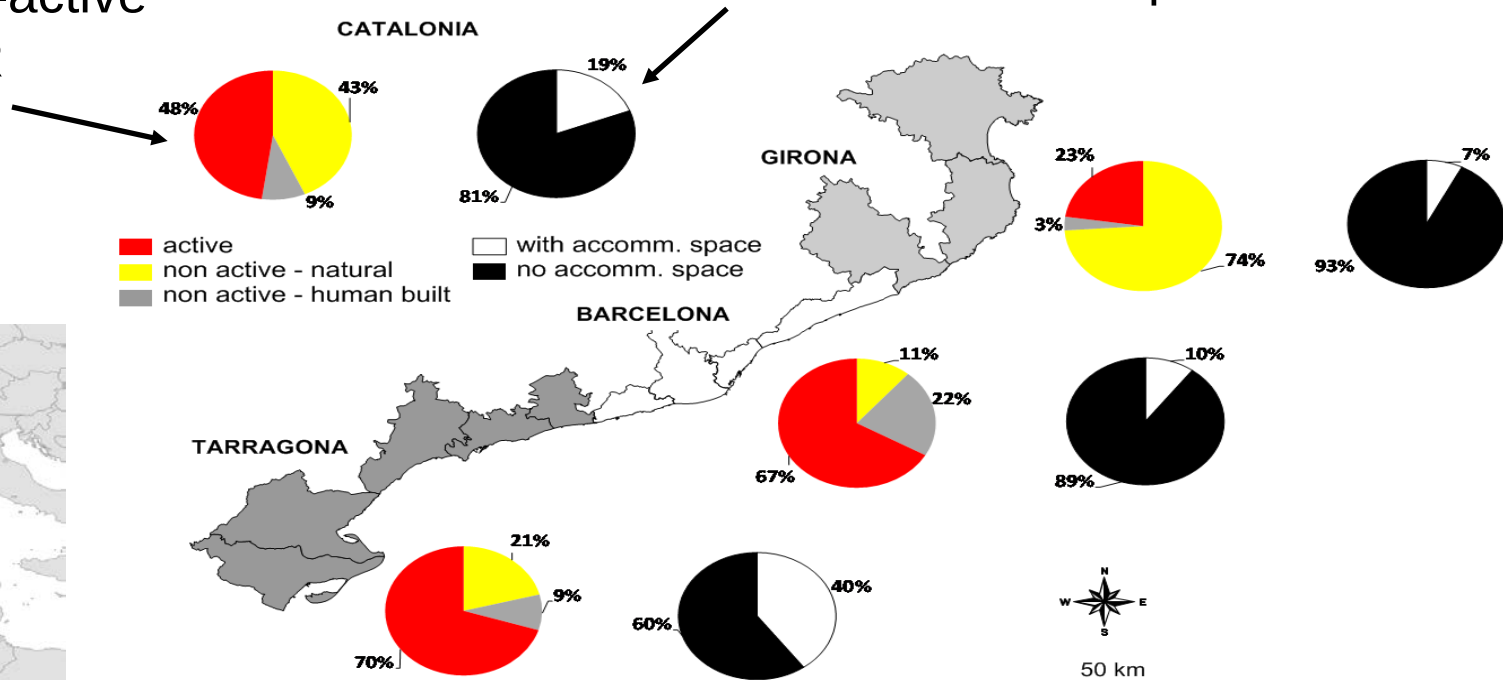


**Active coasts** – dynamically react to SLR ( $\approx$  sedimentary)  
**Non-active coasts** – no reaction, just passive inundation

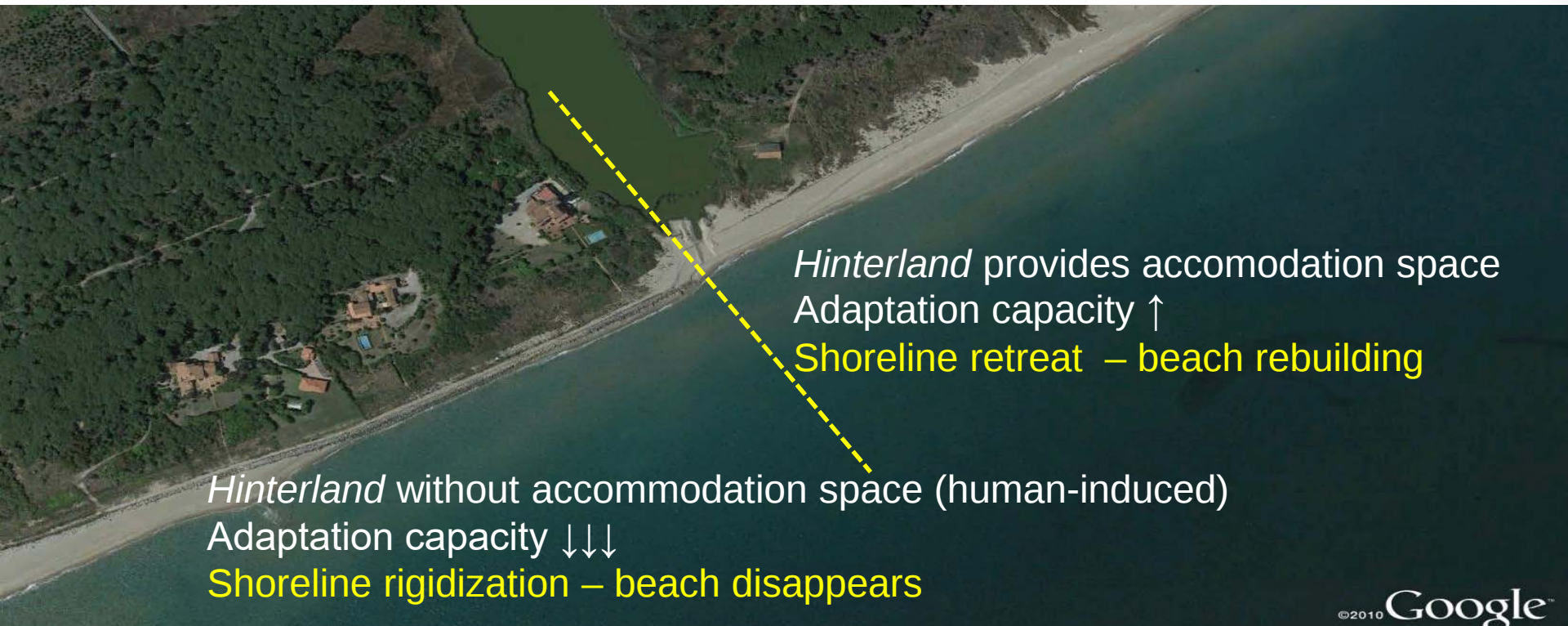
CAT COAST  
 L ~ 280 km

Active vs non-active  
 coasts to SLR

Accommodation space



## Accommodation space & coastal adaptation (Catalan coast)

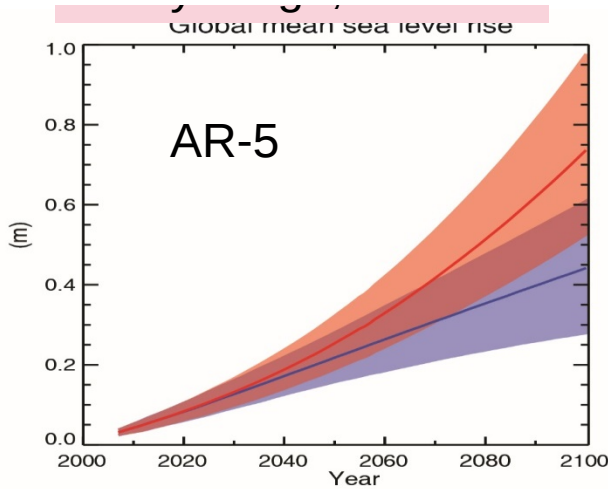
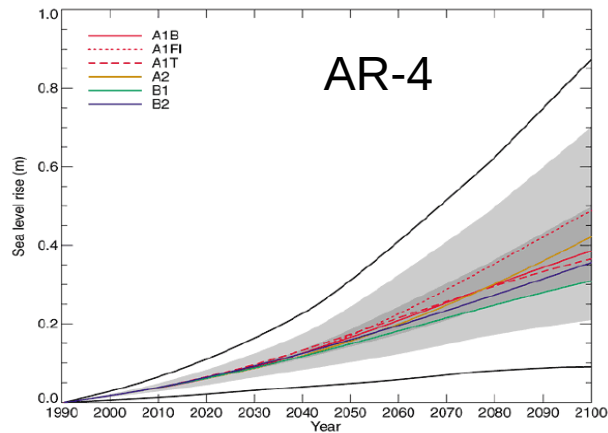


*Hinterland* provides accommodation space  
Adaptation capacity ↑

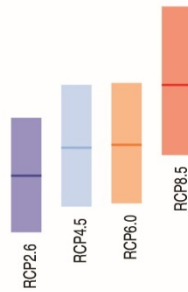
Shoreline retreat – beach rebuilding

*Hinterland* without accommodation space (human-induced)  
Adaptation capacity ↓↓↓

Shoreline rigidization – beach disappears

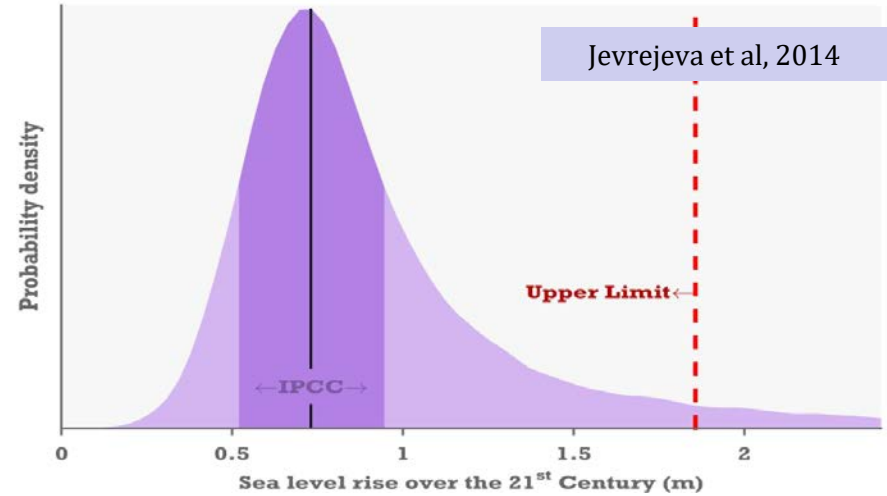


Mean over  
2081–2100



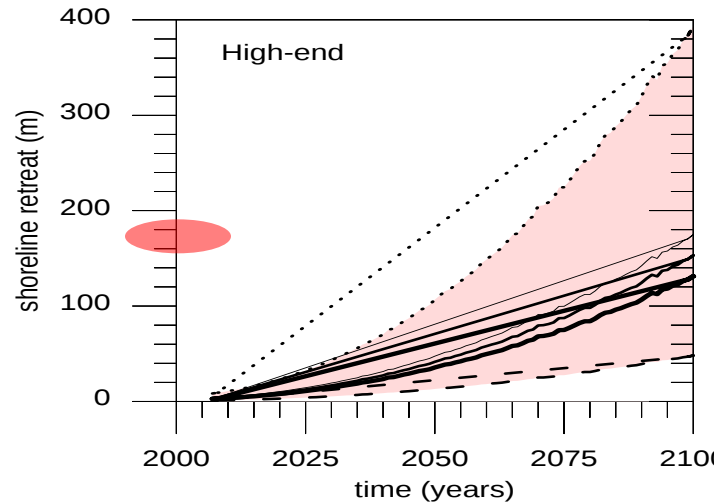
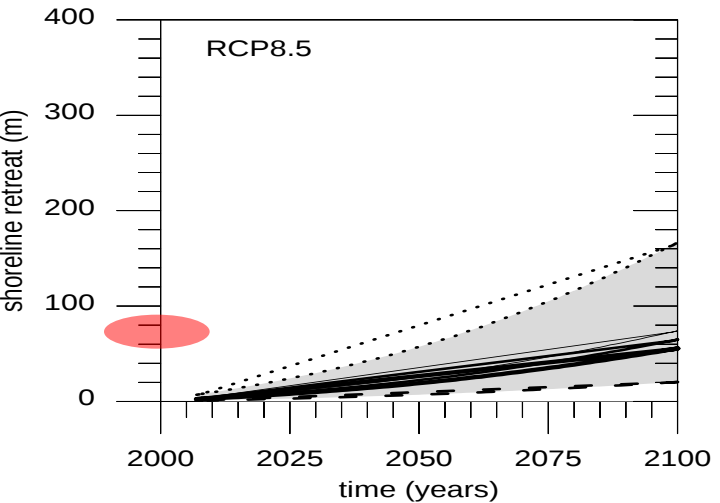
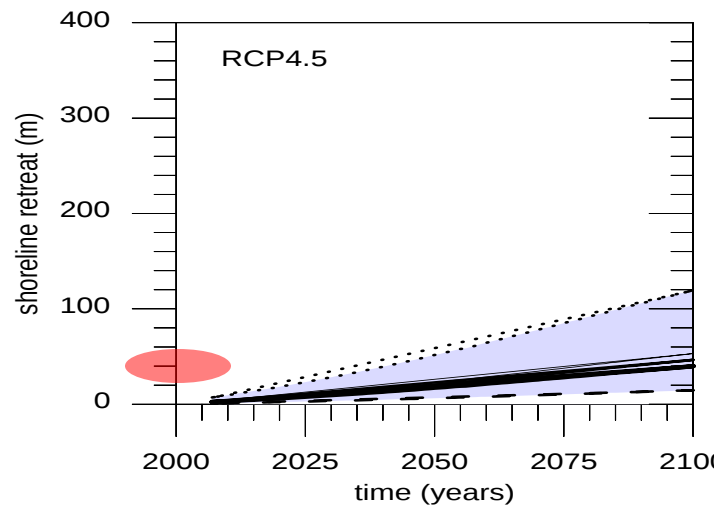
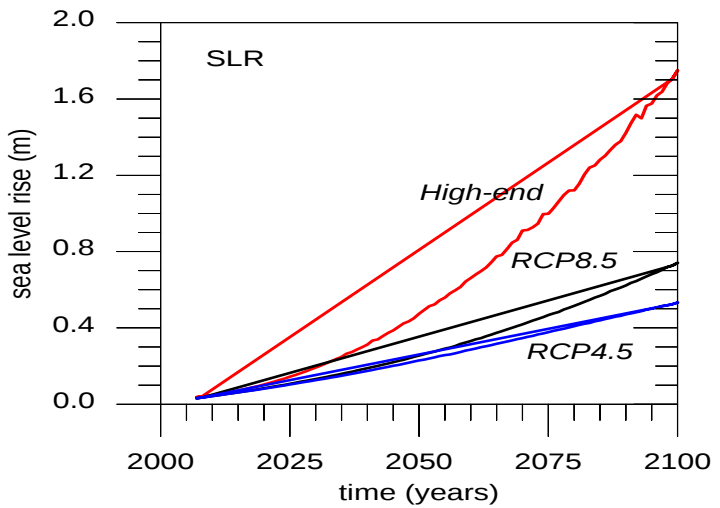
Future climate projections  
Global SLR + subsidence ↑

Upper limit (95%, RCP8.5), 1.8m



(IPCC, 2013)



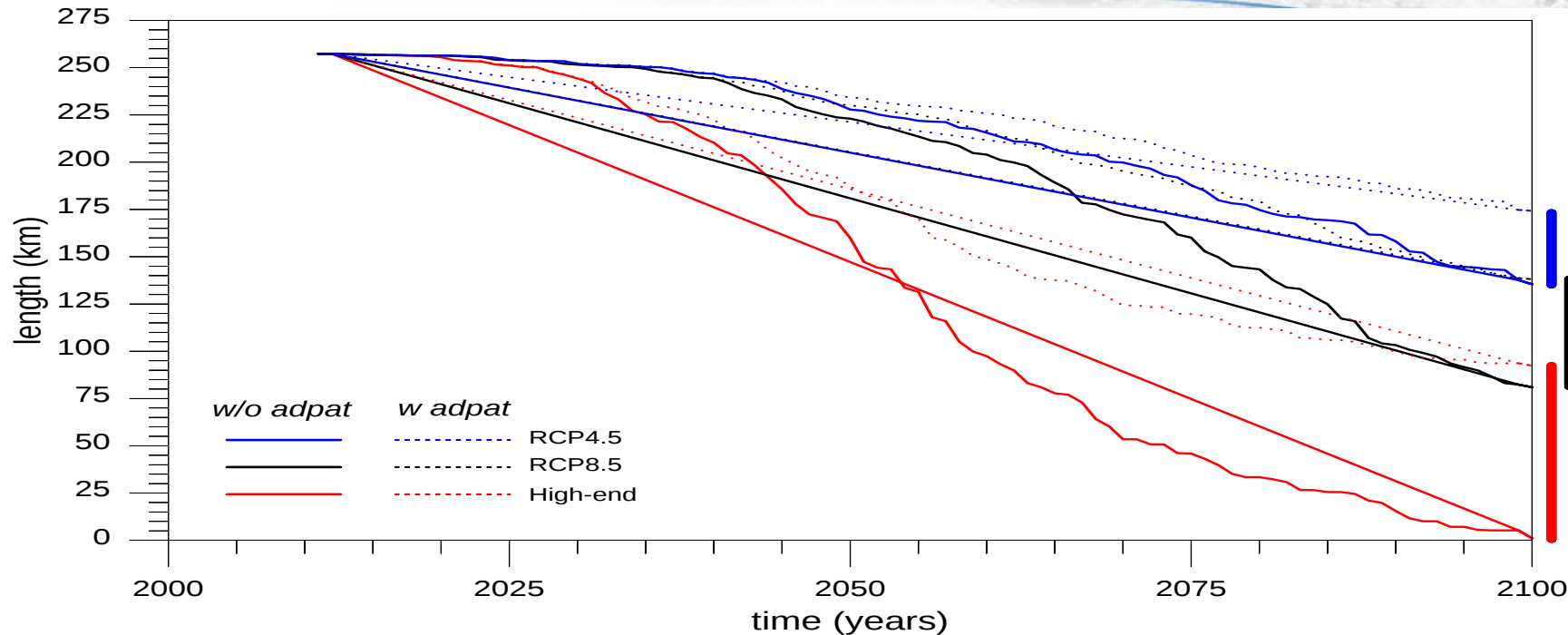


## SLR scenarios

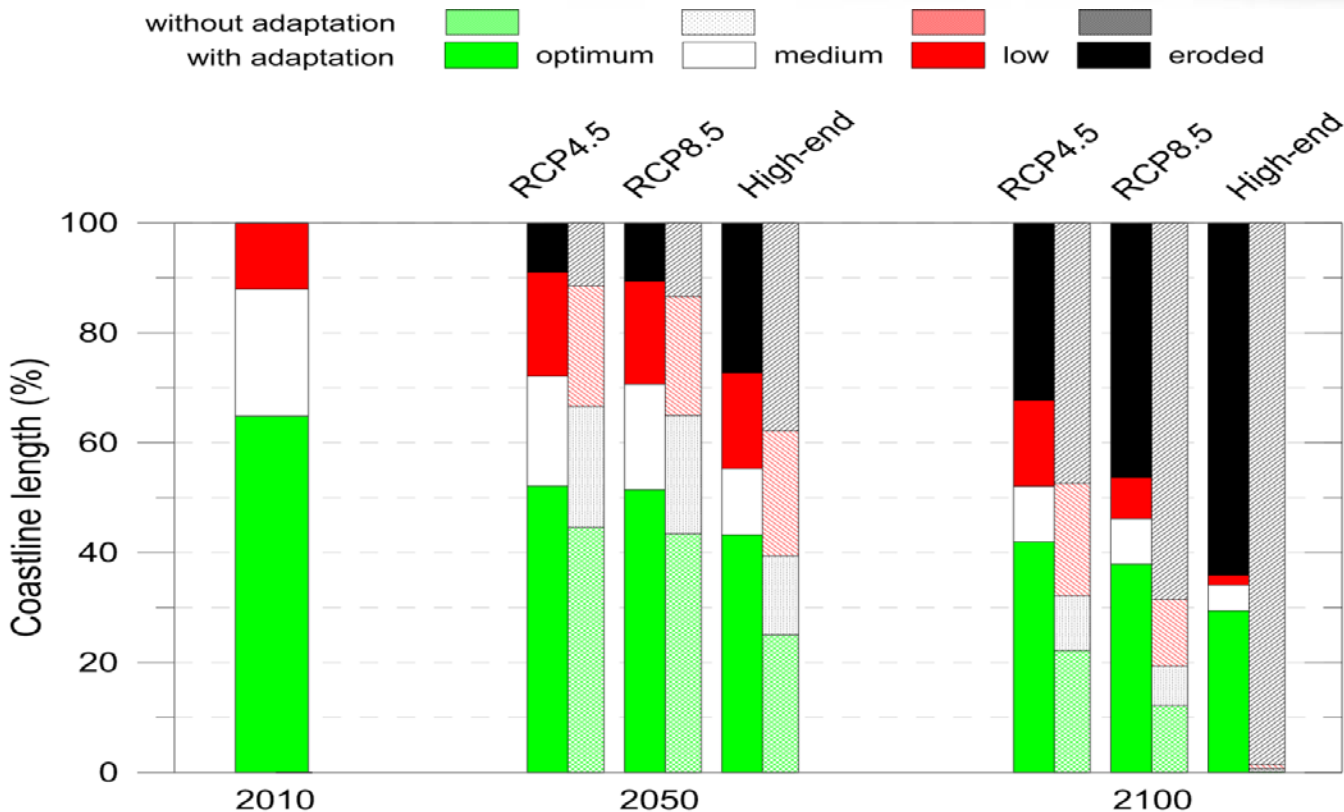
RCP 4.5, 8.5 & High End= 1.8m

## RSLR shoreline retreat

- Cat coast sectors (Ebro delta)
- Bruun's rule (o-o-m for RSLR with adapt. space)
- No variation in river  $Q_{solid}$  ( $\approx 0$  now Cat rivers)



Catalan coast **total beach length**: **decreases** with t due to **SLR** scenarios  
With/without availability of accommodation space

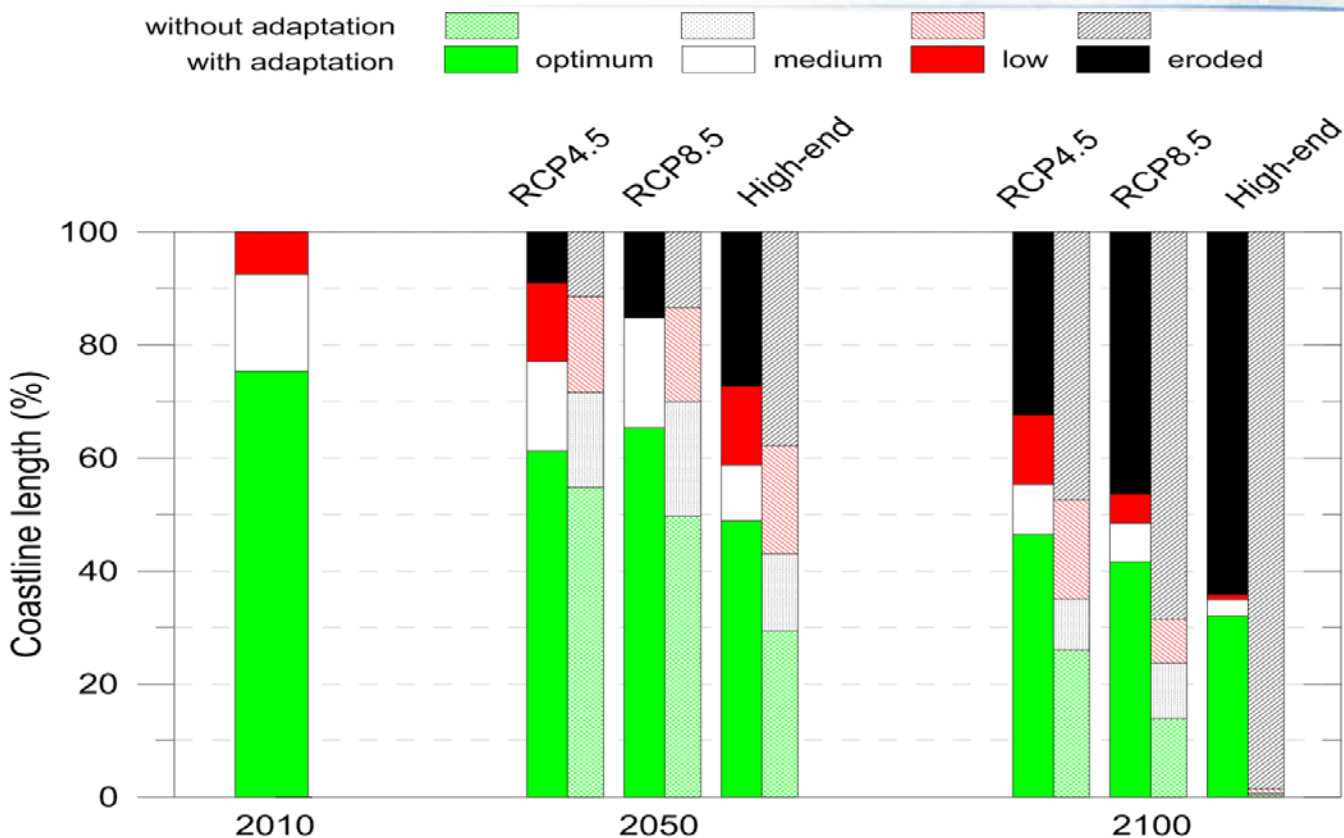


## Evolution of beach recreation function

Length (%) vs

- Quality level
- RCP scenario
- Time

(eroded: % of beach length disappeared)



## Evolution of beach **protection** function

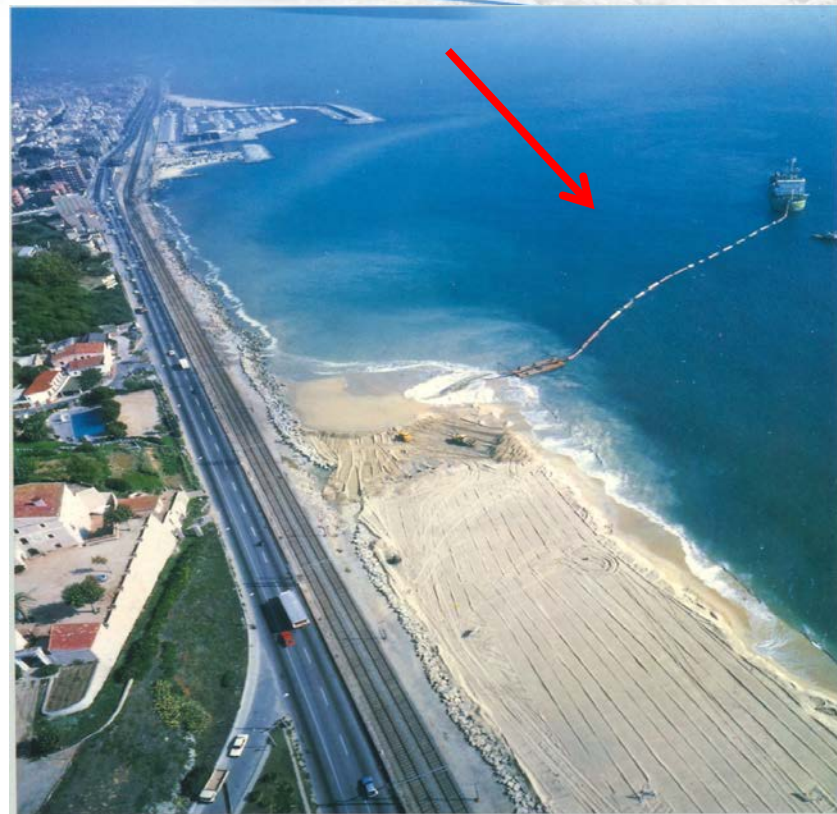
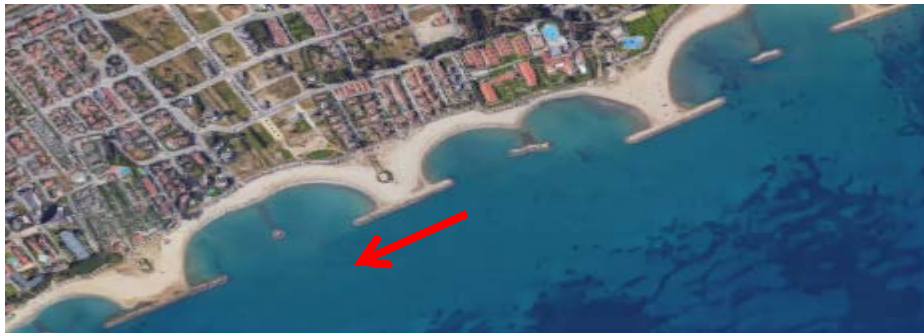
Length (%) vs

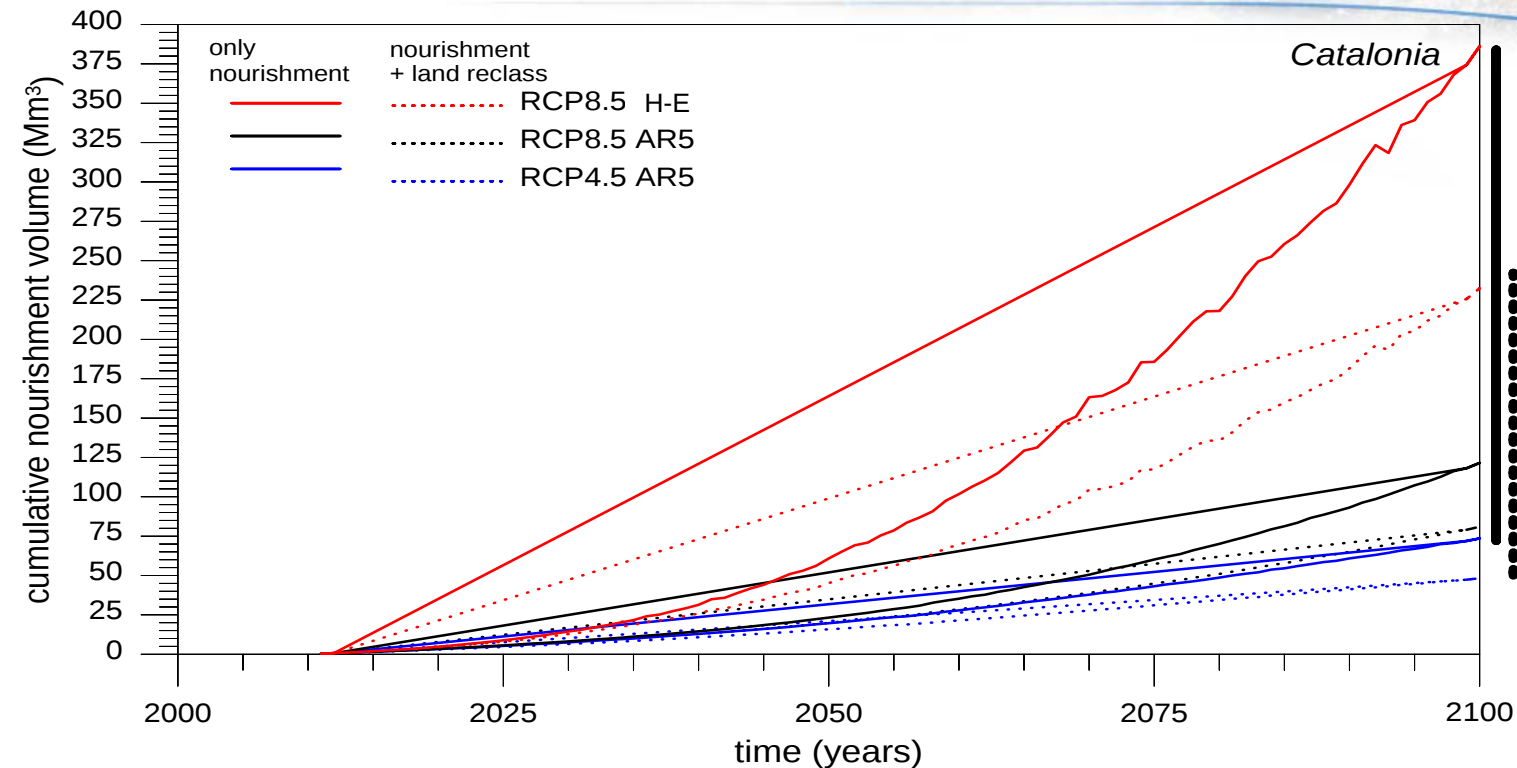
- Quality level
- RCP scenario
- Time

(eroded: % of beach length disappeared)

## Fan of current measures

- Beach nourishment
- Coastal structures
- Setback zones
- Spatial planning
- Relocation





**Sand volume to compensate SLR-erosion (Cat coast)**

VS

Time / Scenario (CC)

W/o accom.  
Space  
(managed retreat)

Accommodation space results in less nourished volume

## Fan of future measures

- Beach nourishment / Coastal structures / Setback zones (public domain)
- **Land planning** (relocation) / Recovering **flexibility** (novel interventions)



# Recovering flexibility: deconstruction of urban area into salt marshes (Pletera) Illustrating flooding (January 2017) that provides sediment inputs

2014 (before)



2017 (after)





Natural sand overwash due to  
storm event December 2008

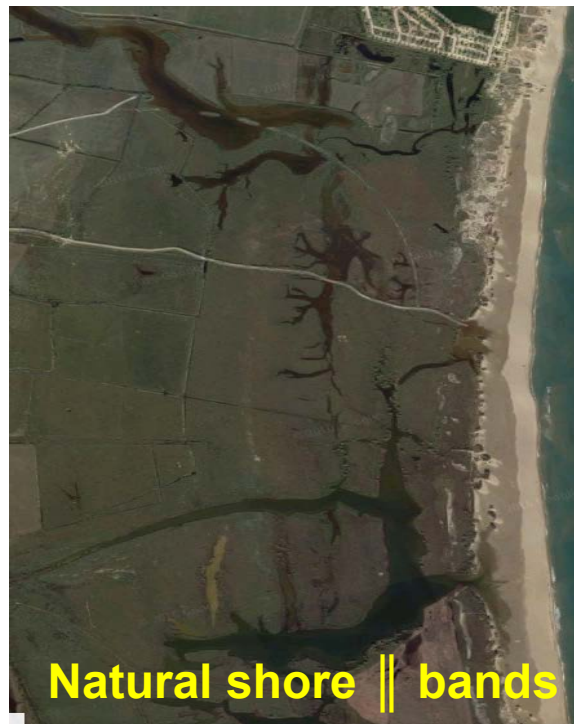
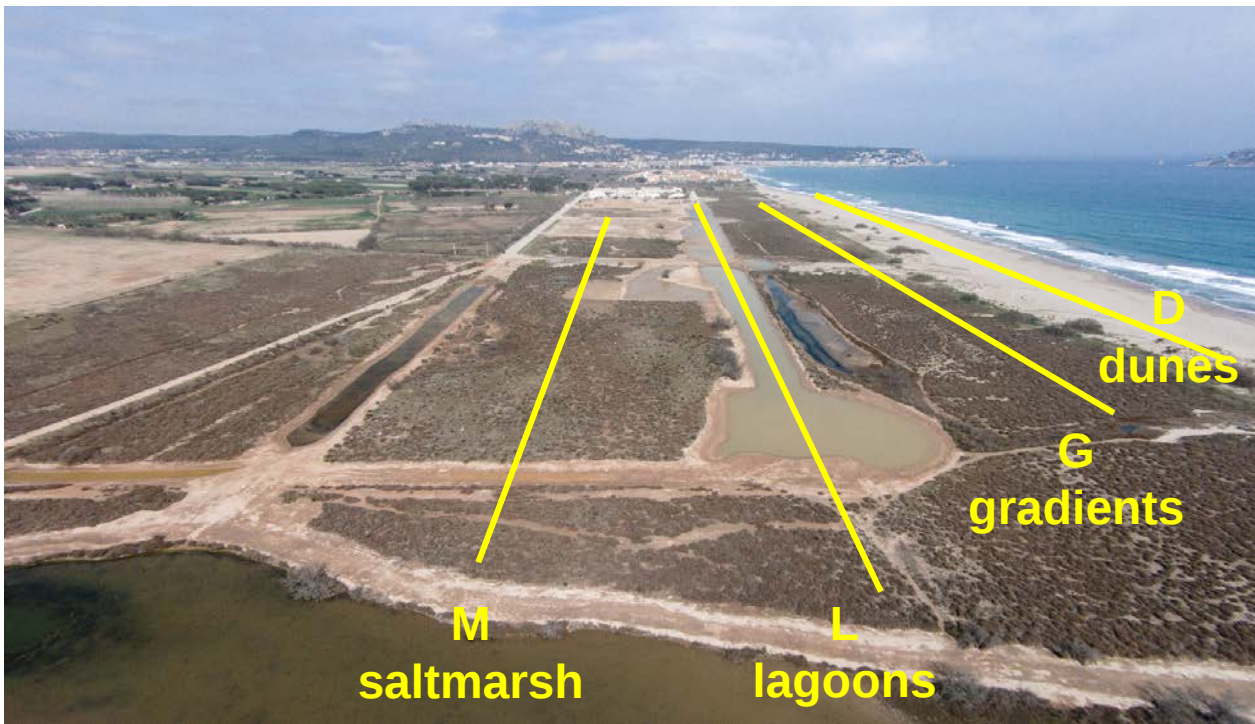


Sand covered paths & vegetation



Natura 2000 area to be rigidized

**Saltmarsh rewilding:** recovery of natural functions  
Design based on shore parallel bands  
(Nature based pattern due to relict water courses/dunes)

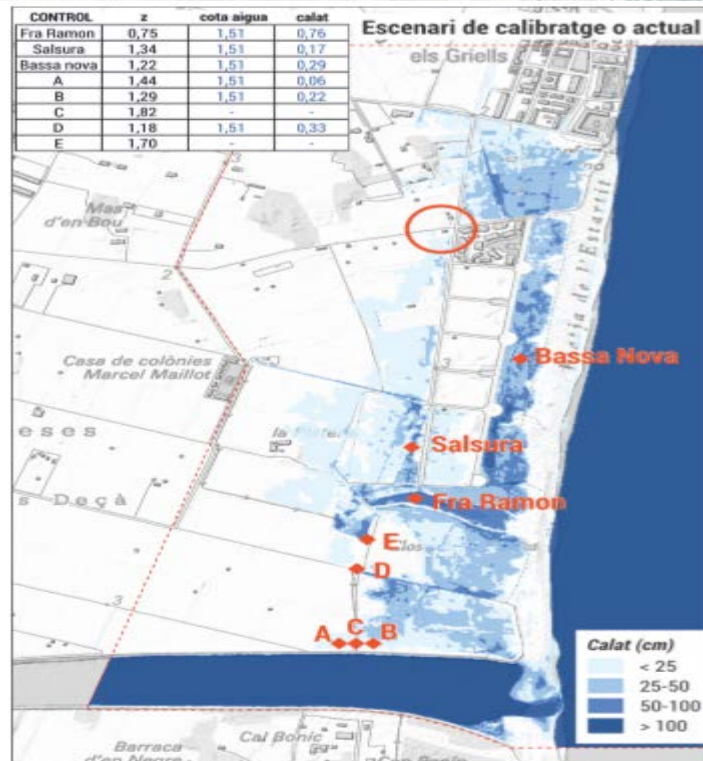


## Distributed fluxes after rewilding

- o 0.25m reduction of flood level
- o 250m reduction of overwash penetration inland



Concentrated fluxes for urbanised area (before)



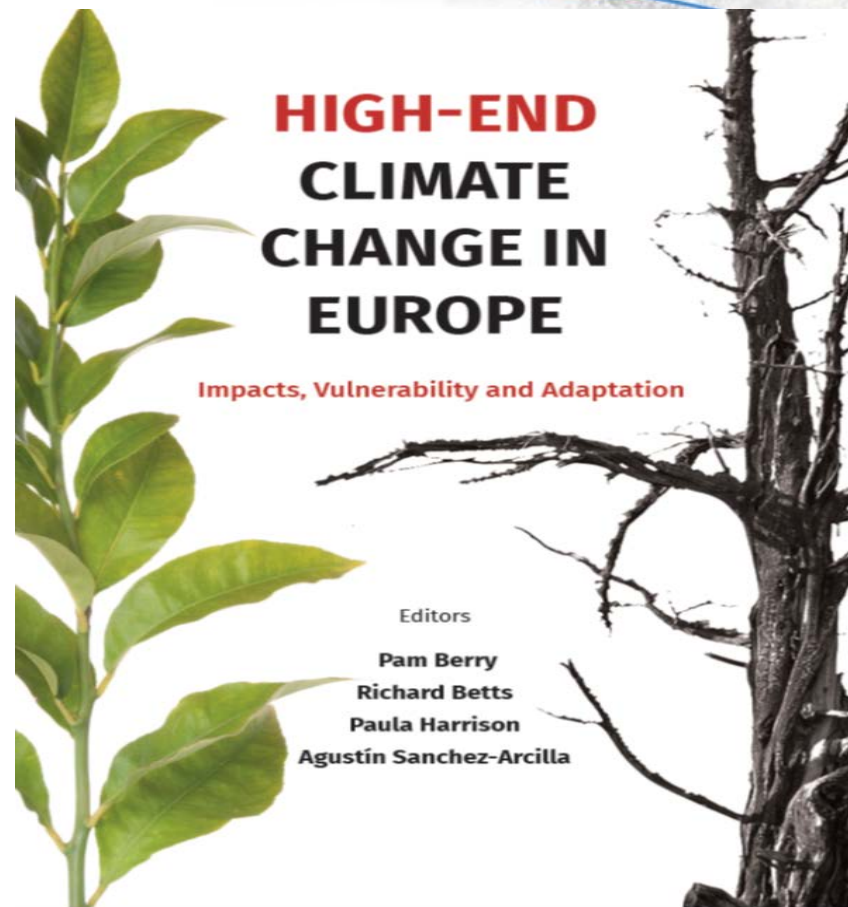
Modelling of sea inundation after deconstruction of La Pletera (after)

# Conclusions

- o Accommodation space reduces vulnerability
- o Benefits of maintaining active coasts
- o Assessment with recreation / protection functions
- o Higher risks for rigidized coasts
- o Feasibility of rewilding / ↑ sustainability
- o Policy implications (POLICY BOOKLET)



## High End Climate Change Policy Booklet



# Acknowledgments



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**PaiRisClima** (CGL2014-55387-R)