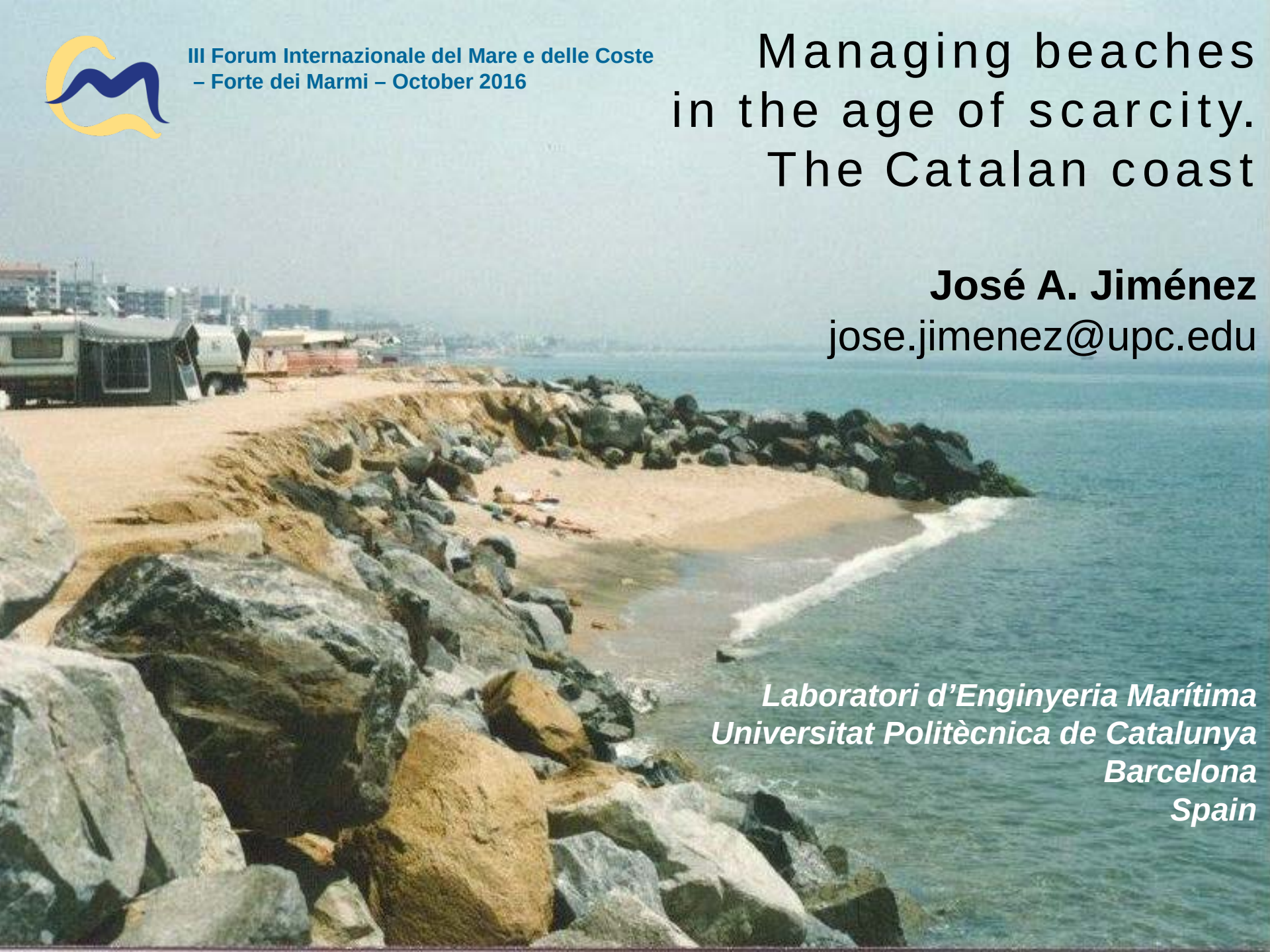

III Forum Internazionale del Mare e delle Coste – Forte dei Marmi – October 2016

Managing beaches in the age of scarcity. The Catalan coast

José A. Jiménez
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Universitat Politècnica de Catalunya
Barcelona
Spain

EL PAÍS
ECONOMÍA

Julio se convierte en el mes con más turistas de la historia en España

El mes pasado visitaron el país 9,6 millones de extranjeros, superando así incluso el mejor agosto de la serie

CRISTINA DELGADO

Madrid - 31 AGO 2016 - 09:32 CEST

Miles de turistas en la playa de Levante de Benidorm./ MANUEL LORENZO

VÍDEOS
NEWSLETTERS
TE PUEDE INTERESAR

Recreational beaches

Managers' target

To maintain a given **beach carrying capacity**.

To provide:

- **R**esources
- **S**ervices
- **S**afety

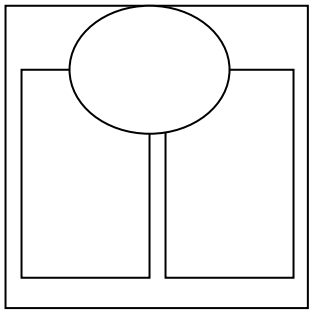
Potential users' load

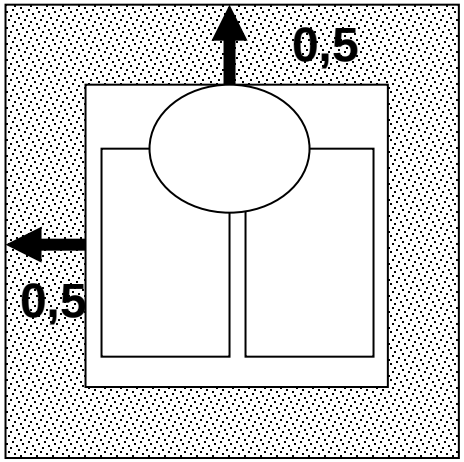
Cp = surface / people

Cp (m^2/user)	**Saturation**
< 2	Unacceptable
3	Saturation
4	**Acceptability limit**
5	Acceptable
> 10 -….	Comfortable

4 m²

Minimum surface occupied by 2 people and beach stuff

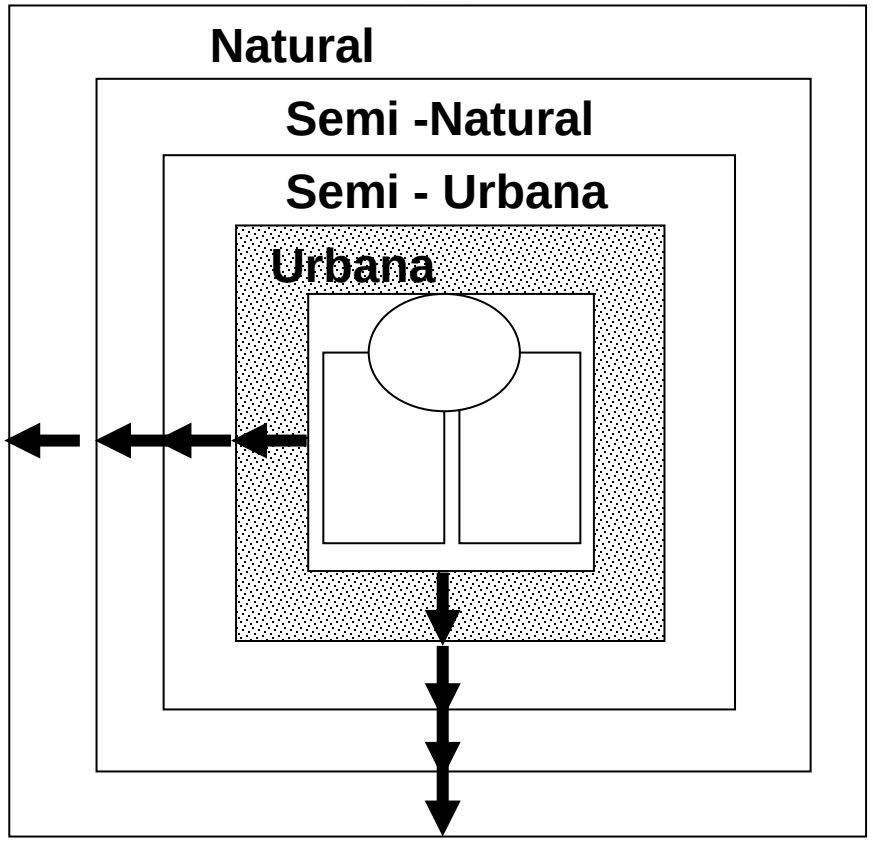




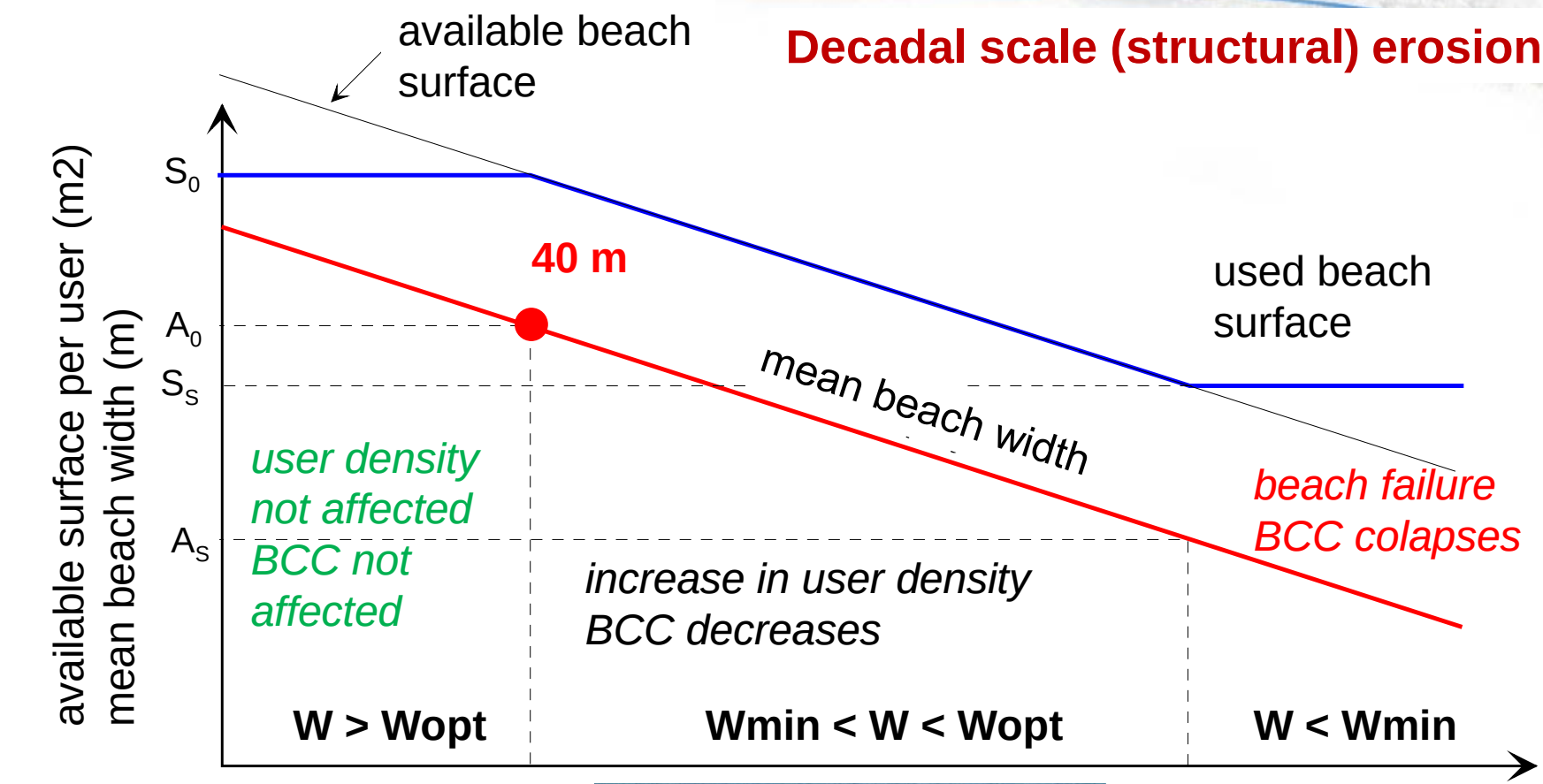
Riera & Fraguell (2004)

Urban beach 3x3


www.dave-derbis.de


Natural
Semi -Natural
Semi - Urbana
Urbana

Decadal scale (structural) erosion



Valdemoro & Jiménez 2006. *Coastal Management* 34:405-423


Which is the current scenario?

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UNIVERSITAT POLITÈCNICA DE CATALUNYA

Decadal scale shoreline evolution

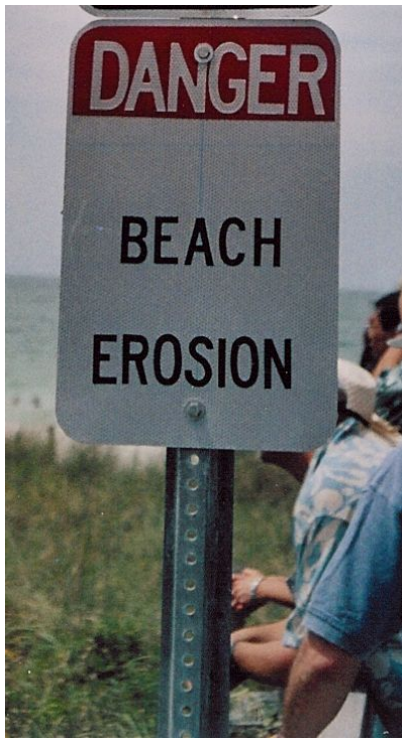
- last 20 years -

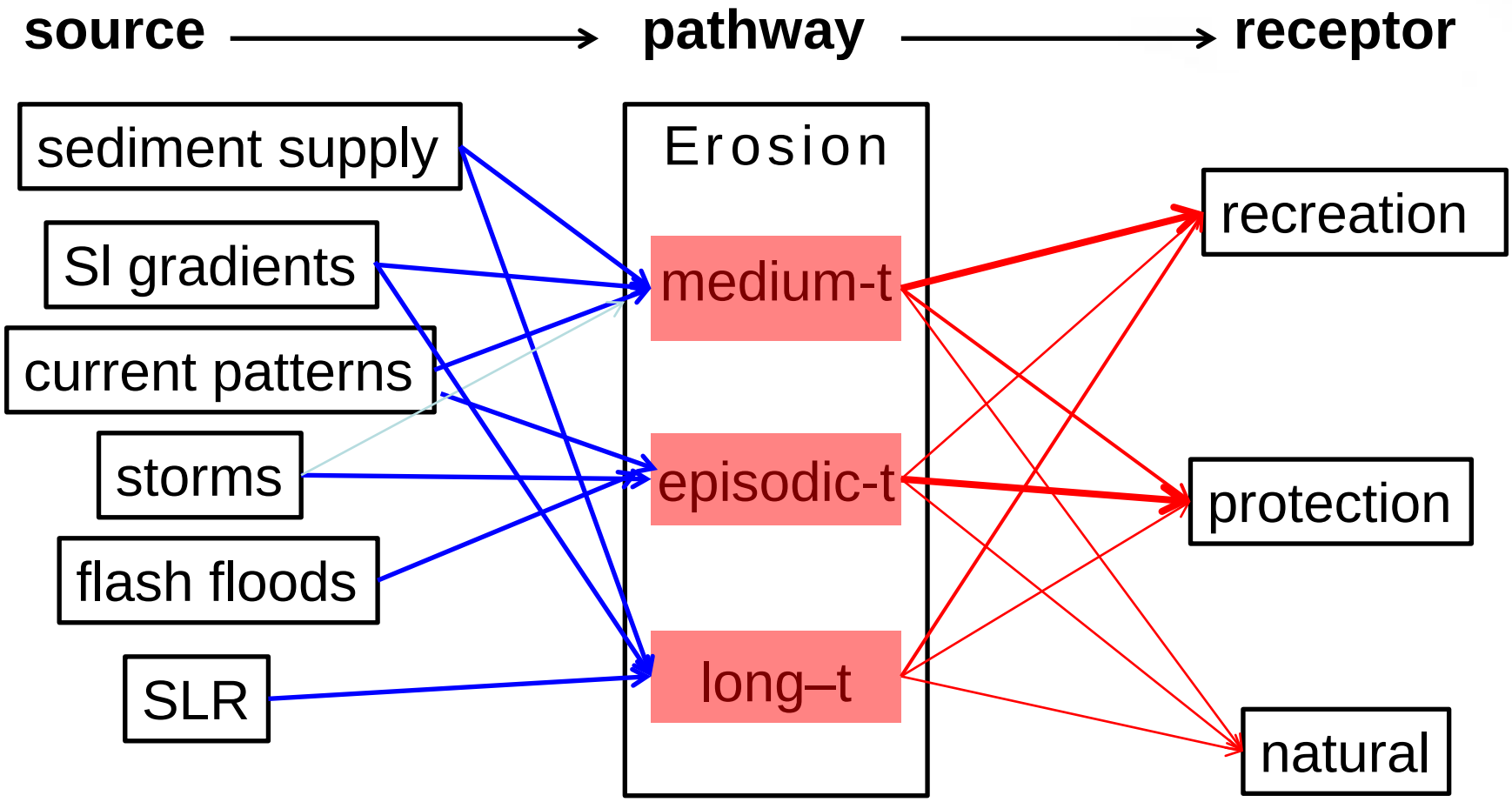
~ 2 Mm^3 / y

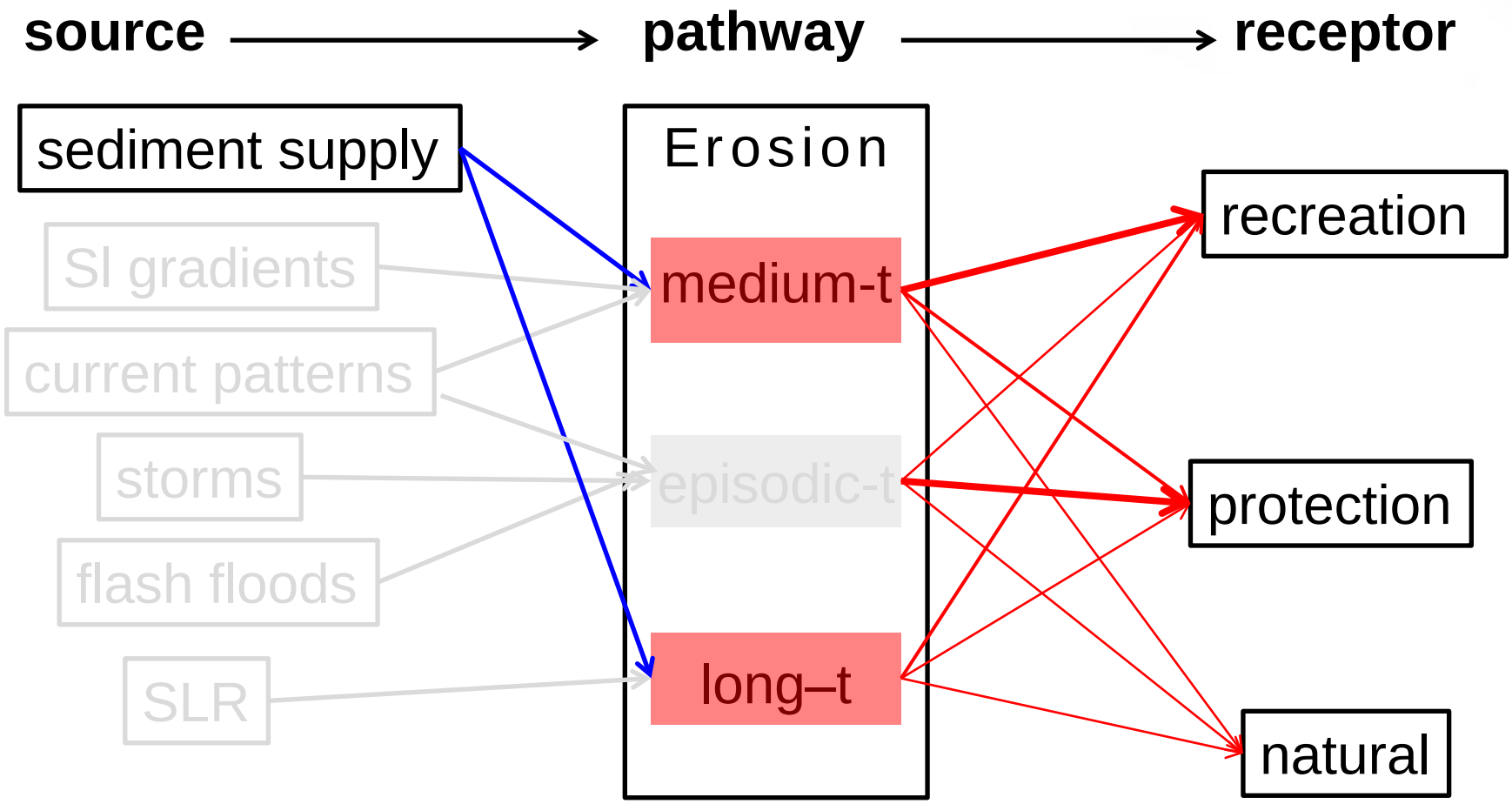
~ 1 m / y

50 km

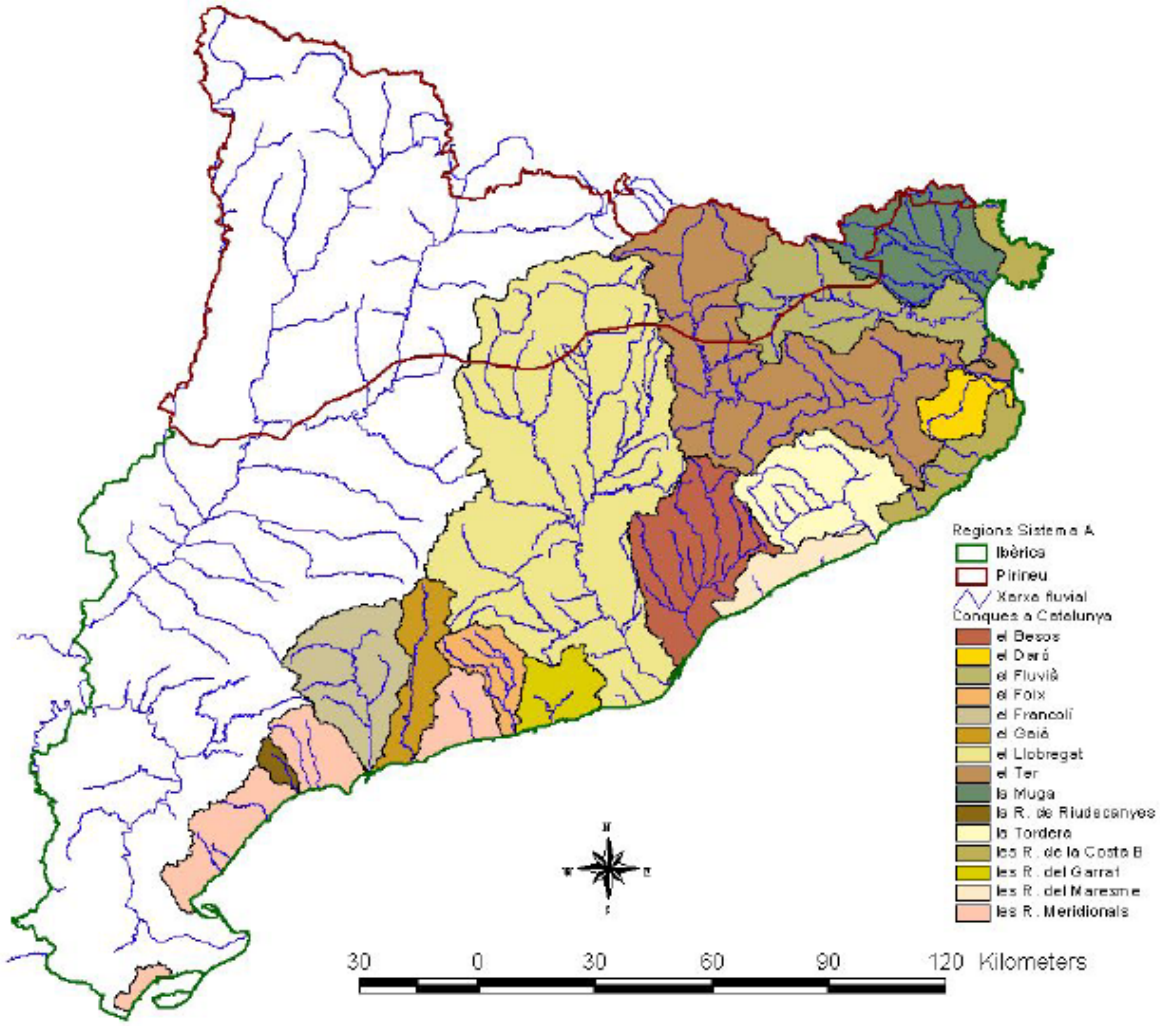
70 % sedimentary coast
under erosion




source
pathway
receptor
sediment supply
Sl gradients
current patterns
storms
flash floods
SLR
Erosion
medium-t
episodic-t
long–t
recreation
protection
natural


source
pathway
receptor
sediment supply
Sl gradients
current patterns
storms
flash floods
SLR
Erosion
medium-t
episodic-t
long–t
recreation
protection
natural

Rivers in Catalonia



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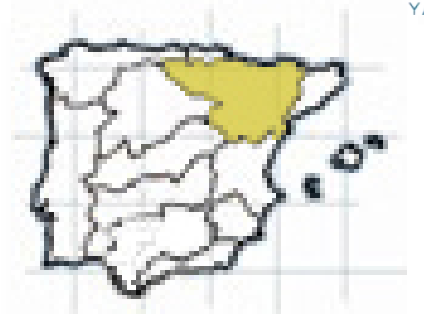
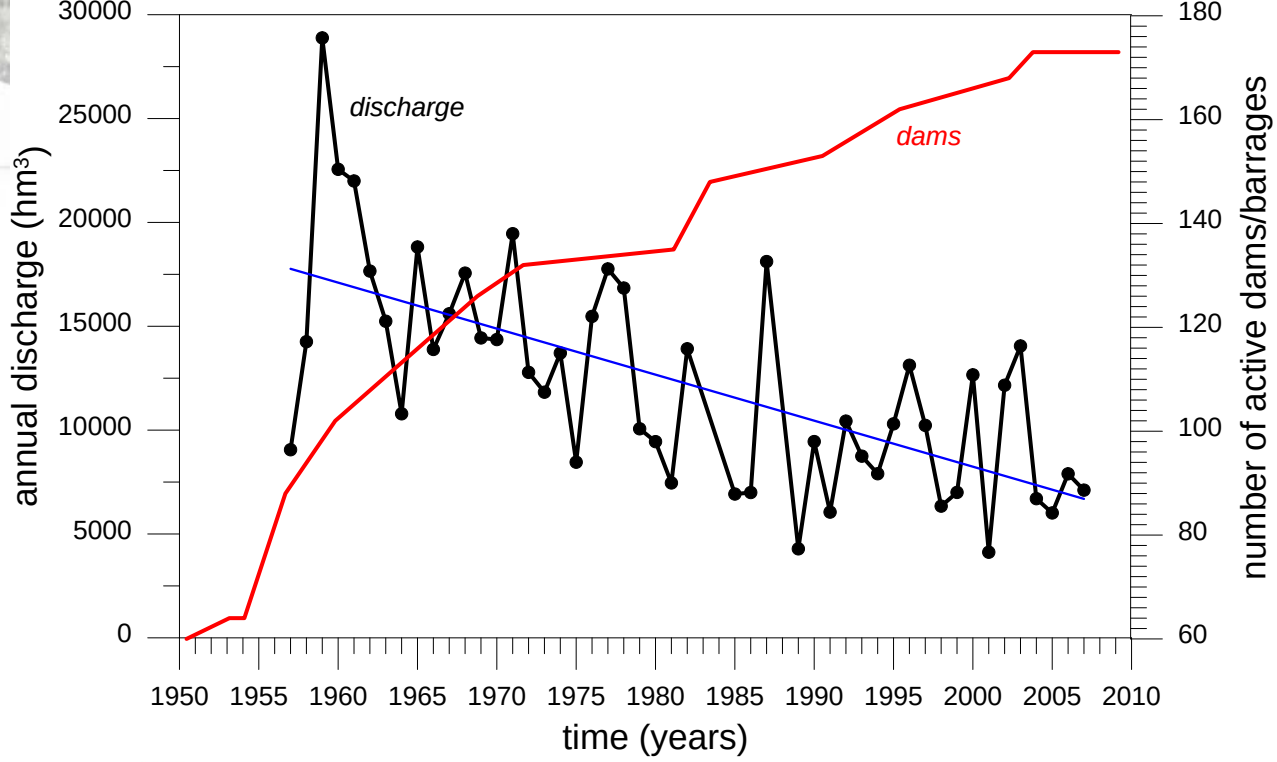
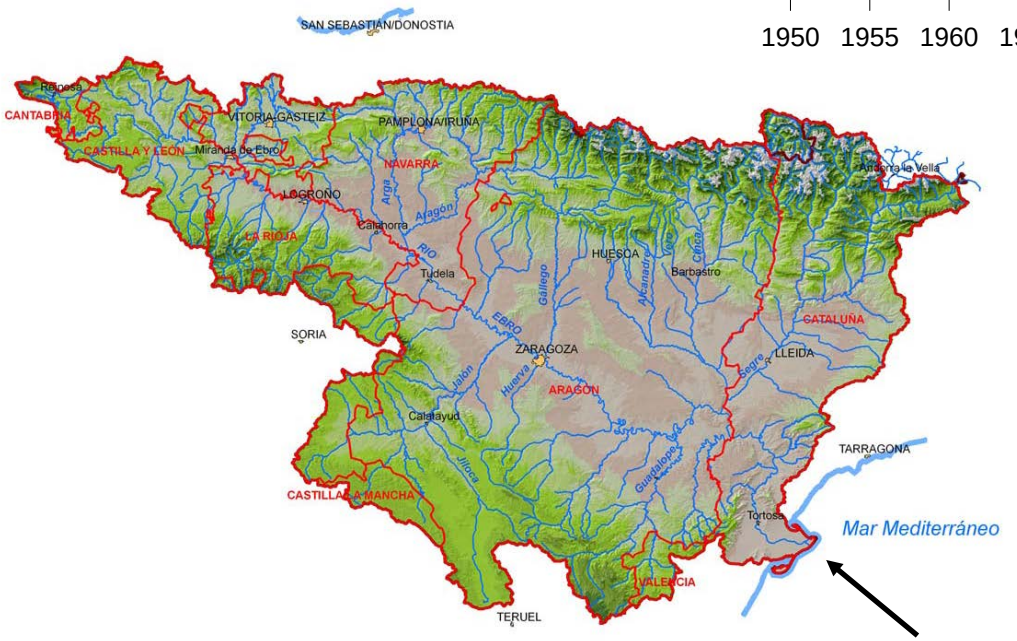




Ebro river basin



Ebro delta

Surface: 85,362 Km²

Length: 910 Km (12.000 Km all streams)

Dam / barrages ~ **180 !!!!**

Regulated basin 82,300 km² (96.4 %)

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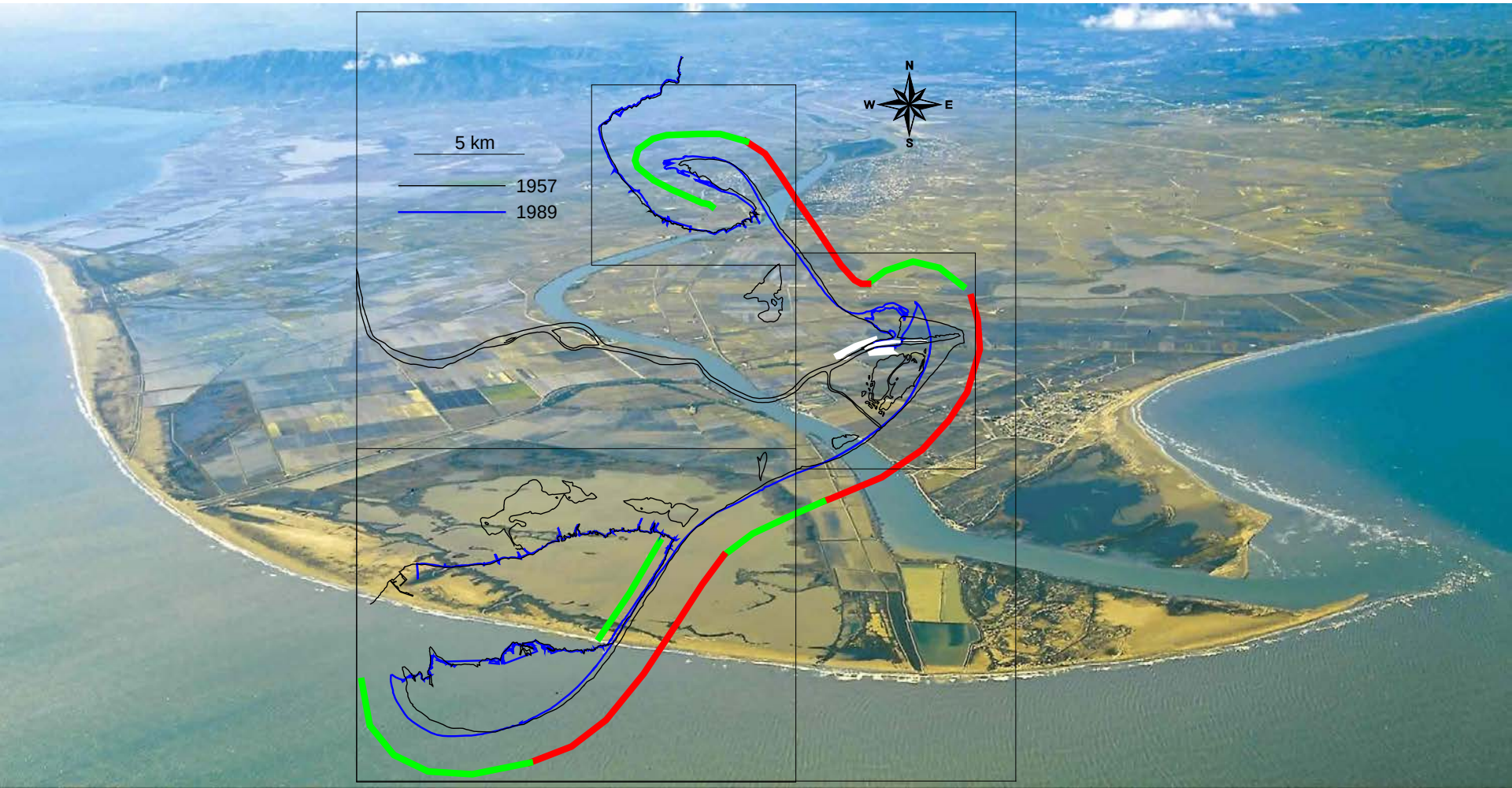
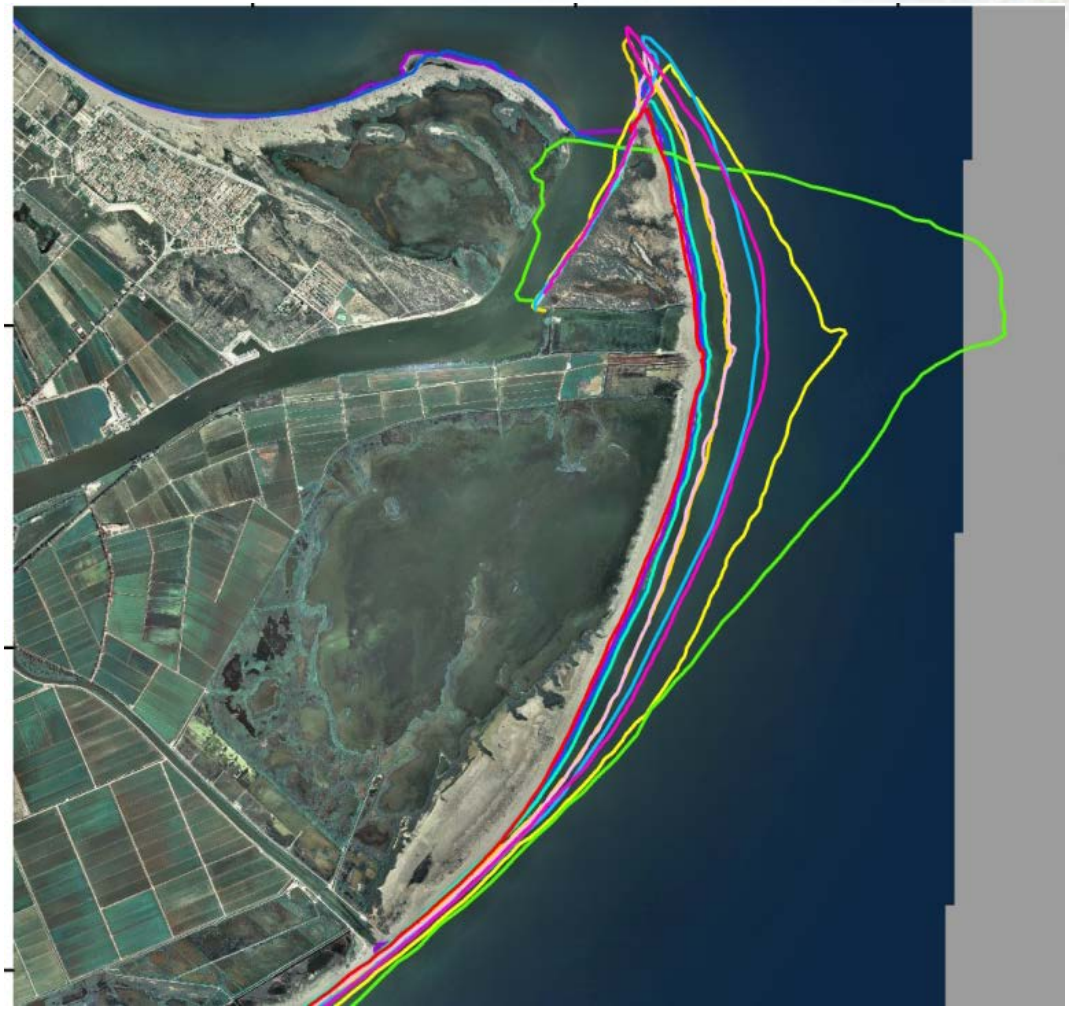
Ebro delta coast L ~ 50 km

Main source Ebro river

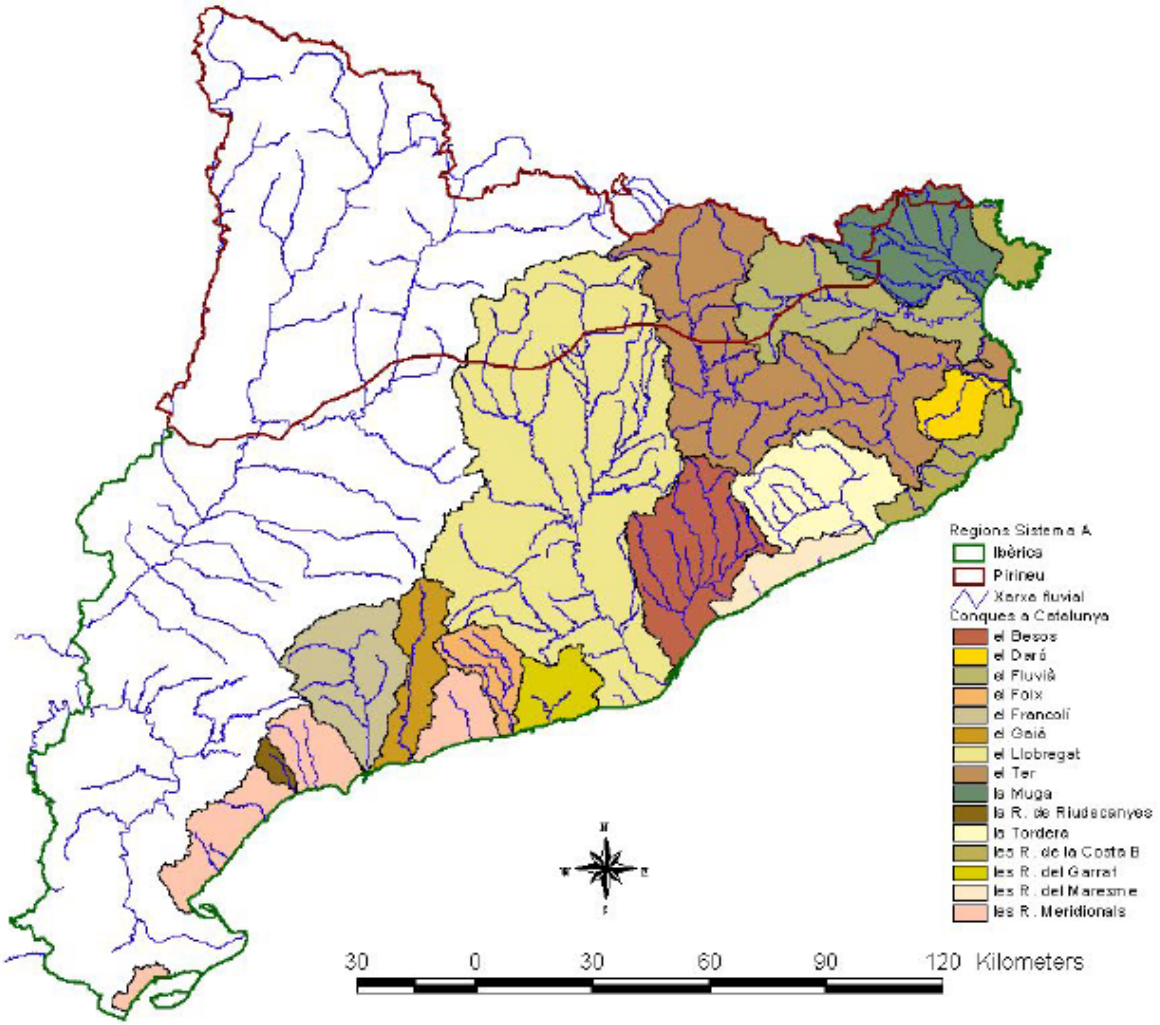
Uninterrupted (but the river mouth) coastline





Max shoreline (Cap Tortosa) retreat > 1900 m in 50 y

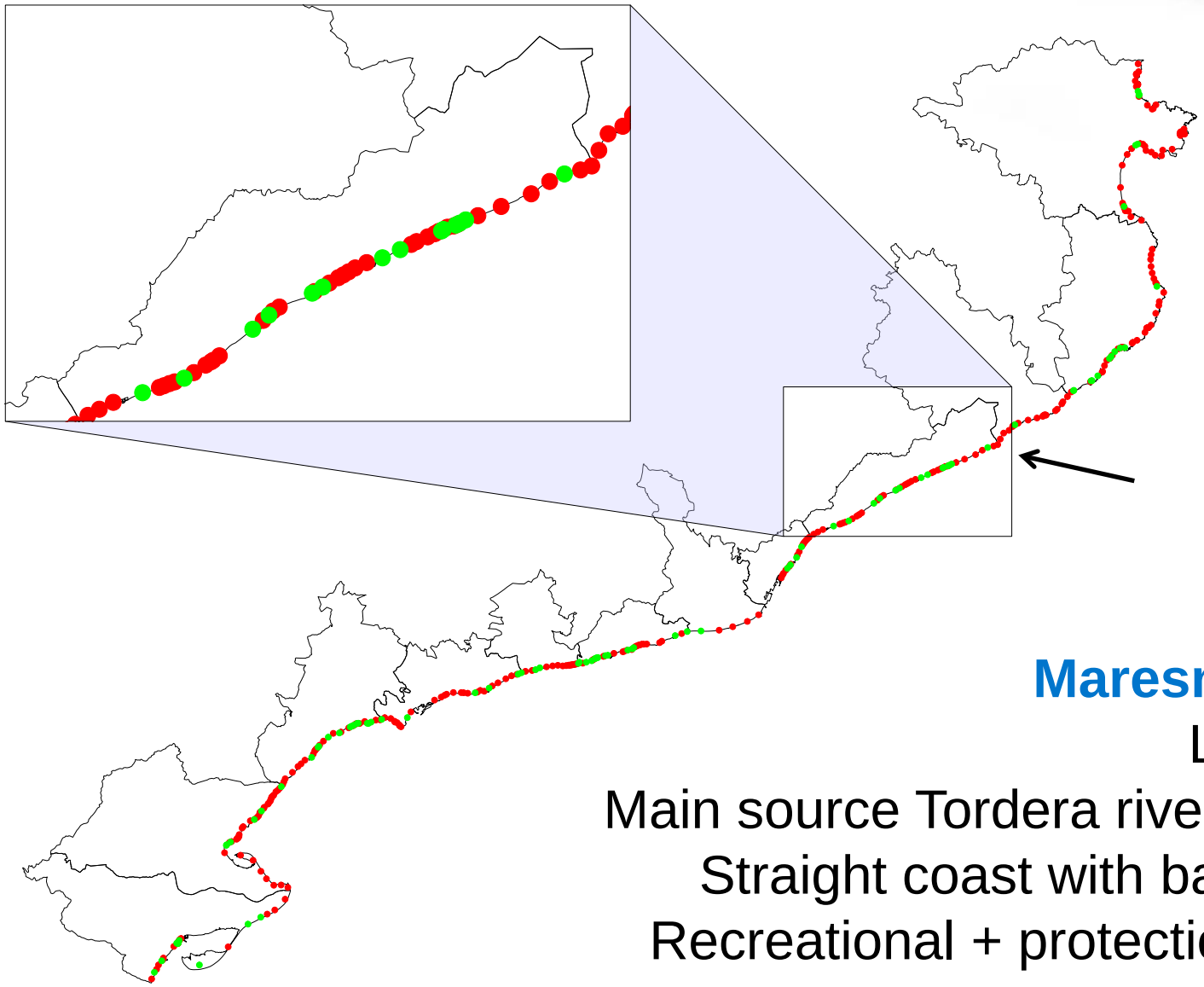
Internal river basins



ACA (2002)

Main human impacts on river sediment flux in Catalonia *(after Liquete et al' 2009)*

Expected effect on sediment flux	**Human impact**	**Catalan rivers markedly affected**
Decrease	Damming	Ter, Foix, Gaia
	Water extraction	Ter, Besos, Llobregat, Foix, Francoli
	Urbanization	**Tordera**, Besos, Llobregat, Foix, Francoli
	Sand and gravel mining	**Tordera**
Increase	Agriculture	Gaia, Francoli
	Deforestation	Besos, Llobregat, Foix
Undetermined	Aridification	Llobregat, Foix, Gaia,



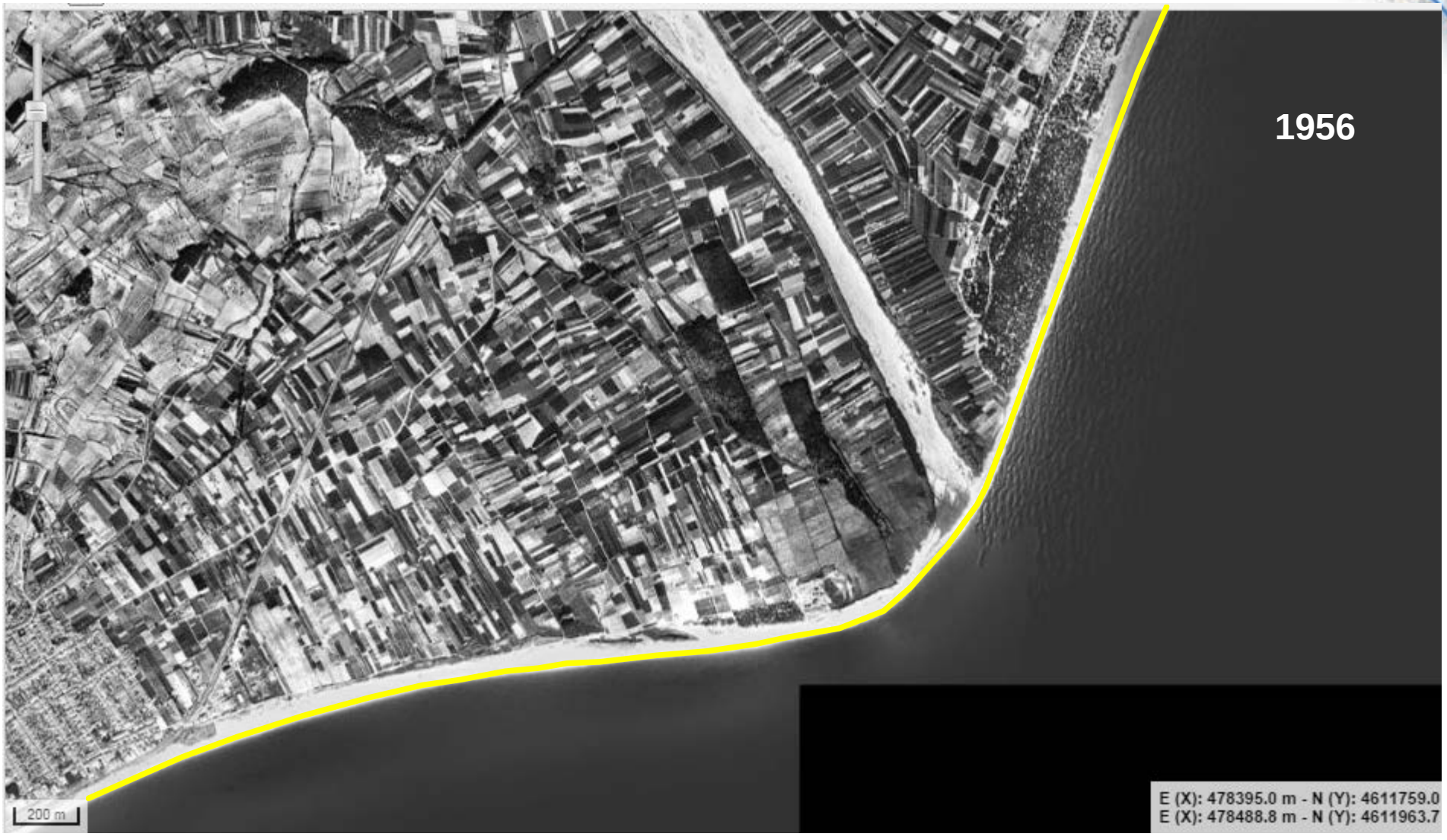
Maresme coast

L ~ 45 km

Main source Tordera river at the N

Straight coast with barriers (6)

Recreational + protection issues


1956
200 m
E (X): 478395.0 m - N (Y): 4611759.0
E (X): 478488.8 m - N (Y): 4611963.7


1990
200 m
E (X): 478465.0 m - N (Y): 461079
E (X): 478558.8 m - N (Y): 461100


1993
200 m
E (X): 478600.0 m - N (Y): 4610239.
E (X): 478693.8 m - N (Y): 4610443.


1994
200 m
E (X): 478380.0 m - N (Y): 4610729.0
E (X): 478473.8 m - N (Y): 4610933.7


1996
200 m
E (X): 478440.0 m - N (Y): 4610469.
E (X): 478533.8 m - N (Y): 4610673.


2000
200 m
E (X): 478390.0 m - N (Y): 4610484.
E (X): 478483.8 m - N (Y): 4610688.


2004
200 m
E (X): 478490.0 m - N (Y): 4610429.
E (X): 478583.8 m - N (Y): 4610633.


2006
200 m
E (X): 478380.0 m - N (Y): 4612169.0
E (X): 478473.8 m - N (Y): 4612373.7


2008
200 m
E (X): 478395.0 m - N (Y): 4610464.
E (X): 478488.8 m - N (Y): 4610668.

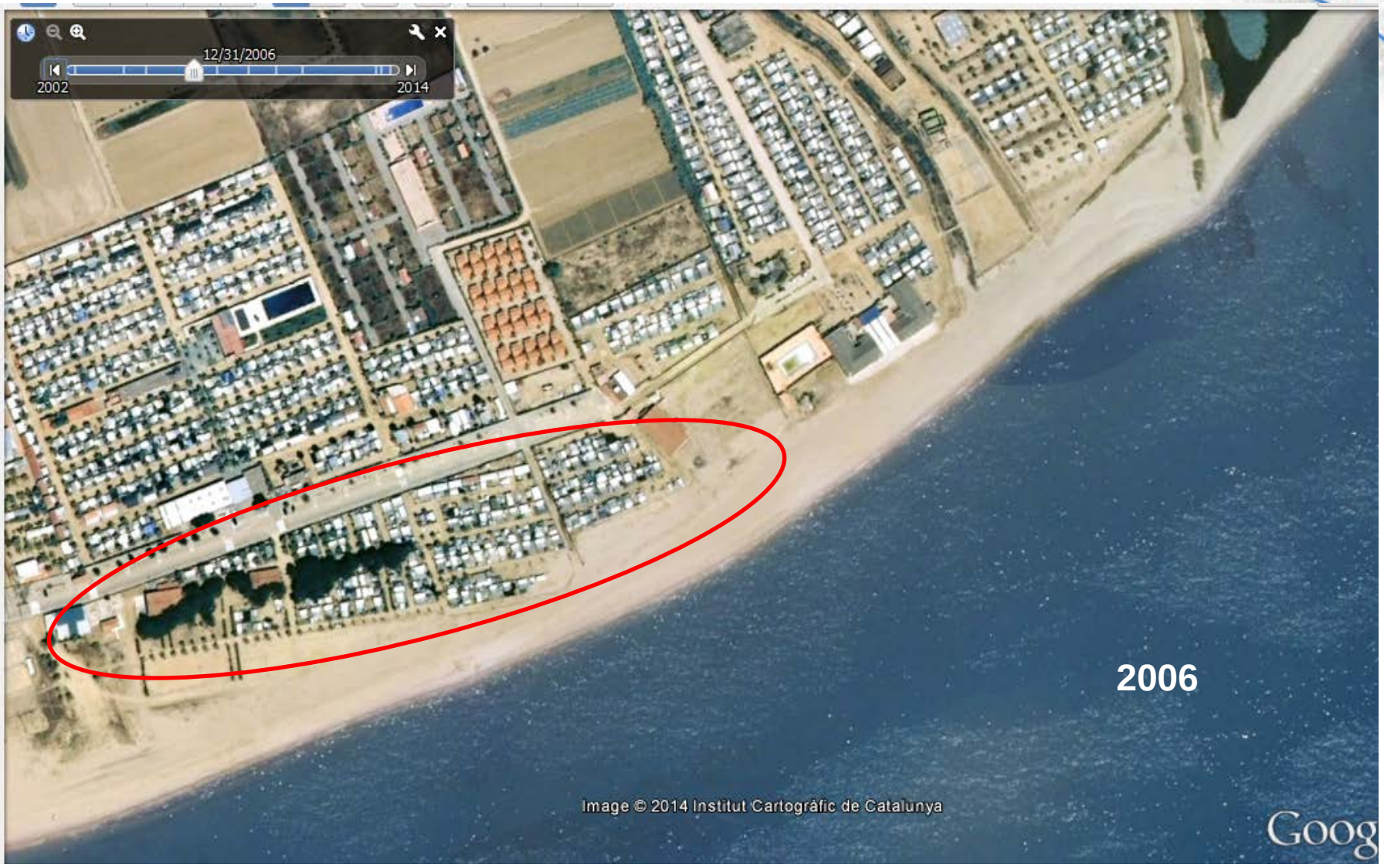

2009
200 m
E (X): 478475.0 m - N (Y): 461009
E (X): 478568.8 m - N (Y): 461030


2010
200 m
E (X): 478435.0 m - N (Y): 4609974.
E (X): 478528.8 m - N (Y): 4610178.


2011
200 m
E (X): 478390.0 m - N (Y): 4610434.
E (X): 478483.8 m - N (Y): 4610638.


2012
200 m
E (X): 478420.0 m - N (Y): 4610884.0
E (X): 478513.8 m - N (Y): 4611088.7


2013
200 m
E (X): 478400.0 m - N (Y): 4611469.0
E (X): 478493.8 m - N (Y): 4611673.7


12/31/2006
2002
2014
2006
Image © 2014 Institut Cartogràfic de Catalunya
Goog


3/2/2014
2002
2014
2014
Image © 2014 DigitalGlobe
Googl

- Are we able to **properly** transfer disturbances in drainage basins and river courses to sediment supplies to the coastal system?

- **Natural sediment sources** are **not** longer (significantly) contributing to coastal sediment budget (human induced) →


8/5/2011
2002
2016
180,000
(2007)
D50 ~ 0.6 – 0.7 mm
108,000 (2015)
250,000
(2009)
Image © 2016 Institut Cartogràfic de Catalunya
Image © 2016 DigitalGlobe
Image NASA
Guía turística
Fecha de las imágenes: 1/1/2010 41°41'07.01" N 2°36'54.55"

S'Abanell (Blanes)

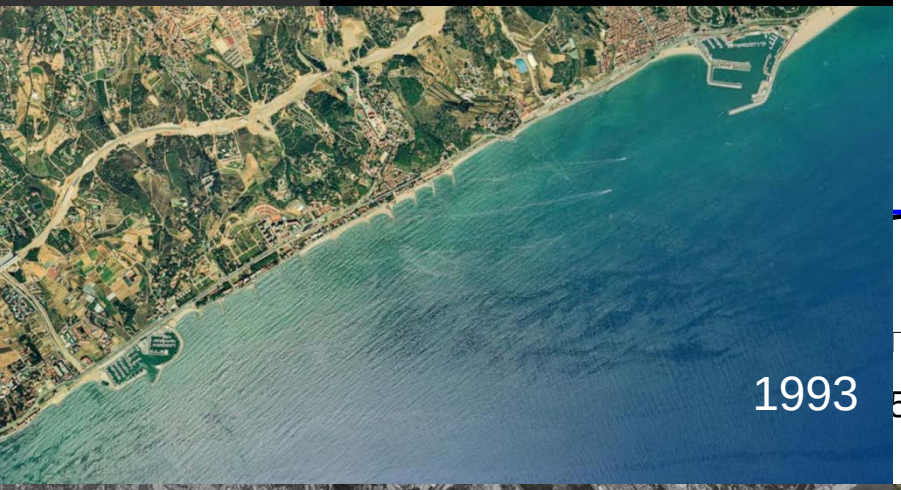
Cumulative volume of sediment supplied **11/07 – 09/09**

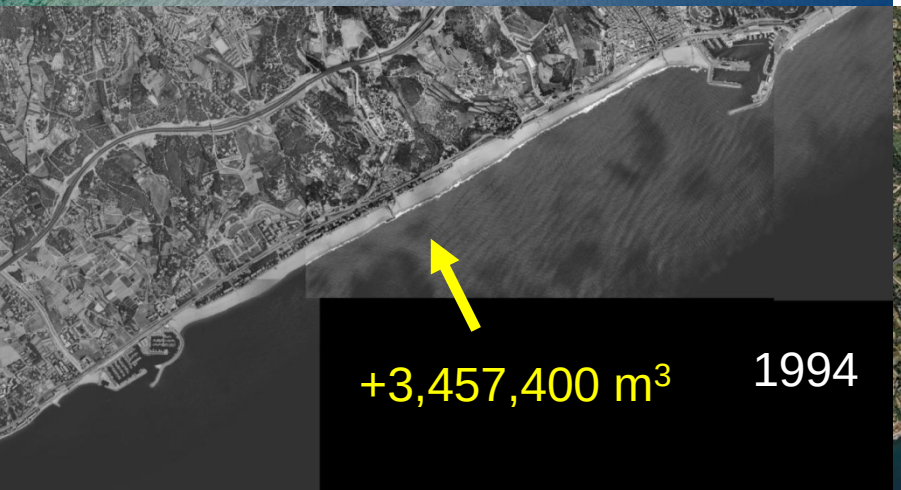
180,000 + 150,000 + 250,000 = **580,000 m³** **~290,000 m³/y**

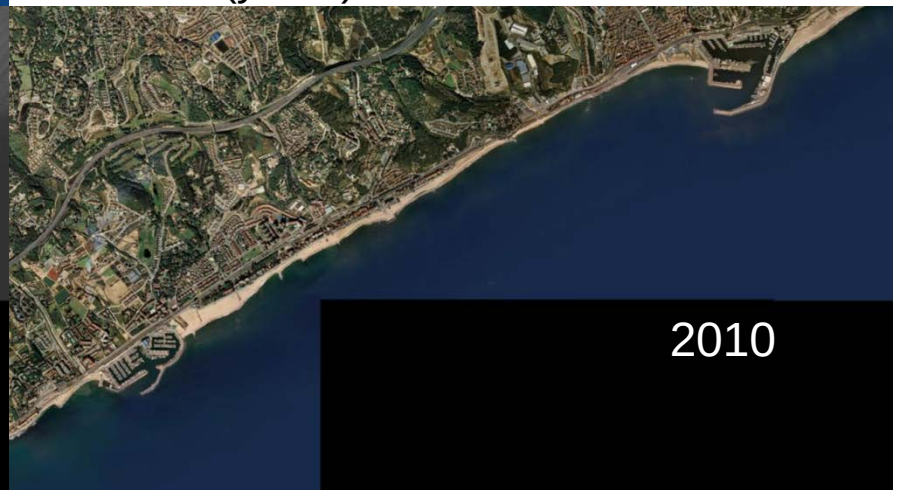
- Are we **properly using** existing resources?

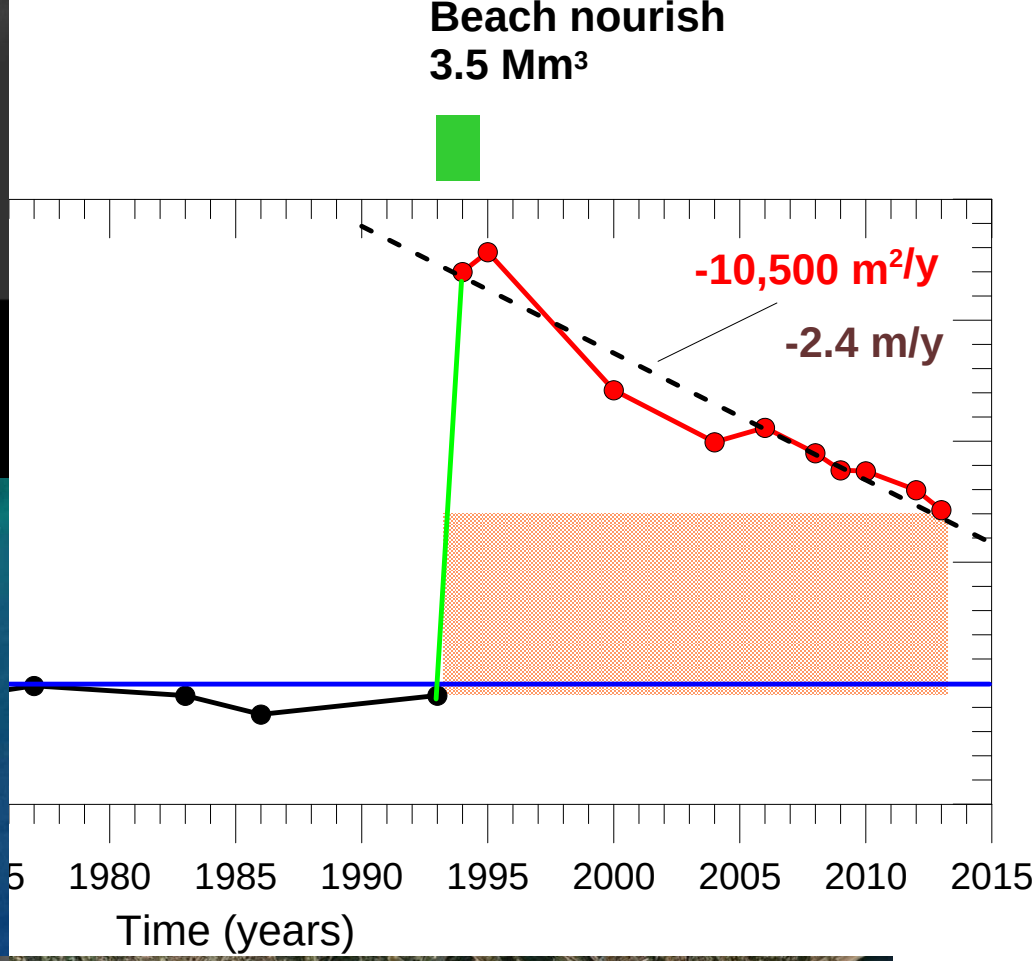
!!

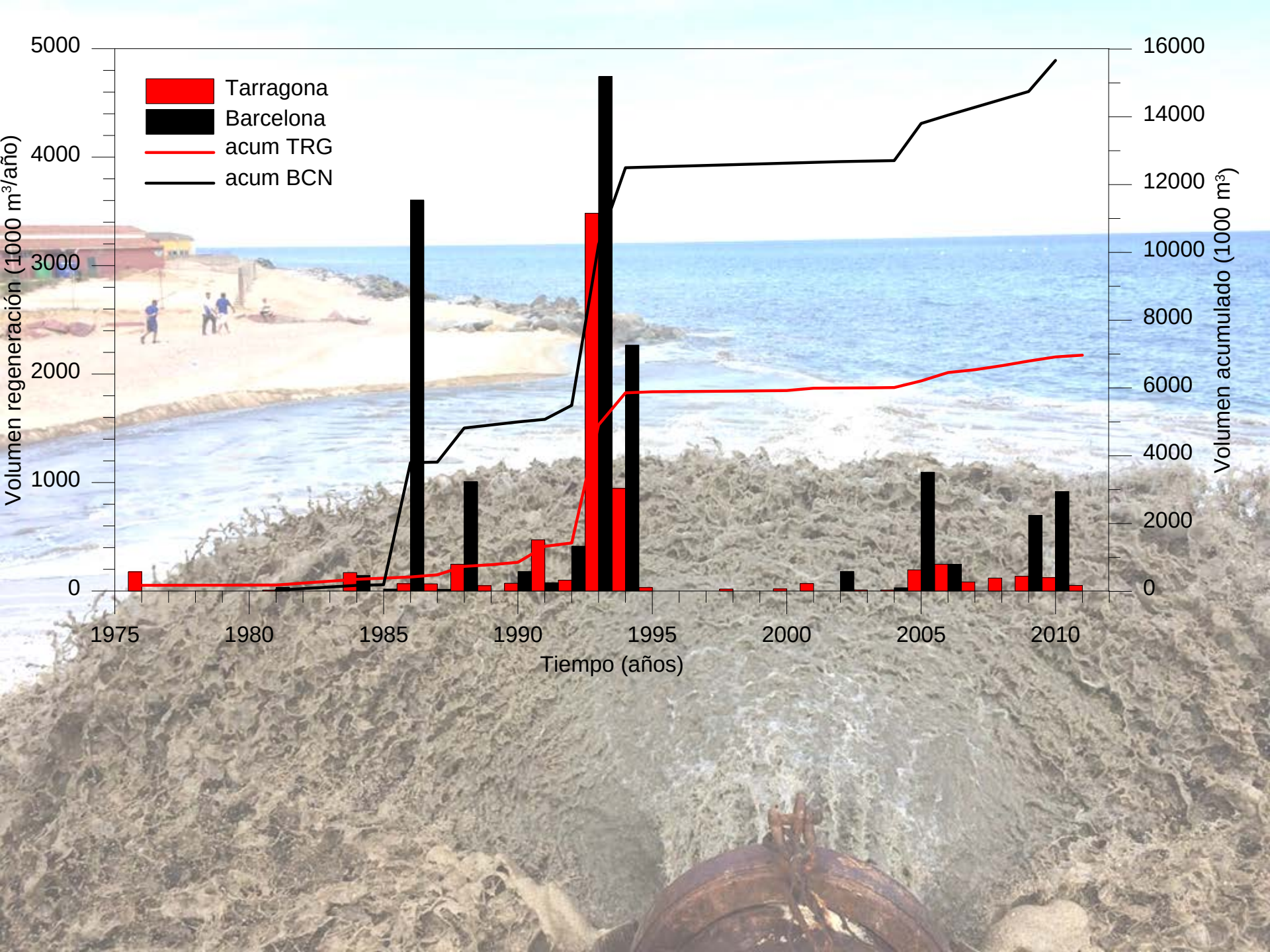

1956


1993


+3,457,400 m3
1994


2010


Beach nourish
3.5 Mm3
-10,500 m2/y
-2.4 m/y
1980
1985
1990
1995
2000
2005
2010
2015
Time (years)


Tarragona
Barcelona
acum TRG
acum BCN
Volumen regeneración (1000 m³/año)
Volumen acumulado (1000 m³)
Tiempo (años)
5000
4000
3000
2000
1000
0
16000
14000
12000
10000
8000
6000
4000
2000
0
1975
1980
1985
1990
1995
2000
2005
2010

- Are we able to **properly / accurately** transfer disturbances in drainage basins and river courses to sediment supplies to the coastal system?

- In the absence of a long-term planning are we able to **mimic / predict decisions** on (artificial) sediment inputs to the coastal zone?

  - **Natural sediment sources** are not longer (significantly) contributing to coastal sediment budget (human induced) → Substituted by **artificial nourishment (> 25 Mm^3 since 80's)**.

- Are we **properly using** existing resources?

- Are we able to **maintain** the current use of existing resources?

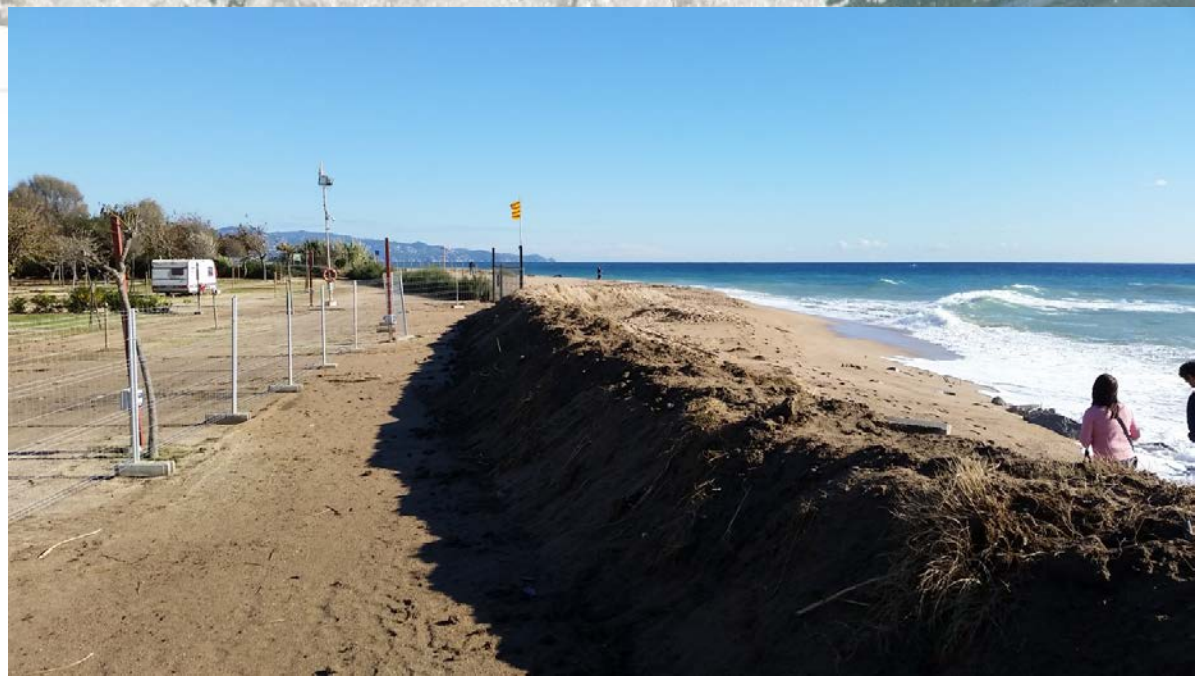
Current measures

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

Current measures

Other

- **Self protection**



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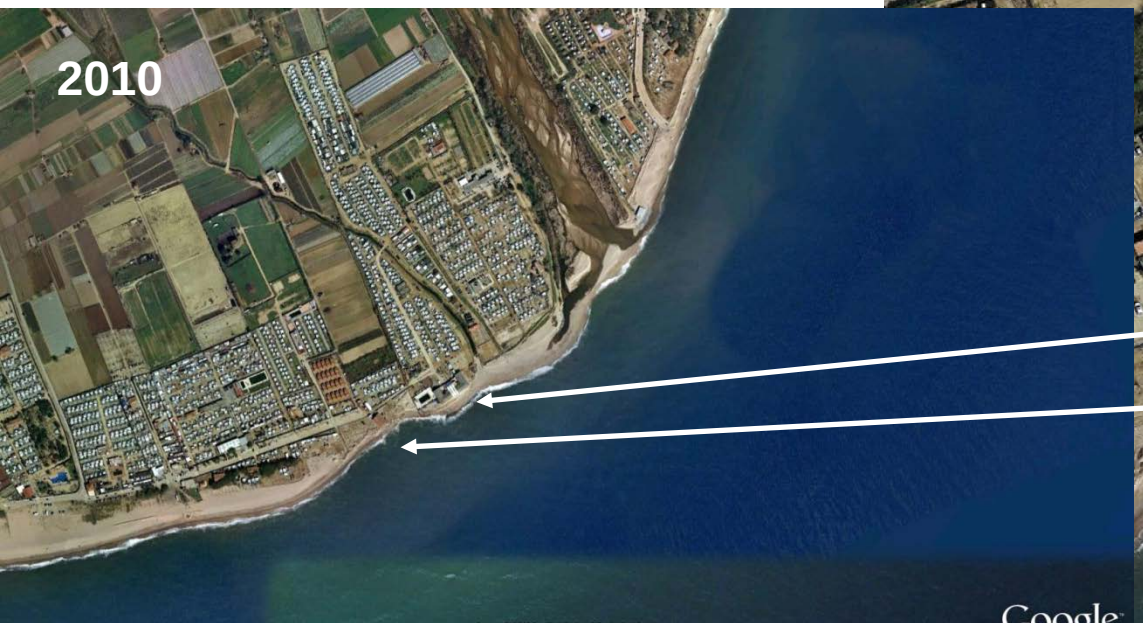
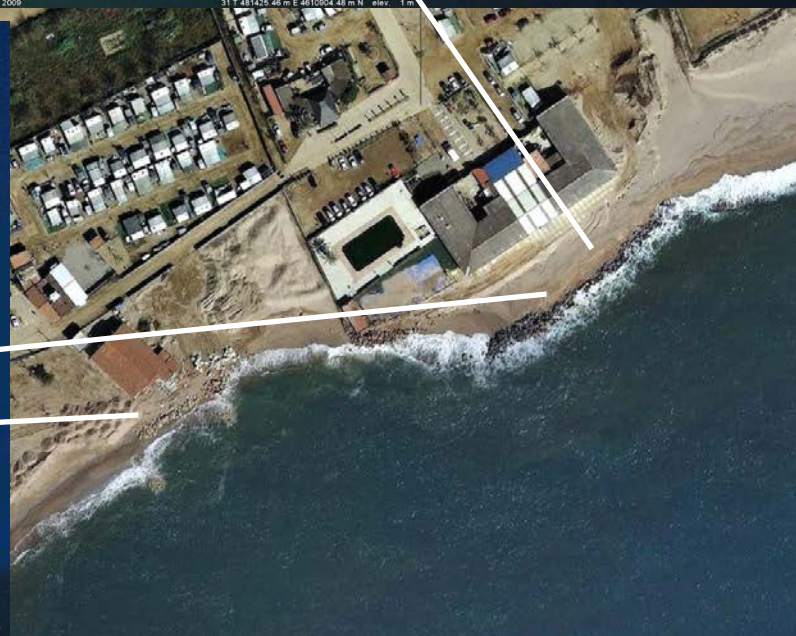
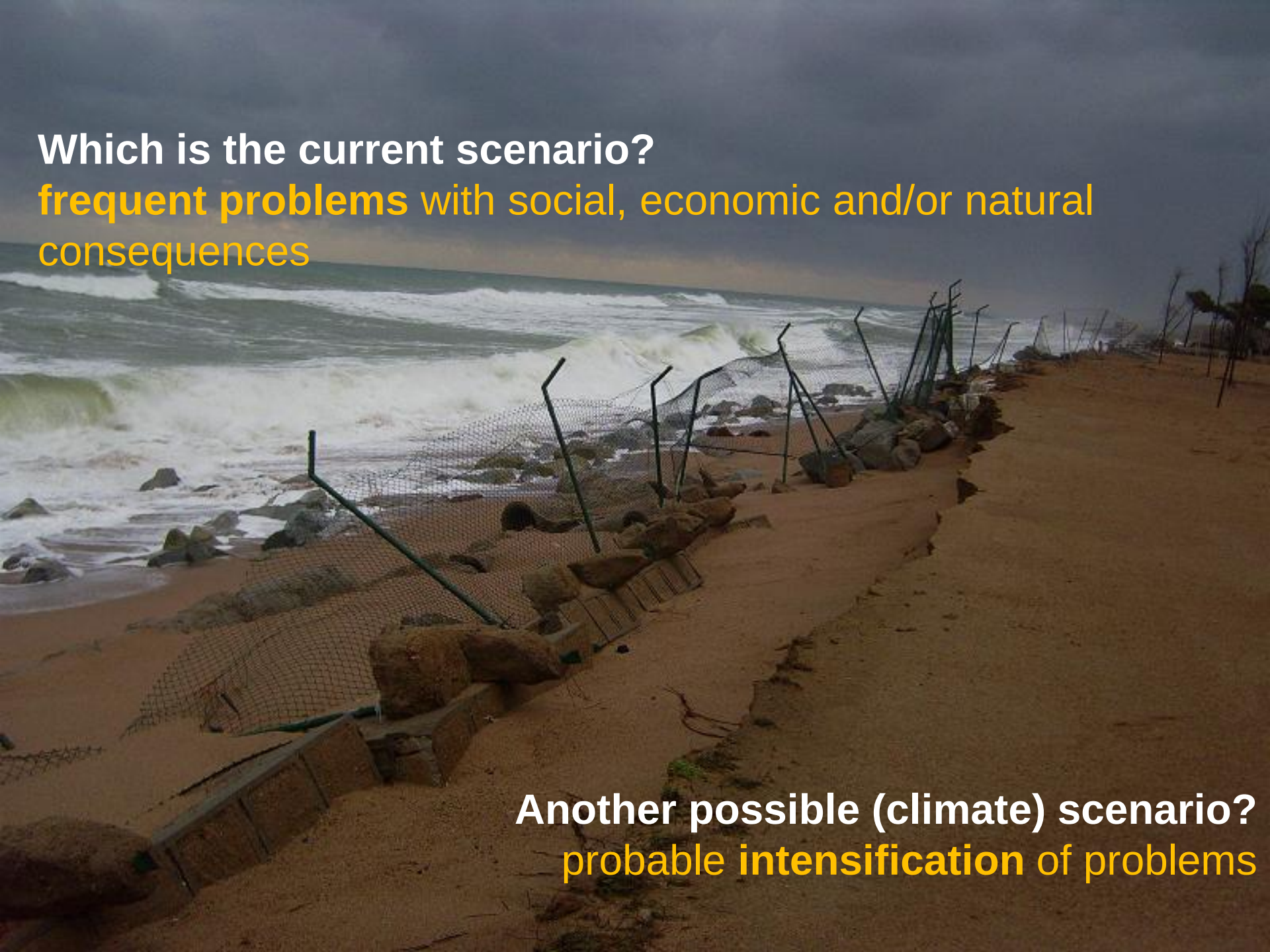


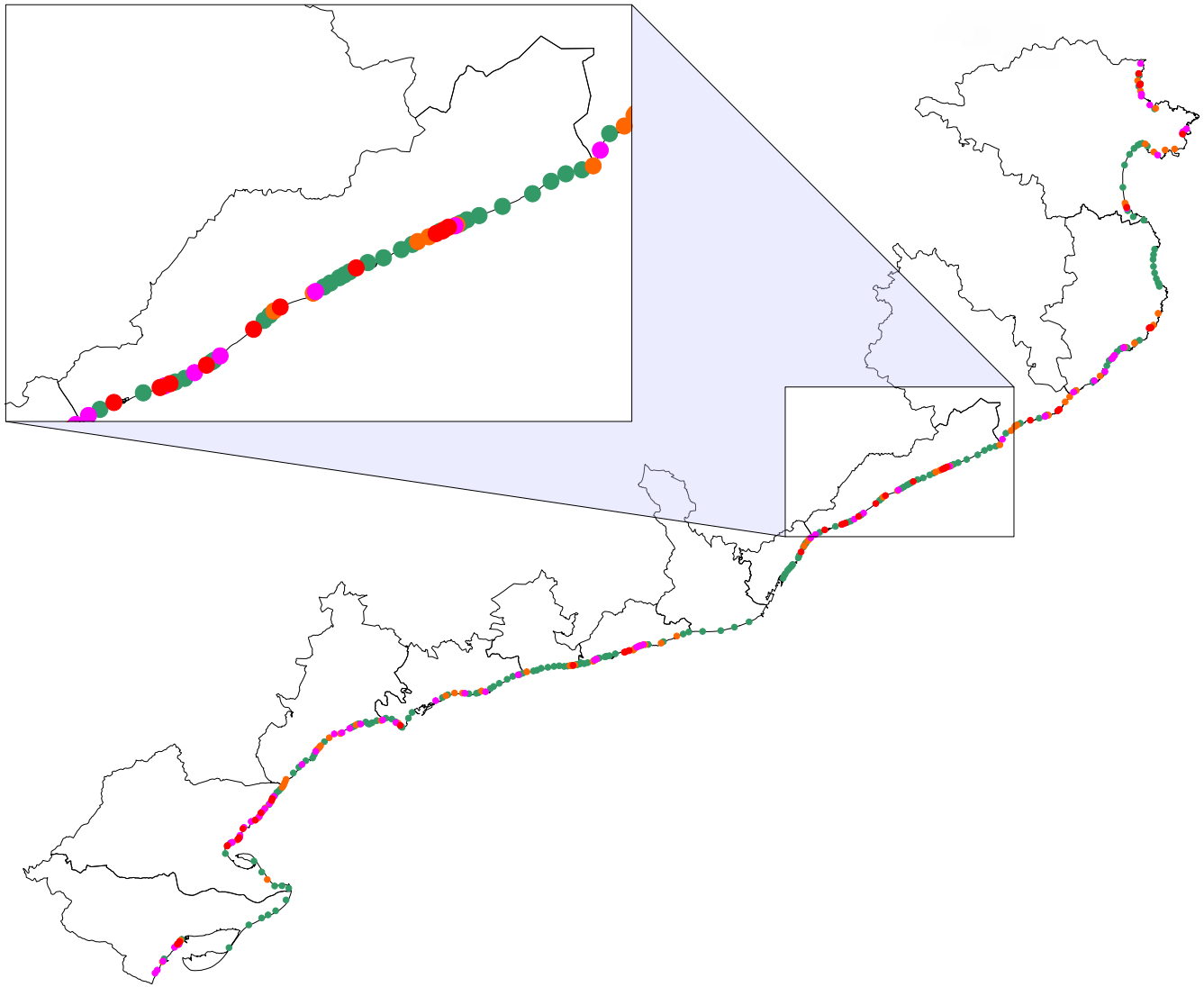


- In coastlines with significant disturbances, decadal scale behaviour is hardly to be explained by just one process.

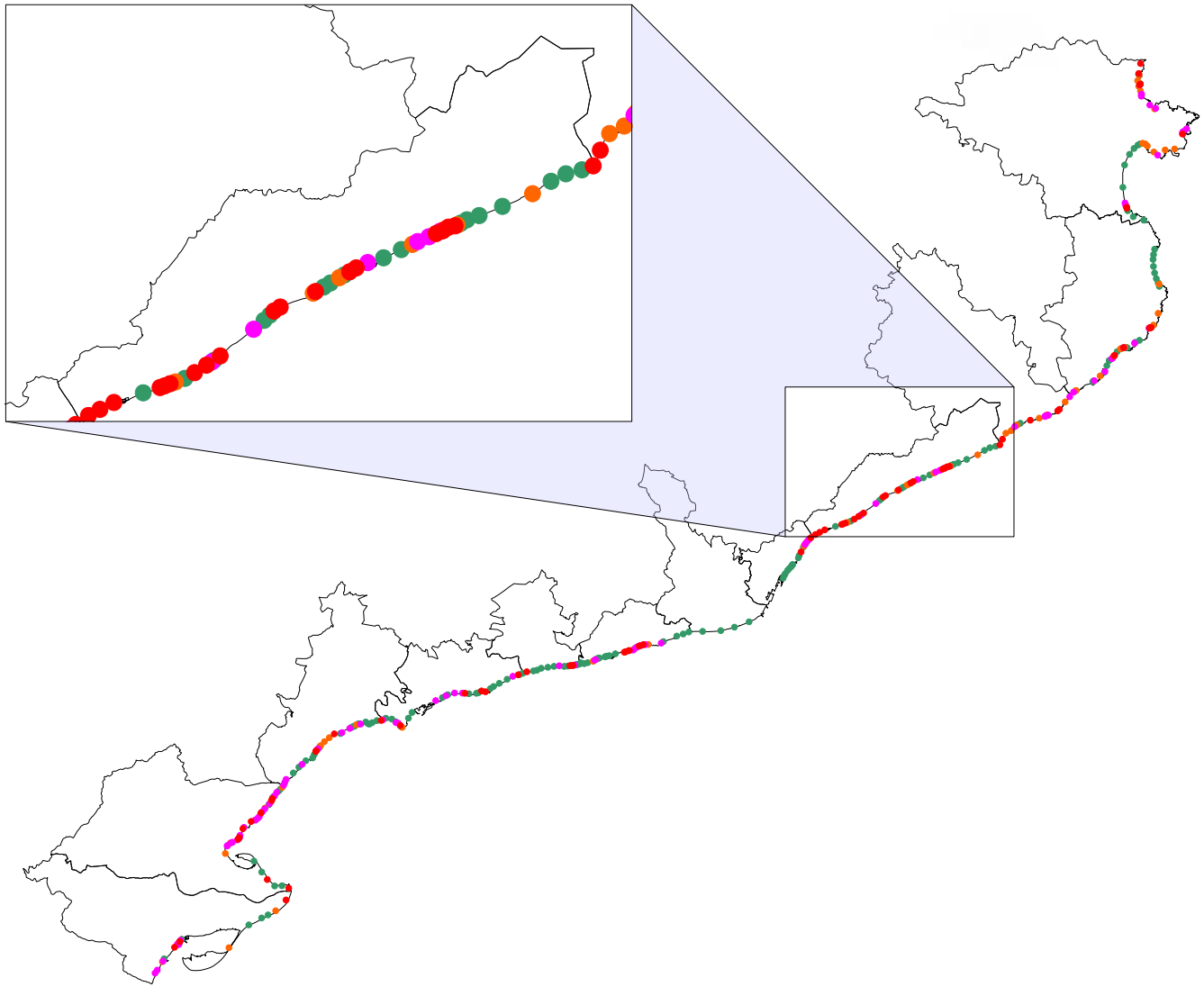
- In the presence of "urgent" unresolved problems are we able to **mimic / predict (including illegal) decisions / actions** on the coast?


Which is the current scenario?
frequent problems with social, economic and/or natural consequences
Another possible (climate) scenario?
probable intensification of problems

Current beaches – recreational function (2010)



Current beaches – recreational function (2020)



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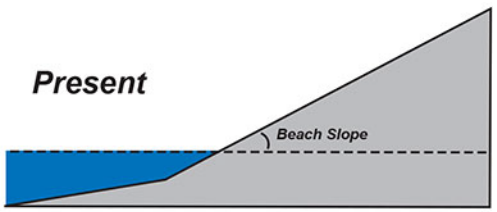
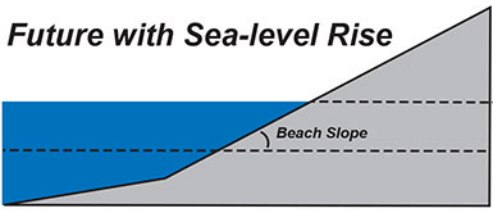
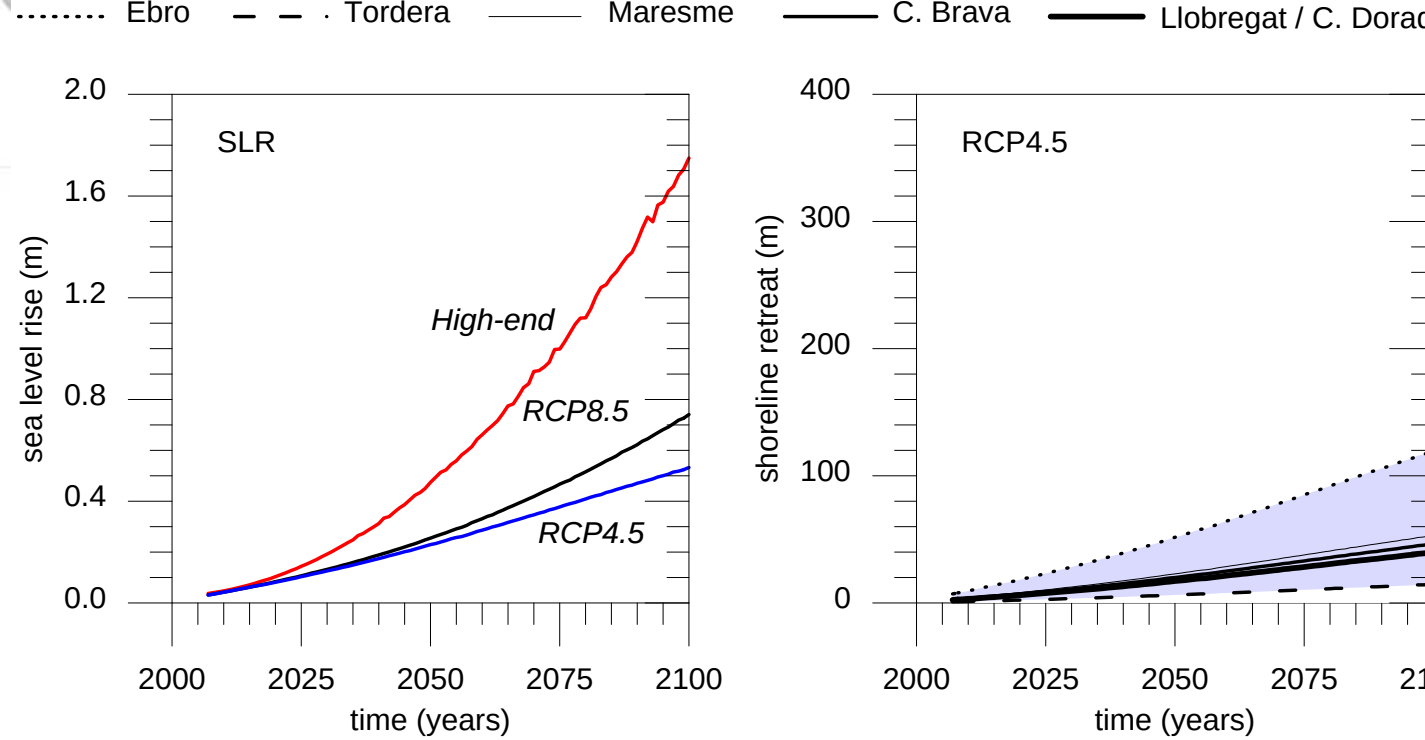
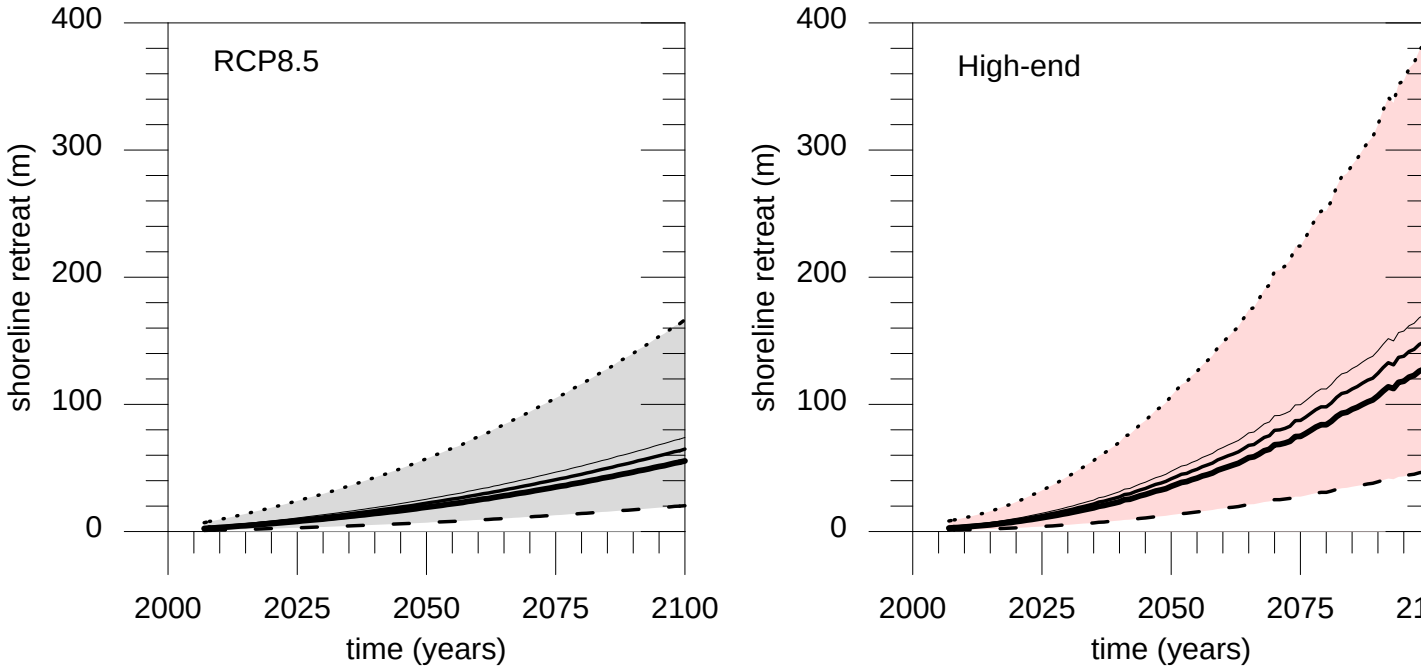
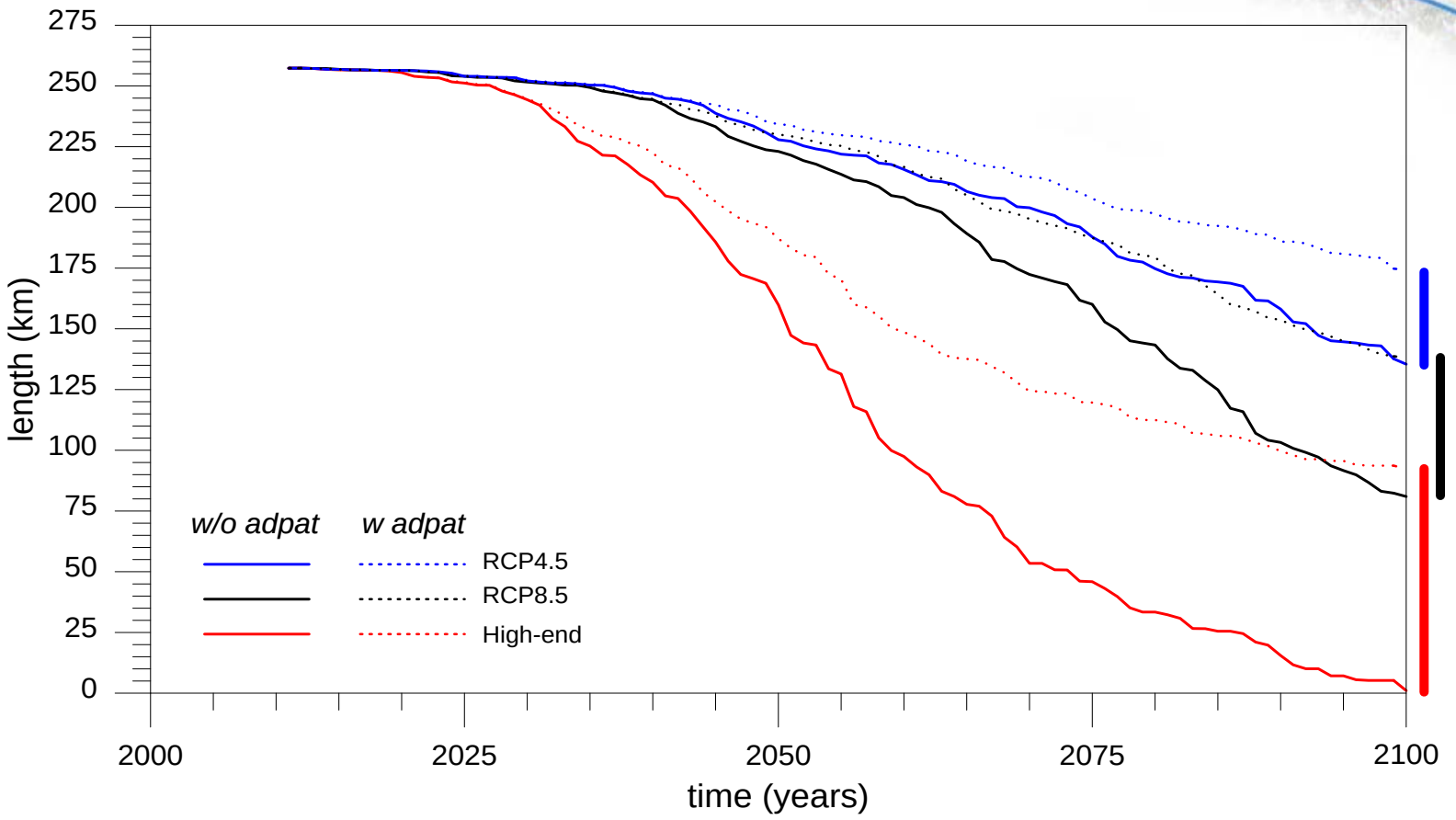




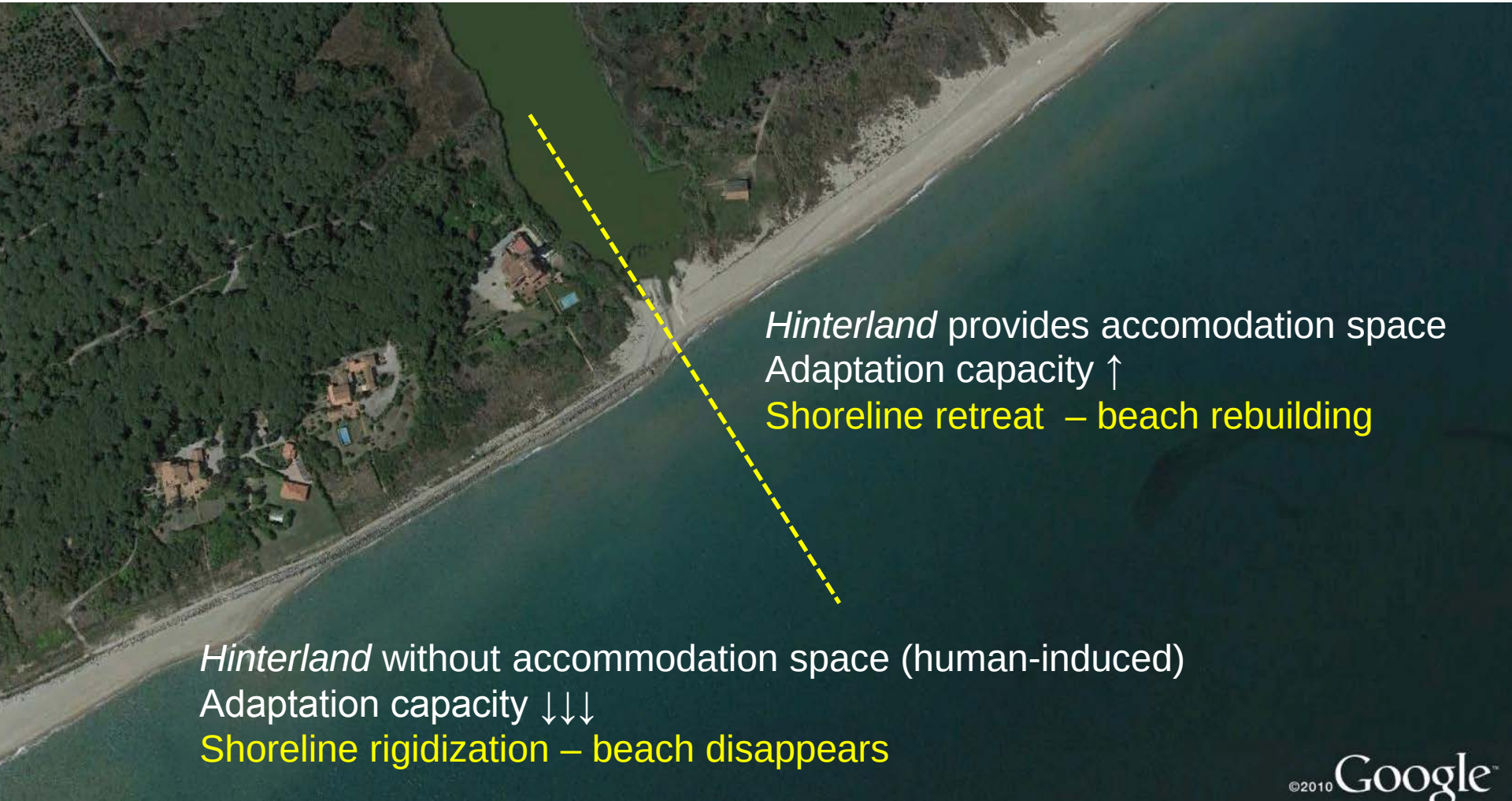


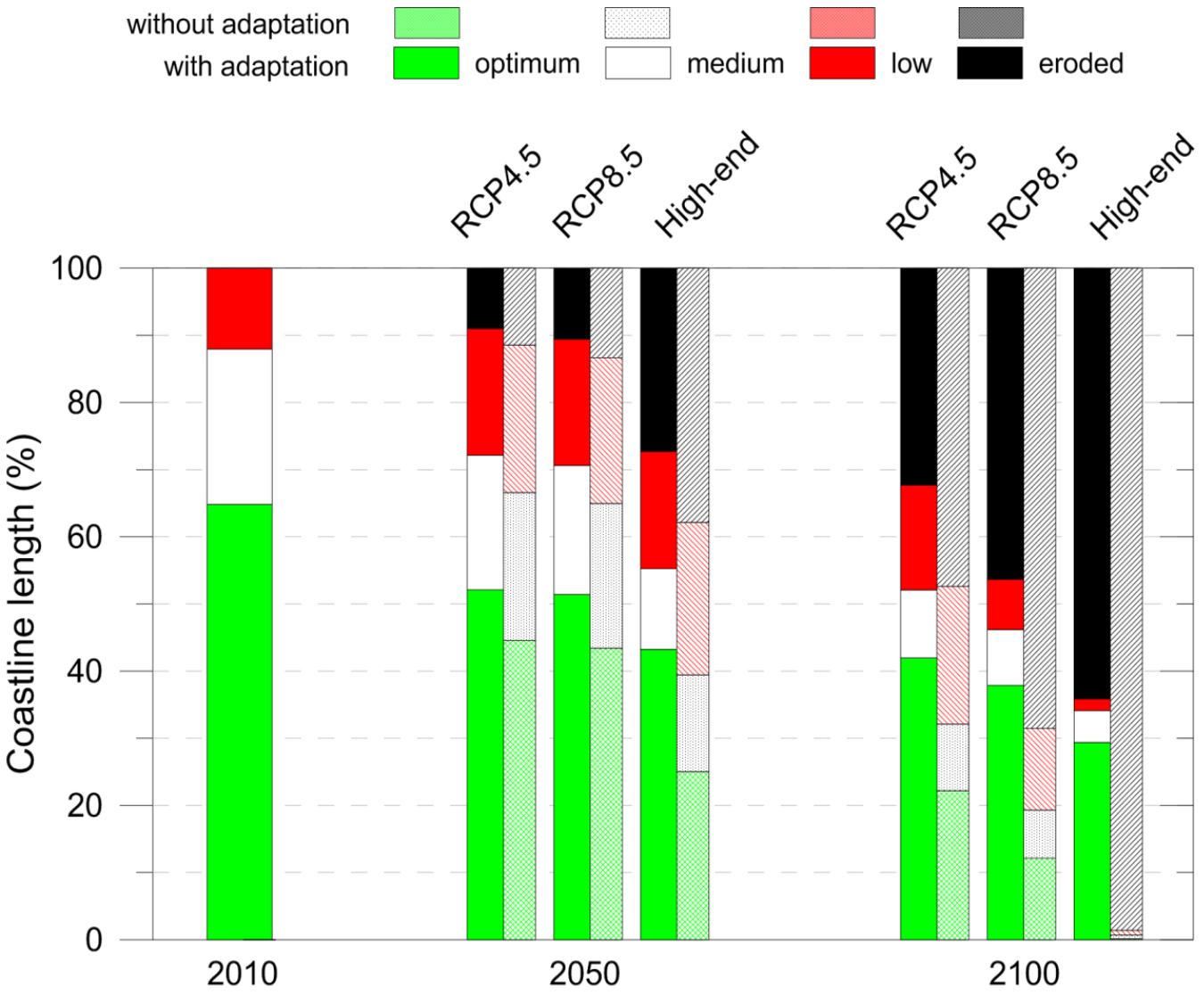




Total length of existing beaches along the Catalan coast under each **SLR scenarios** including and excluding the effects of the availability of accommodation space.

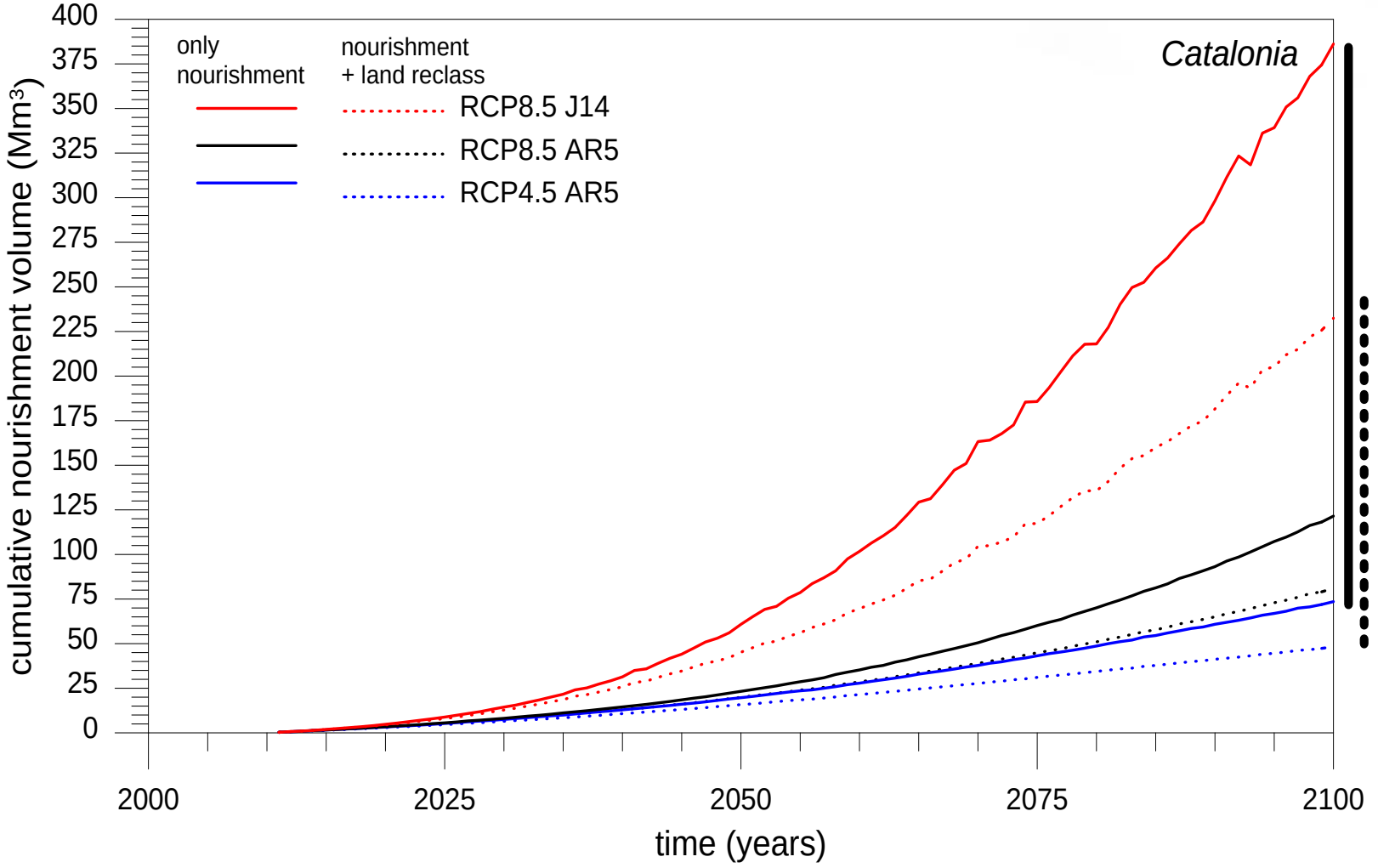
Accommodation space & coastal adaptation

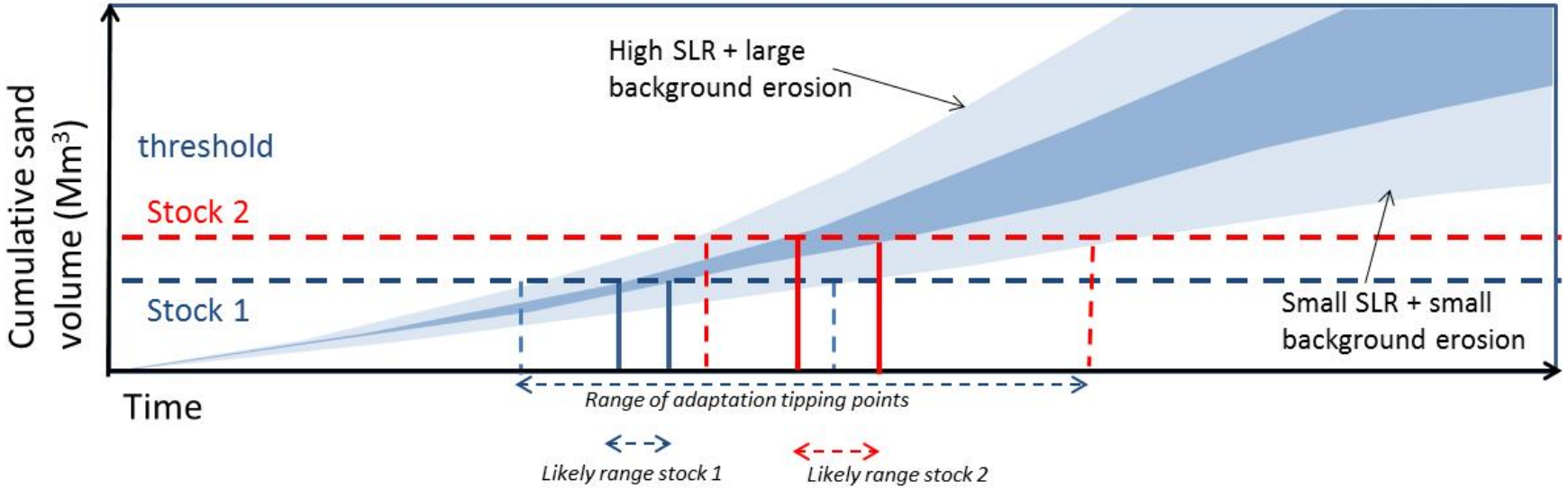




Extension of beaches along the Catalan coast classified in terms of their configuration to support **recreational** use under each SLR scenario (eroded: % of beaches fully eroded).

- Are we **properly using** existing resources?
- Are we able to **maintain** the current use of existing resources?
- Shall we have resources **enough**?


Catalonia
only nourishment
nourishment + land reclass
RCP8.5 J14
RCP8.5 AR5
RCP4.5 AR5
cumulative nourishment volume (Mm³)
400
375
350
325
300
275
250
225
200
175
150
125
100
75
50
25
0
2000
2025
2050
2075
2100
time (years)



Range of tipping points for adaptation options based on the use of **beach nourishment** as a function of the existing **sediment stock** (threshold) and range of **expected nourishment volume** (function of SLR scenarios and additional background erosion).

Future measures

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

Summary

significantly

- **Natural sediment sources** are not longer contributing to coastal sediment budget (human induced) → Substituted by **artificial nourishment (> 25 Mm^3 since 80's)**.

- **Need** to properly predict decadal-scale variations in sediment supplies (natural and man-made) to the coastal system **(too late?).**

- There is a need to identify/quantify a **strategic sediment reservoir** if current beach use wants to be maintained by beach nourishment. **(not sure to have enough)**.

- Current protection/adaptation practices need to **be re-evaluated** for future climate scenarios.

- A **long-term perspective** need to be adopted for sustainable beach management

Acknowledgements

Comune di Forte dei Marmi

Funded by

GOBIERNO DE ESPAÑA · MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD

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RISC-KIT (603458) & **RISES-AM** (603396)