



Innovative technologies for safer
European coasts in a changing climate

INNOVATIVE TECHNOLOGIES FOR SAFER EUROPEAN COASTS IN A CHANGING CLIMATE

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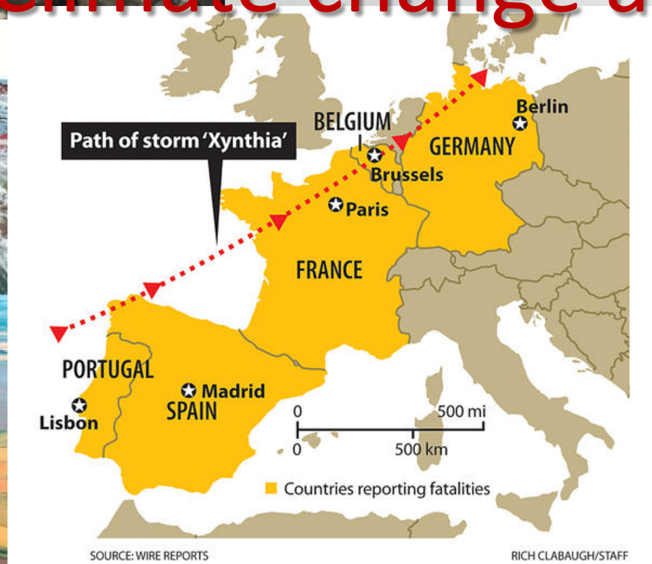
Climate change and storminess



Xynthia, May 5th 2010

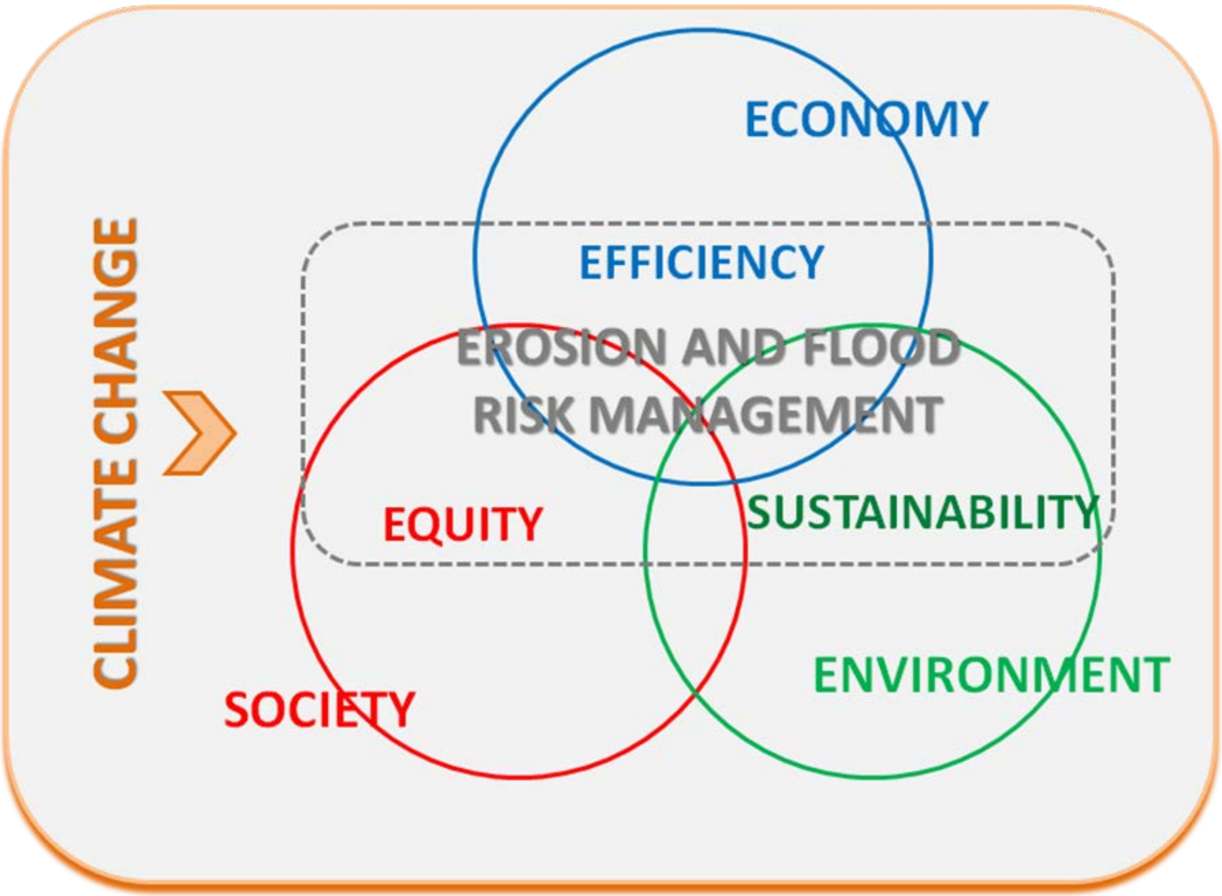
Traditional coastal defences

THESEUS at a glance

- Title: Innovative coastal technologies for safer European coasts in a changing climate
- Instrument: Large Integrated Project - FP7
- Total Cost: 8.519.726 €, EC Contribution: 6.530.000 €
- Duration: 48 months, Start Date: 01/12/2009
- Consortium: 31 partners from 18 countries
- Project Coordinator: Barbara Zanuttigh, Alma Mater Studiorum Università di Bologna (Italy)
- Project Web Site: http://www.theseusproject.eu
- Key Words: coast, flood, erosion, risk, technology, mitigation, adaptation, climate change

Theseus and the Minotaur

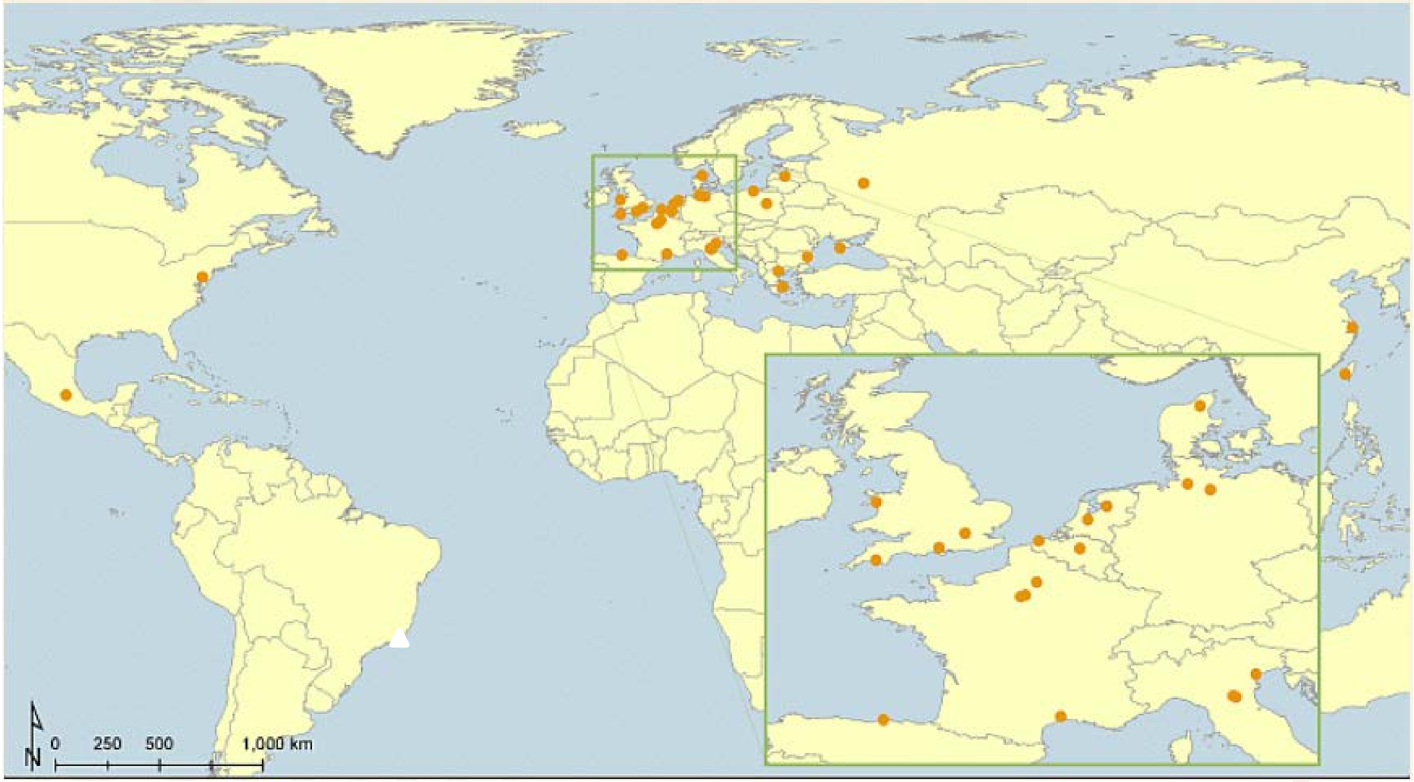
The labyrinth



THESEUS Aim

- deliver a safe (or low-risk) coast for human use/development and healthy coastal habitats as sea levels rise and climate changes and the European economy continues to grow.

THESEUS team members (31 partners)



THESEUS team members (31 partners)

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Universidad de Cantabria	UC	ES	Inigo J. Losada
University of Plymouth	UOP	UK	Richard C.Thompson
Aalborg Universitet	AAU	DK	Hans F. Burcharth
INFRAM International BV	INFRAM	NL	Gosse Jan Steendam
GKSS - Forschungszentrum Geesthacht GKSS	GMBH	DE	Jens Kappenberg
University of Southampton	SOTON	UK	Robert J. Nicholls
Université de Versailles St-Quentin-en-Yvelines	UVSQ	FR	Jean Paul Vanderlinden
Centre d'Etudes Techniques Maritimes Et Fluviale	CETMEF	FR	Philippe Sergent
Middlesex University Higher Education Corporation	MU	UK	Loraine McFadden
Instytut Meteorologii I Gospodarki Wodnej	IMGW	PL	Marzenna Sztobryn
Institute of Oceanology - Bulgarian Academy Of Sciences	IO-BAS	BG	Stoyan Keremedchiev
Athens University of Economics and Business – Research Center	AUEB-RC	GR	Phoebe Koundouri
Koninklijke Nederlandse Akademie Van Wetenschappen	KNAW	NL	Tjeerd Bouma
Consorzio per la gestione del centro di coordinamento delle attivita di ricercainerenti il sistema lagunare di Venezia	CORILA	IT	Pier Paolo Campostrini

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Bureau de Recherches Géologiques et Minières	BRGM	FR	Carlos Oliveros
Hamburg Port Authority	HPA	DE	Nino Ohle
EID- Mediterranée	EID	FR	Stéphanie Grosset
Latvijas Universitate	UL	LV	Raimonds Ernsteins
Istituto Superiore per la Ricerca e la Protezione Ambientale	ISPRA	IT	Andrea Taramelli
Vlaams Instituut Voor De Zee Vzw	VLIZ	BE	Simon Claus
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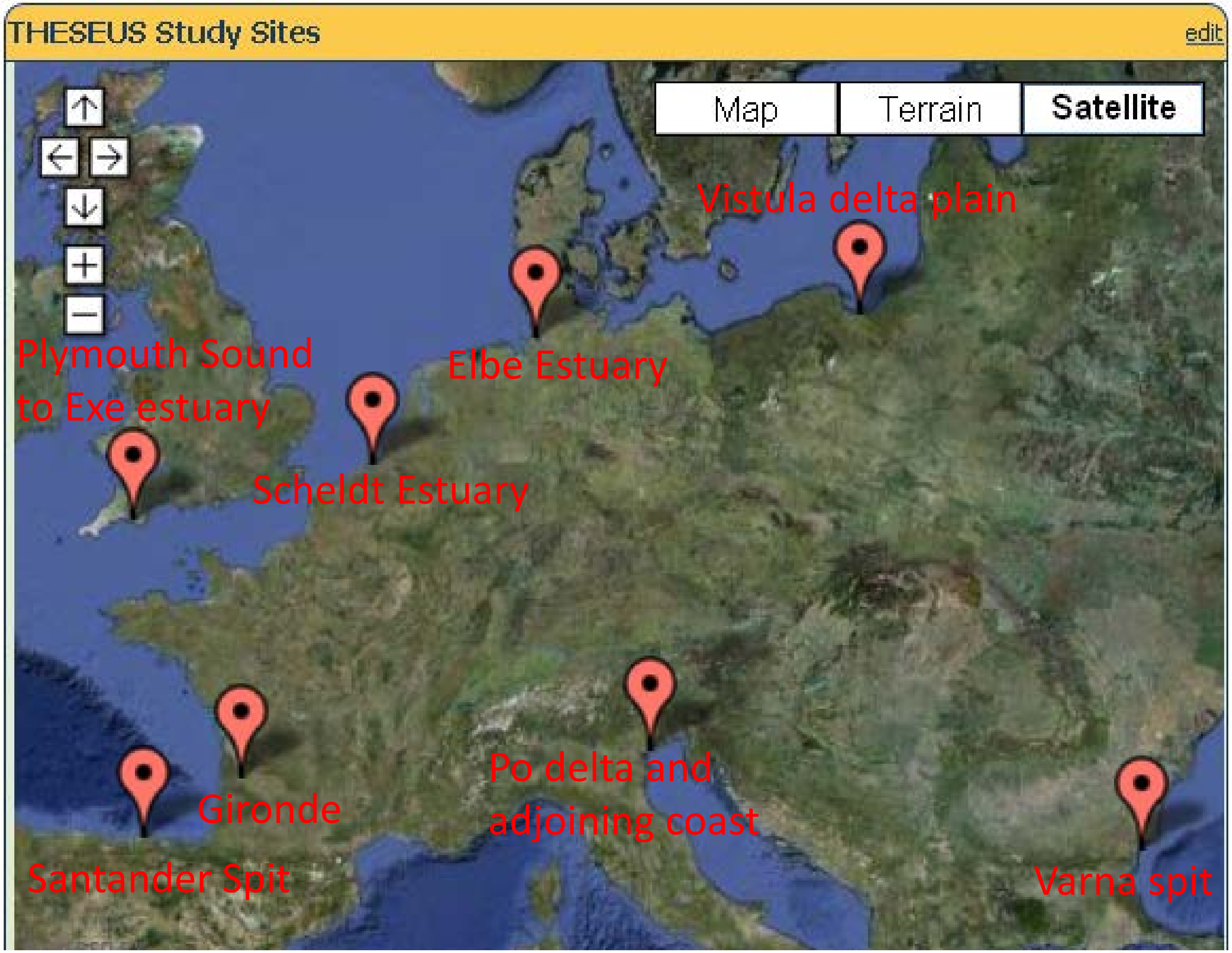
Universidad Nacional Autonoma De Mexico	UNAM	ME	Rodolfo Silva
East China Normal University	ECNU SKLEC	CH	Pingxing Ding
National Cheng Kung University	NCKU	TA	Kao Chia Chuen

THESEUS in pratice

- Risk assessment, policy management and planning strategies
- in cooperation with stakeholders and authorities through applications in 8 sites
- Low, medium, long term scenarios: 2020s, 2050s, 2080s

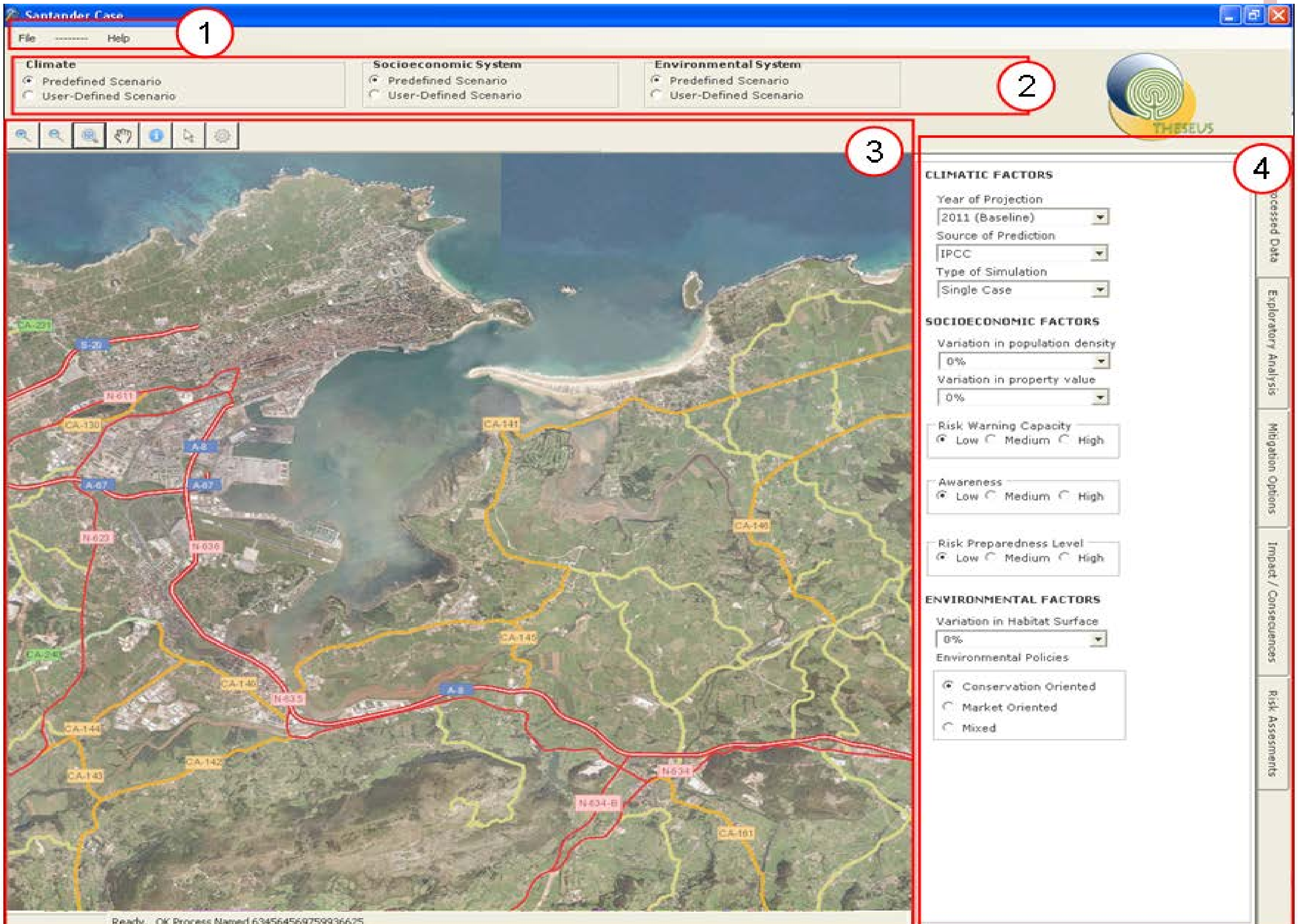
THESEUS study sites



Integrating science into practice

- Development of a fully participatory approach to coastal defence planning and design.
- Questionnaire and interviews during the first project year to gather data for a systems analysis in the 8 study sites.
- The goal was to obtain sufficient information to assess per study site the coastal system (including its flood defence systems) and its resilience on the short, medium and long term.

Set-up of a DSS: ongoing, major DL

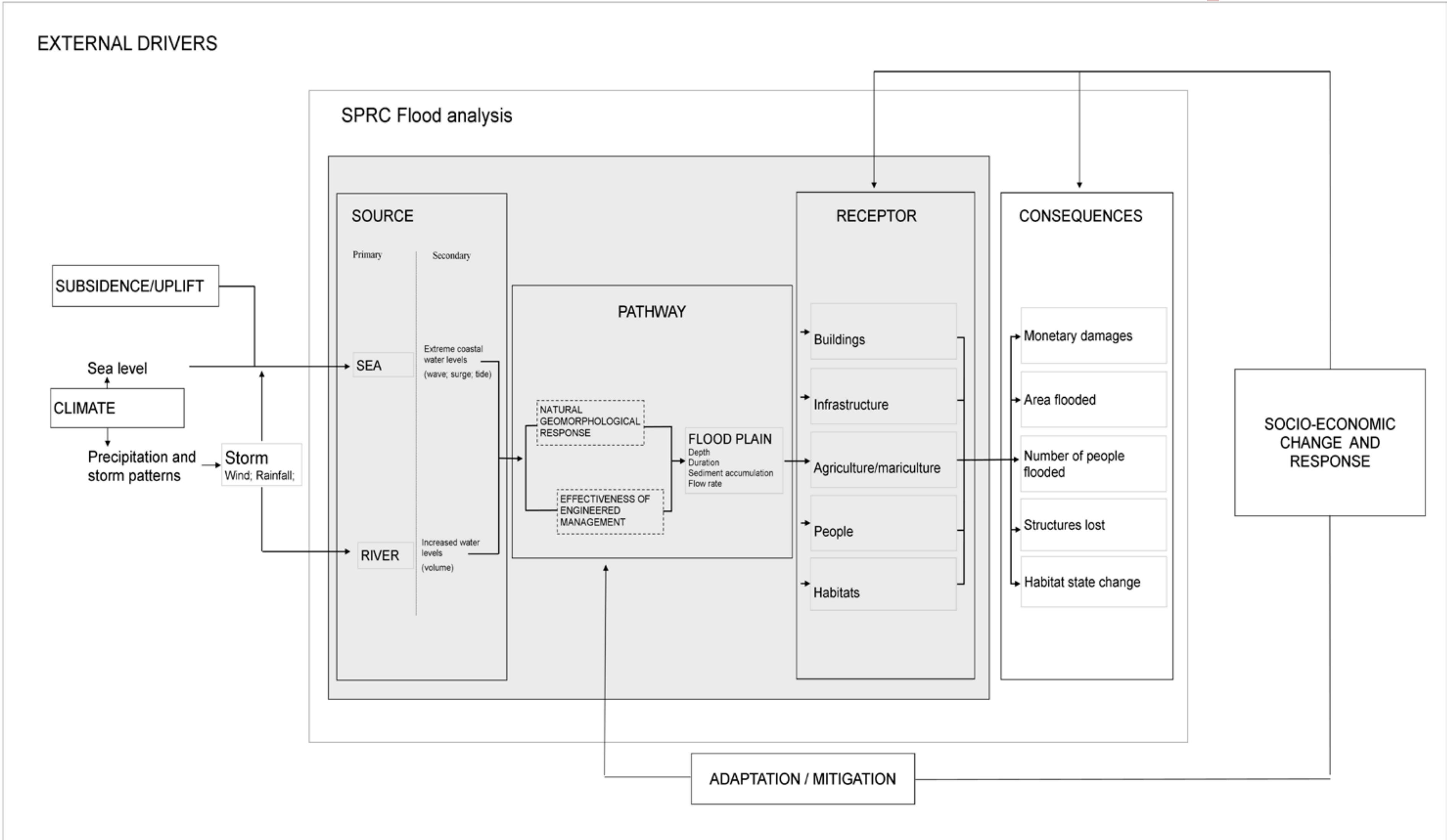


Focus on the IT sites

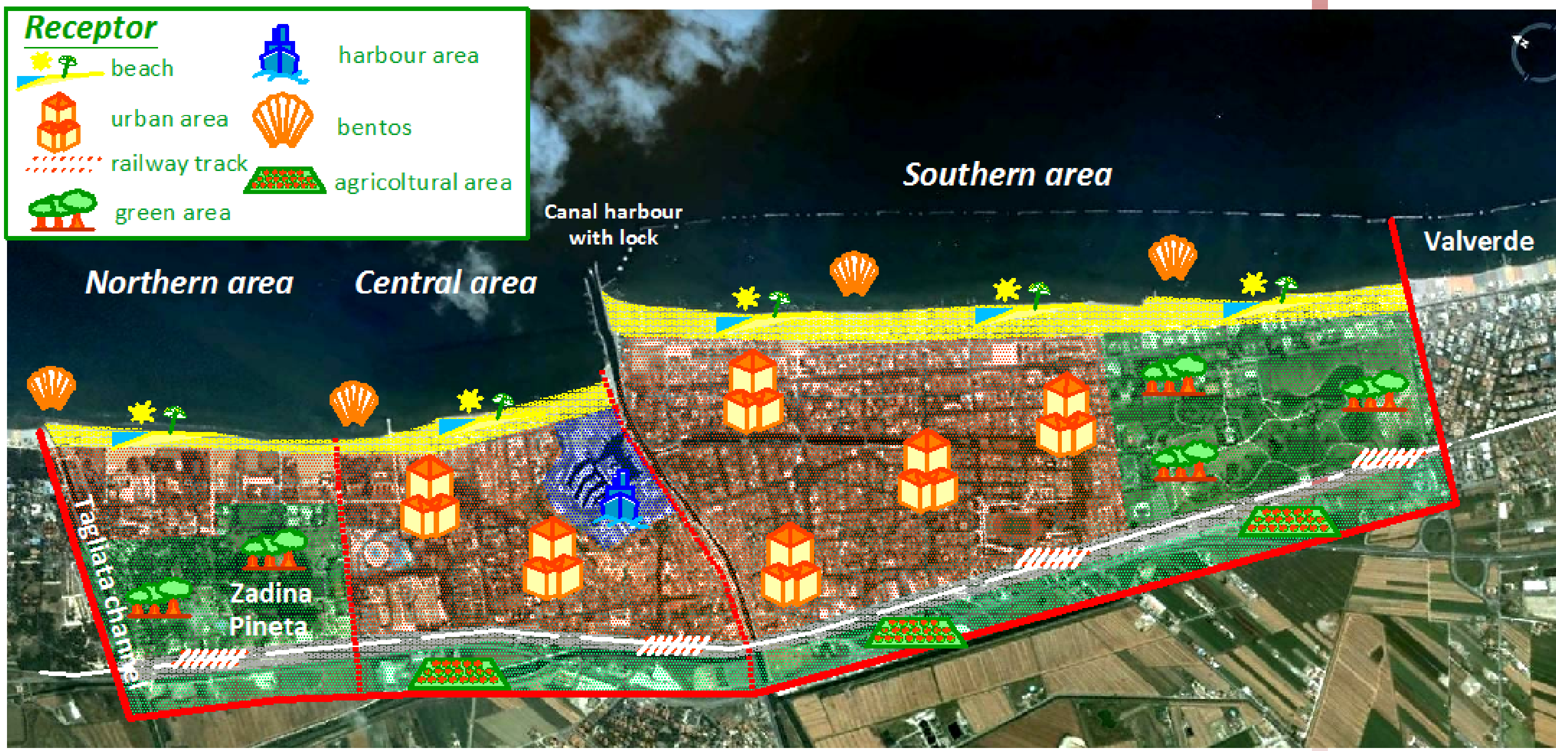




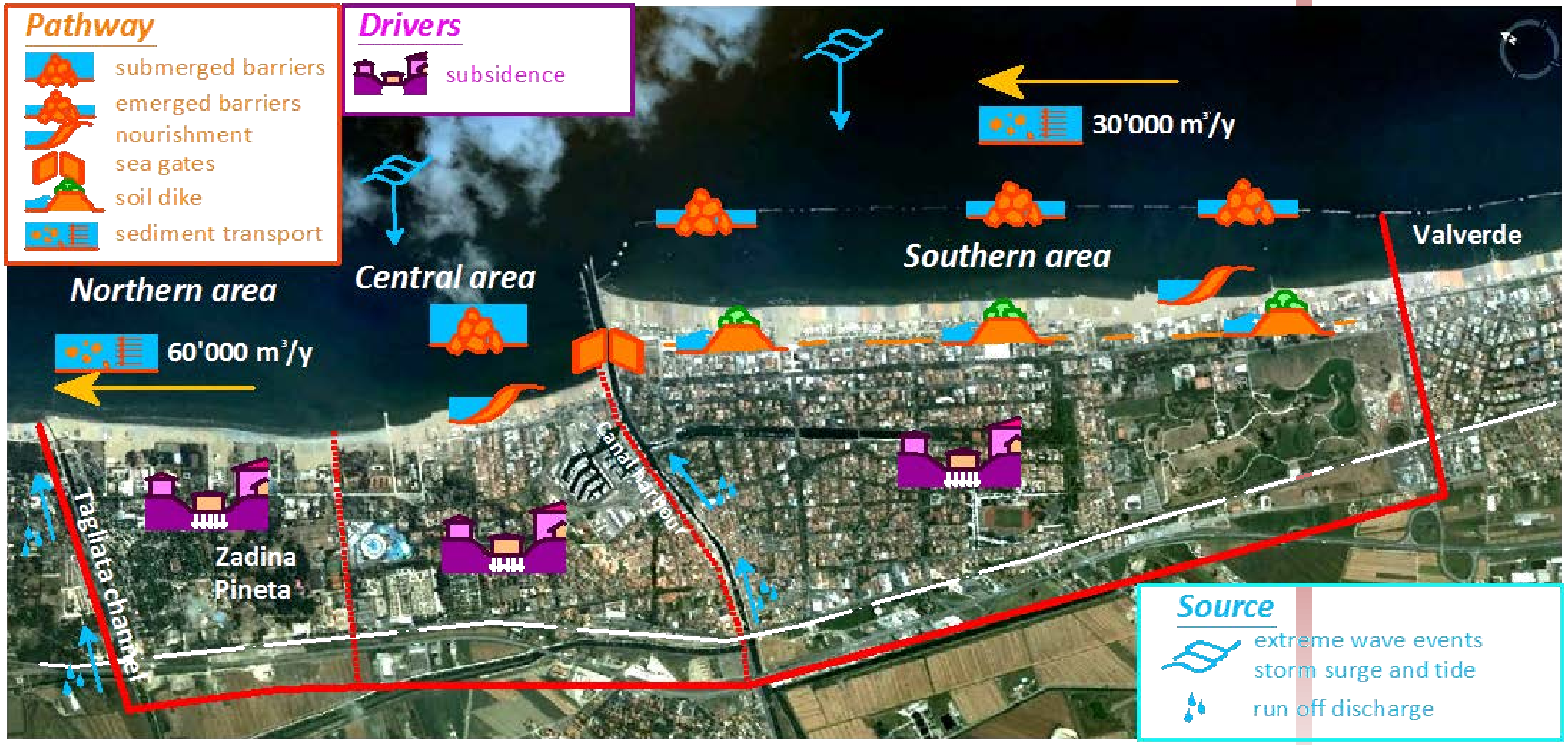
The SPRC method



Receptors


Receptor
beach
urban area
railway track
green area
harbour area
bentos
agricoltural area
Southern area
Canal harbour
with lock
Valverde
Northern area
Central area
Tagliata channel
Zadina
Pineta

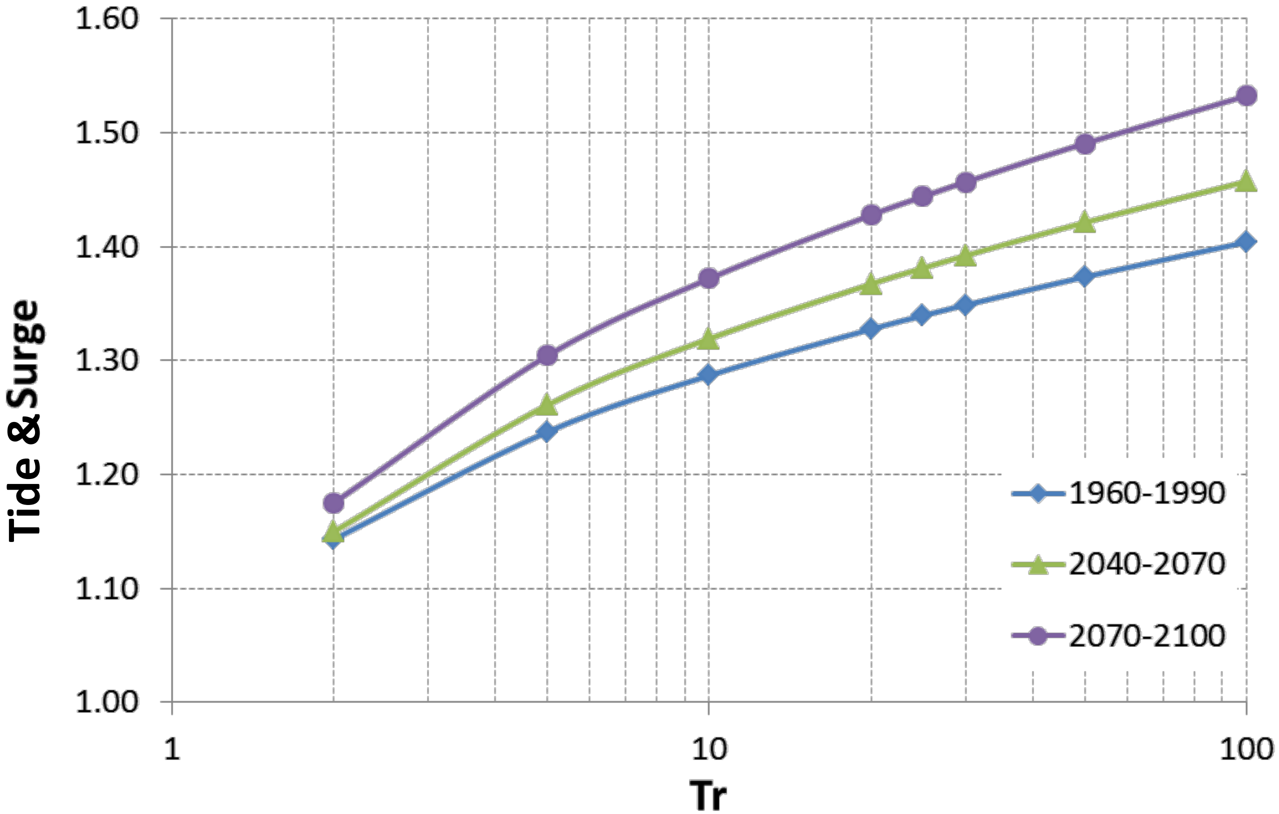
Sources, Drivers and «Pathways»



WT 1.1

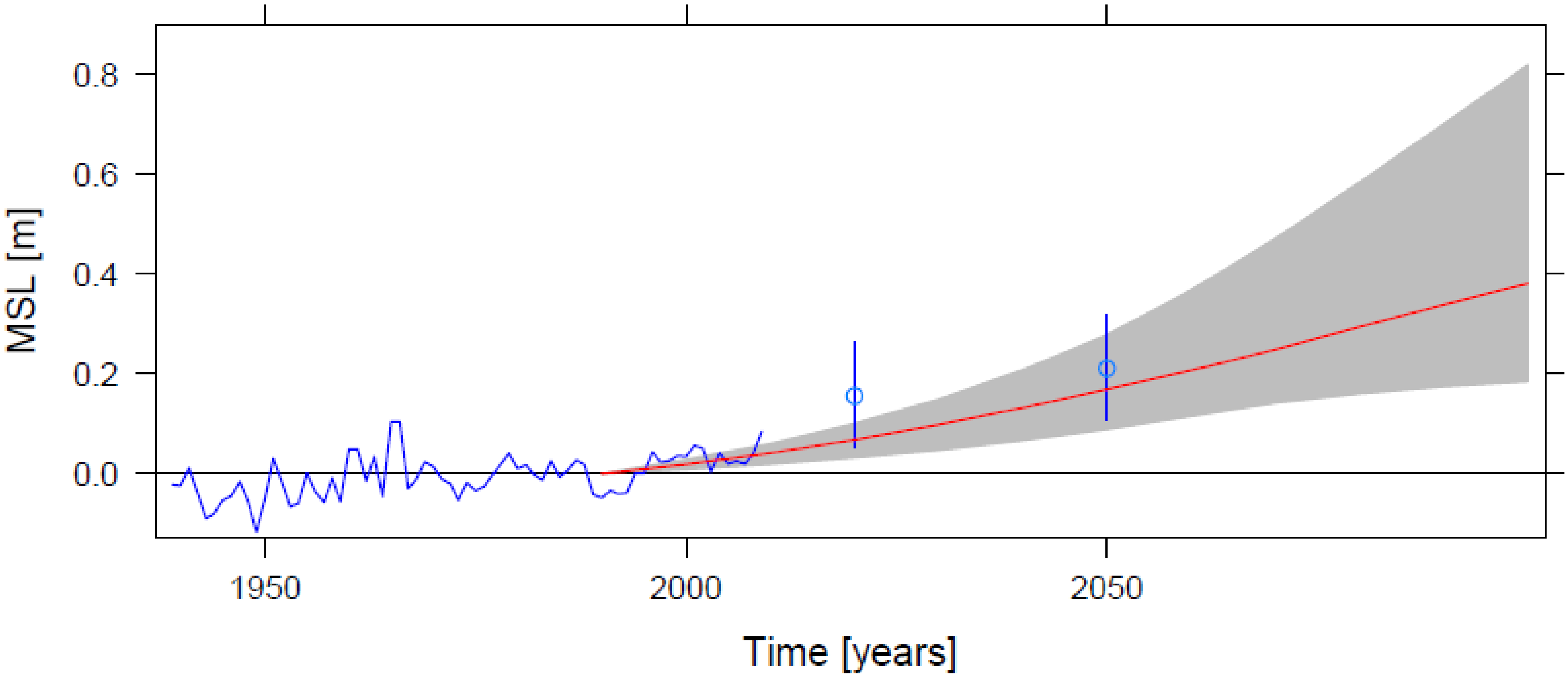
Sources: storm surge, waves

- Flooding scenarios

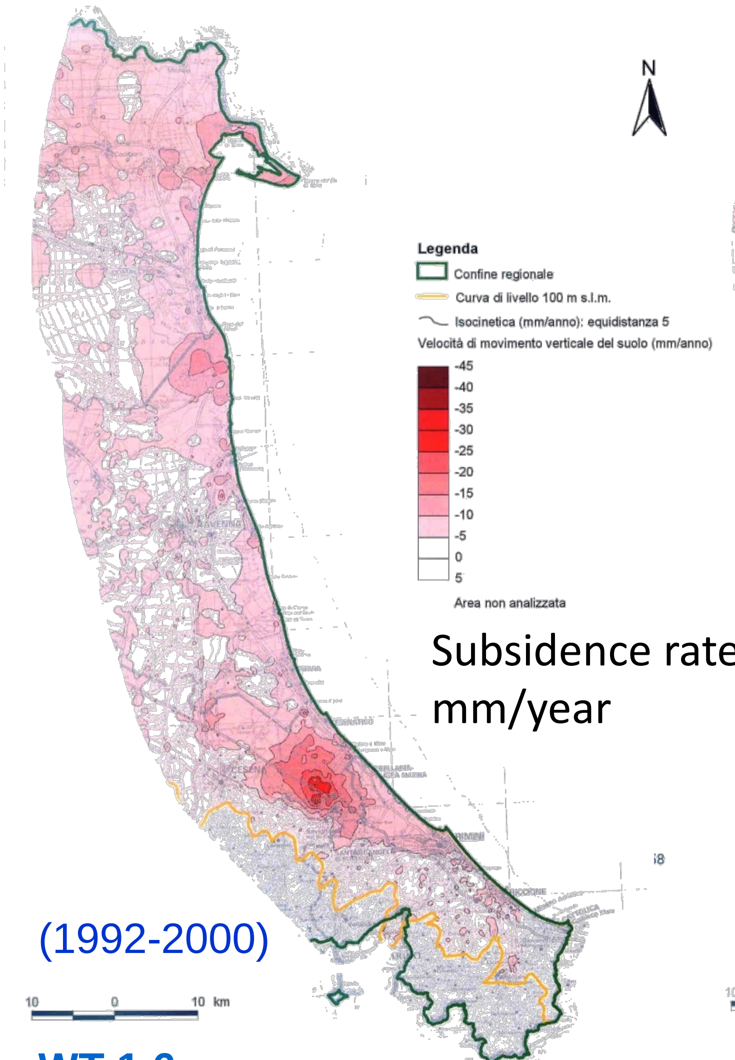


WT 1.2, WT 1.4

Climate change and MSL

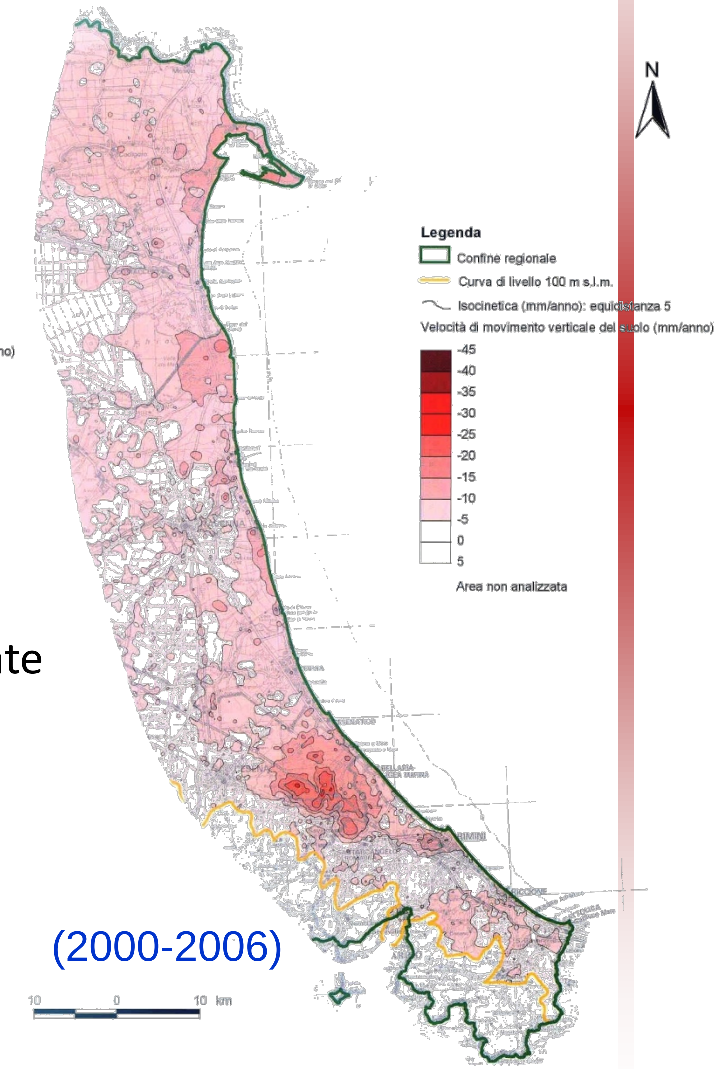


Drivers - Subsidence



Subsidence rate mm/year

(1992-2000)



(2000-2006)

WT 1.6

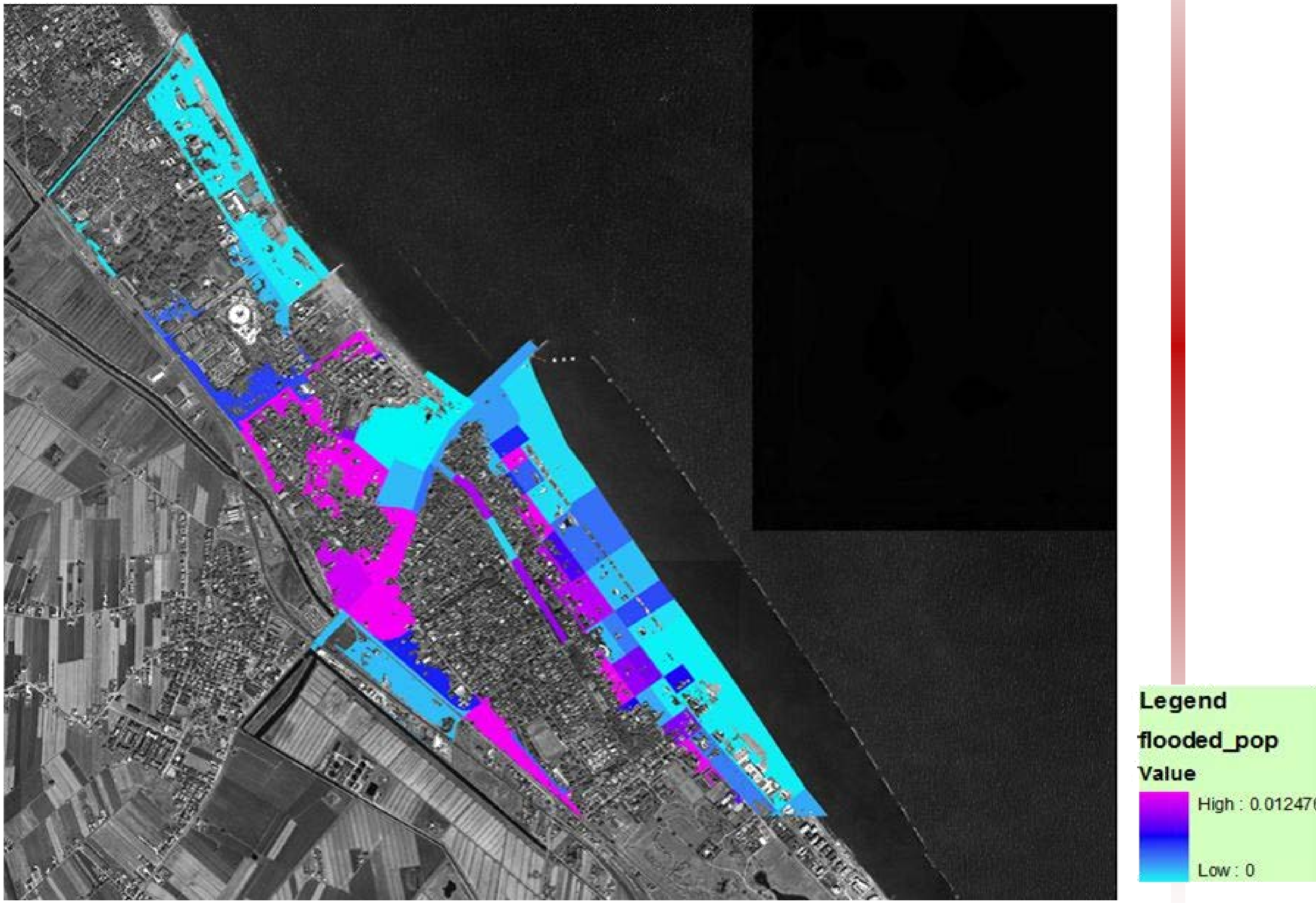
Flooding: simplified GIS based model

Hydraulic vulnerability and flooding depth

WT 1.4

Tr=100 years

Social vulnerability: ‘flooded’ people



WT 1.7

Tr=100 years

Distribution of economic damages

WT 1.7

Tr=100 years

Environment vulnerability assessment

Sampling, Historical data

Temperature
Wind
Currents
Granulometry
Sediment transport
……

Biological variables

FBEM learning algorithm

FBEM predictive algorithm

New sampling, Physical model, On line data

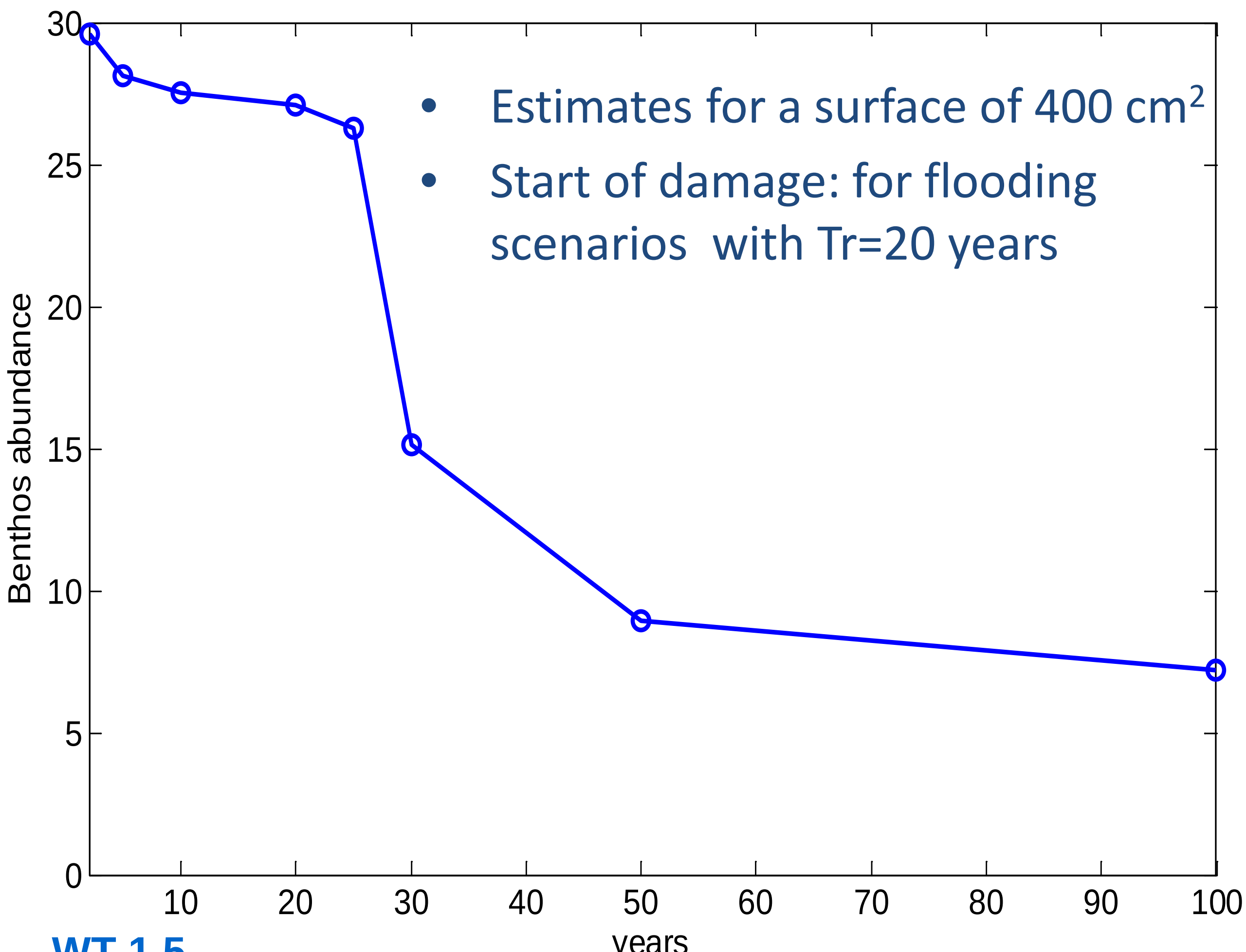
Δ Temperature
Δ wind
Δ currents
Δ granulometry
Δ sediment transport
……

Δ biological variables + biological autocorrelation

WT 1.5

Vulnerability of benthic communities

- Estimates for a surface of 400 cm^2
- Start of damage: for flooding scenarios with Tr=20 years



WT 1.5

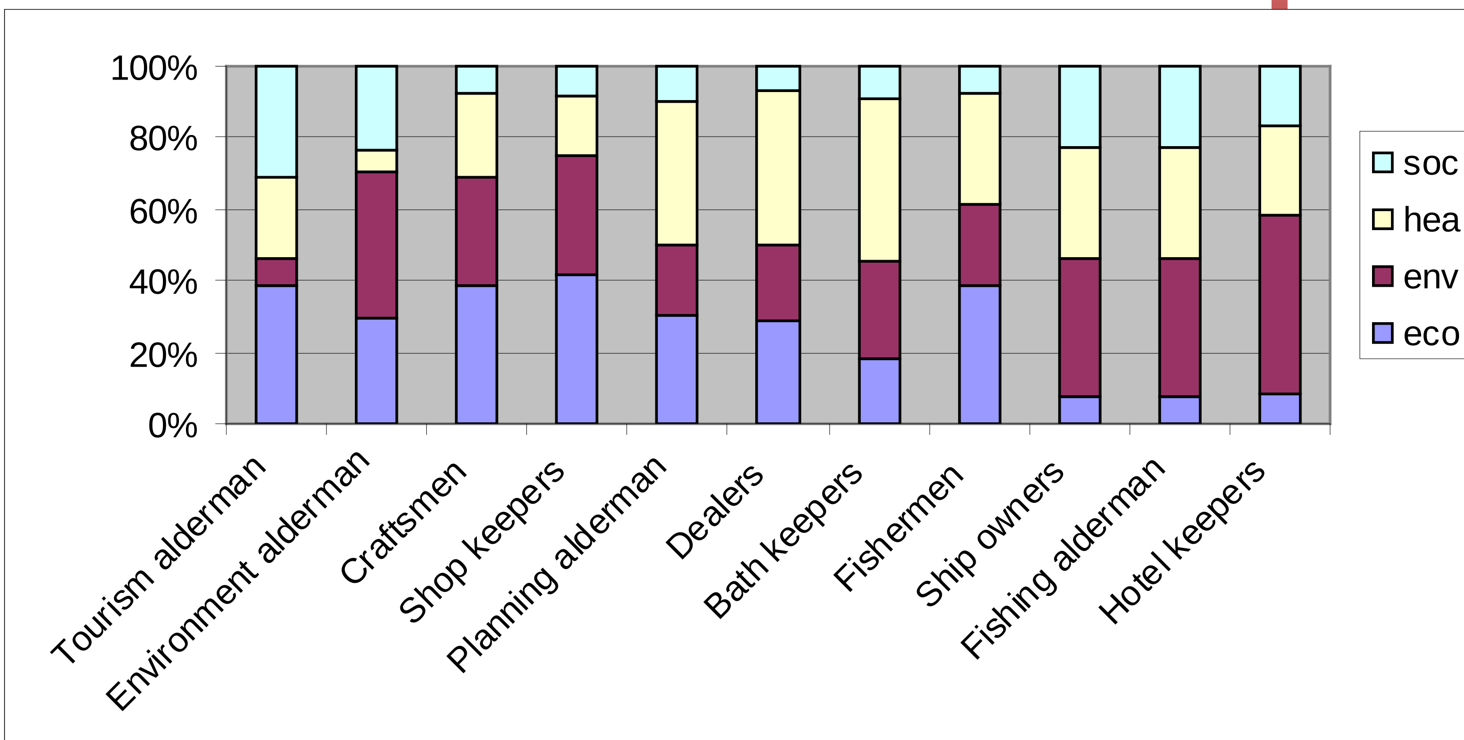
Stakeholder perception

- 11 face to face semi-structured interviews with stakeholders
- Participants: representative of commercial associations, primary, secondary and tertiary industry, representative of tourism industry, environmental planners
- Questions: identification of places, groups, assets at risk of erosion and flooding ; current and future options to manage risks
- Preliminary results

WT 1.7

Stakeholder perception of damages

- Priorities associated to social, health, environmental and economic damages



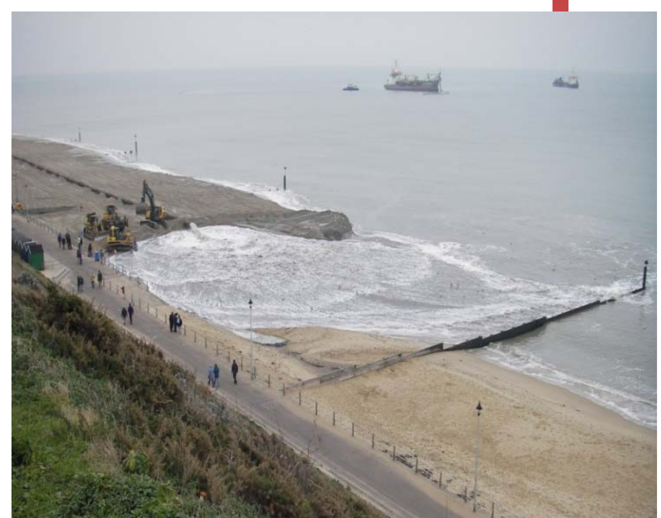
WT 1.7

Improved engineering solutions

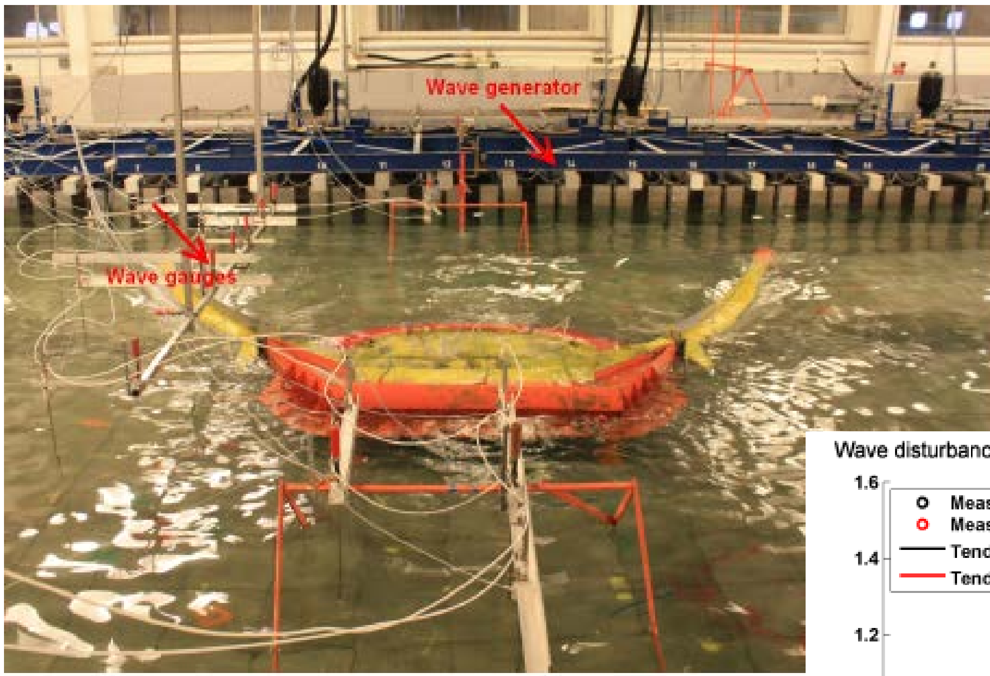


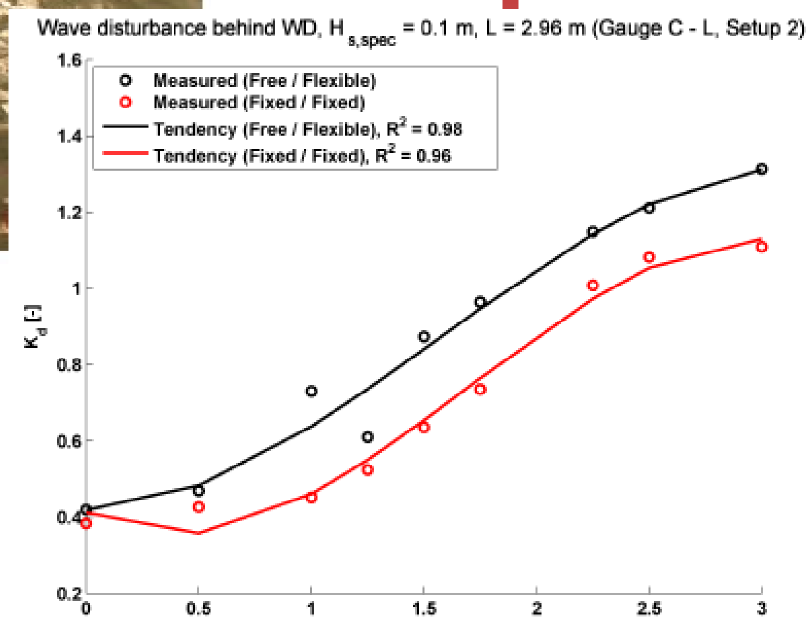




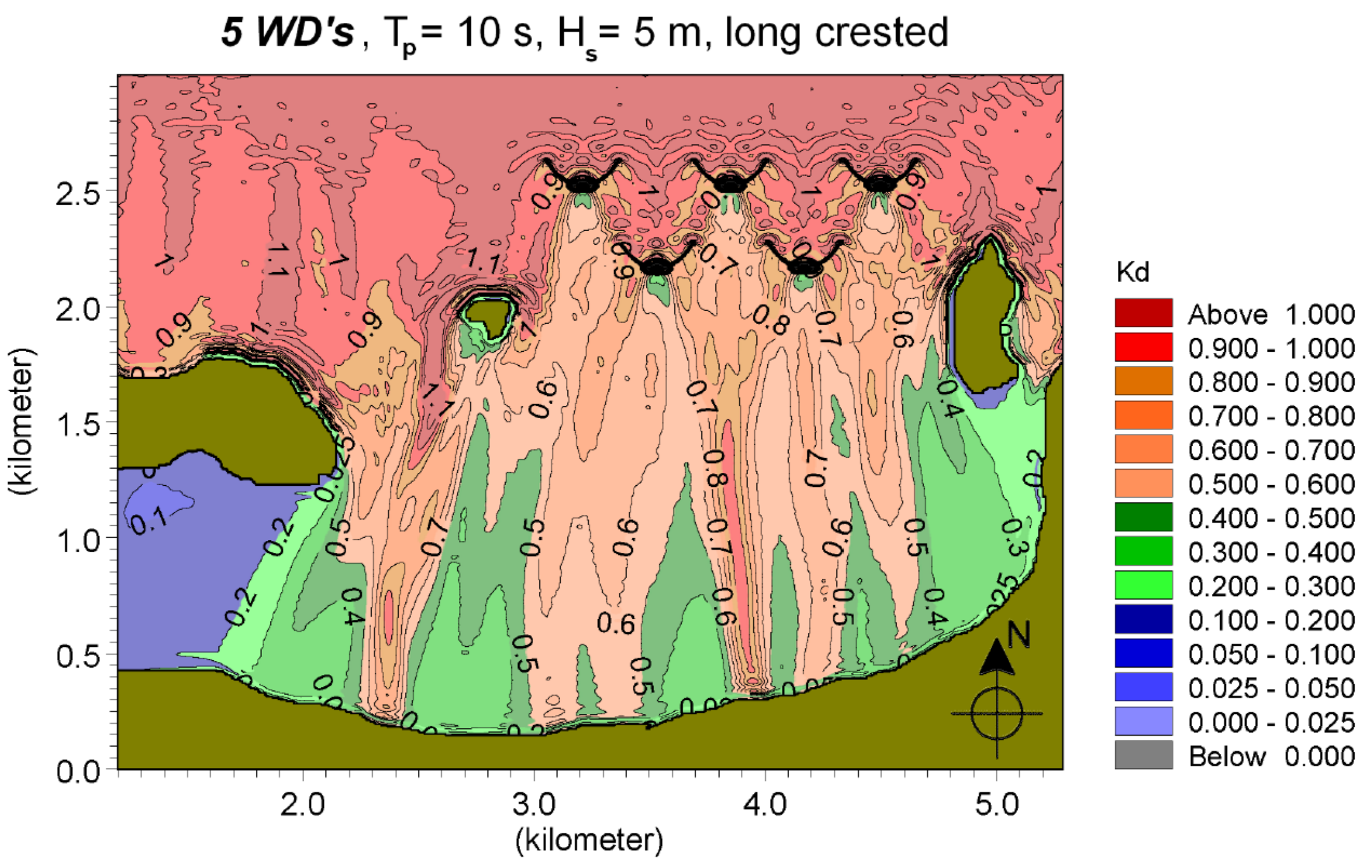



Wave energy conversion and coastal protection



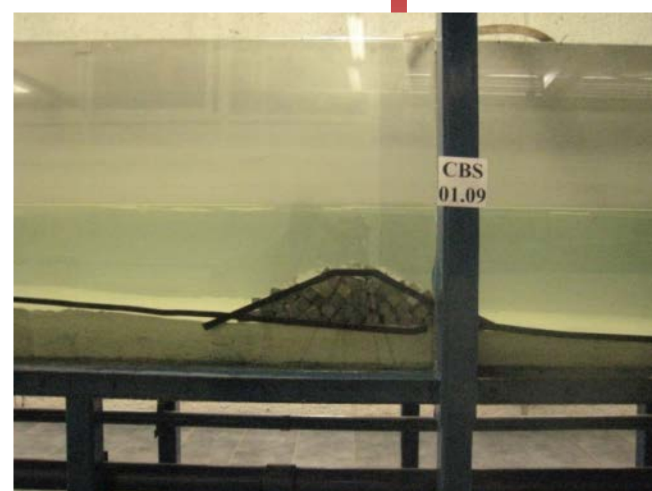


Wave energy conversion and coastal protection

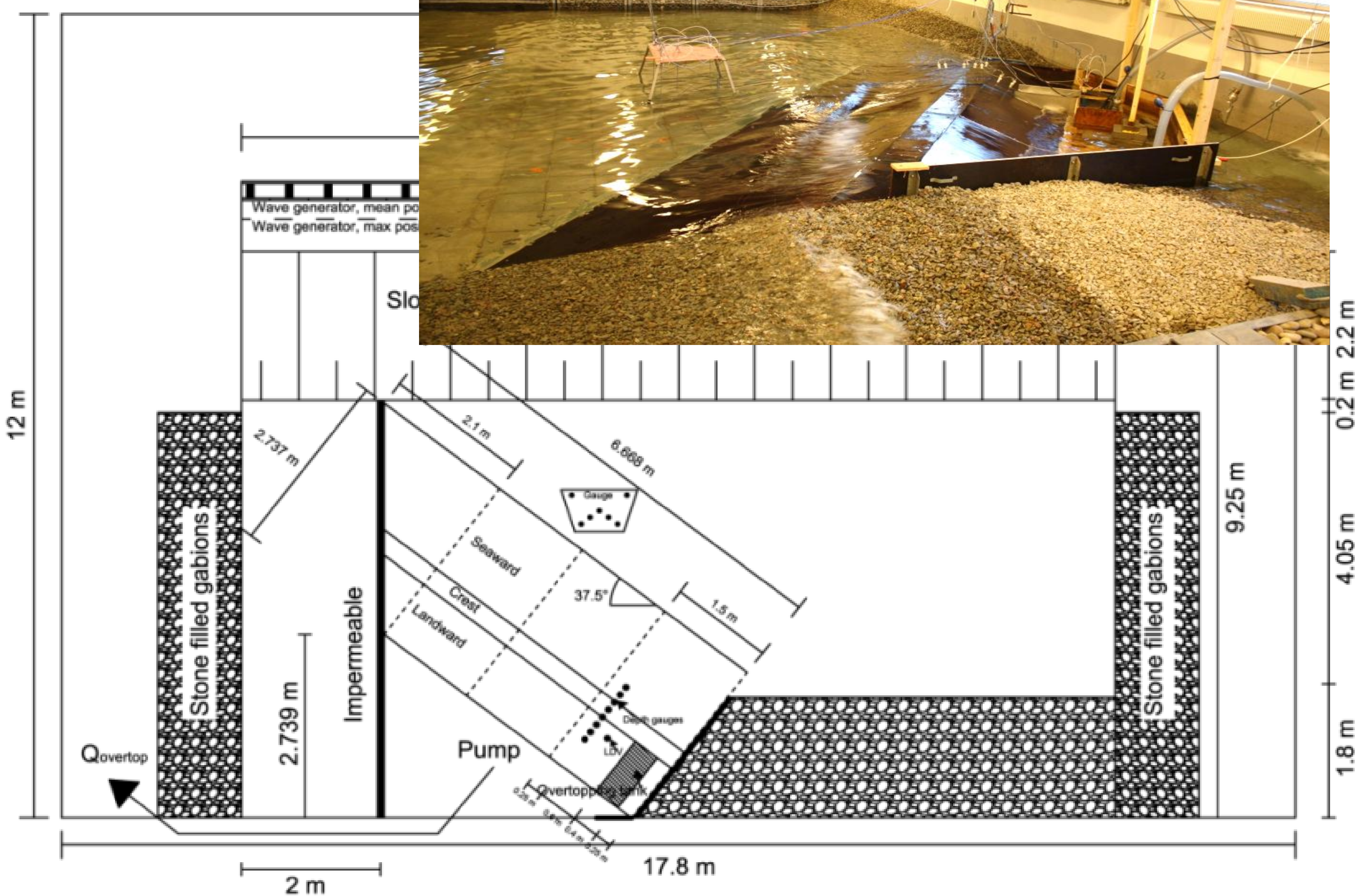


Farm of wave energy converters

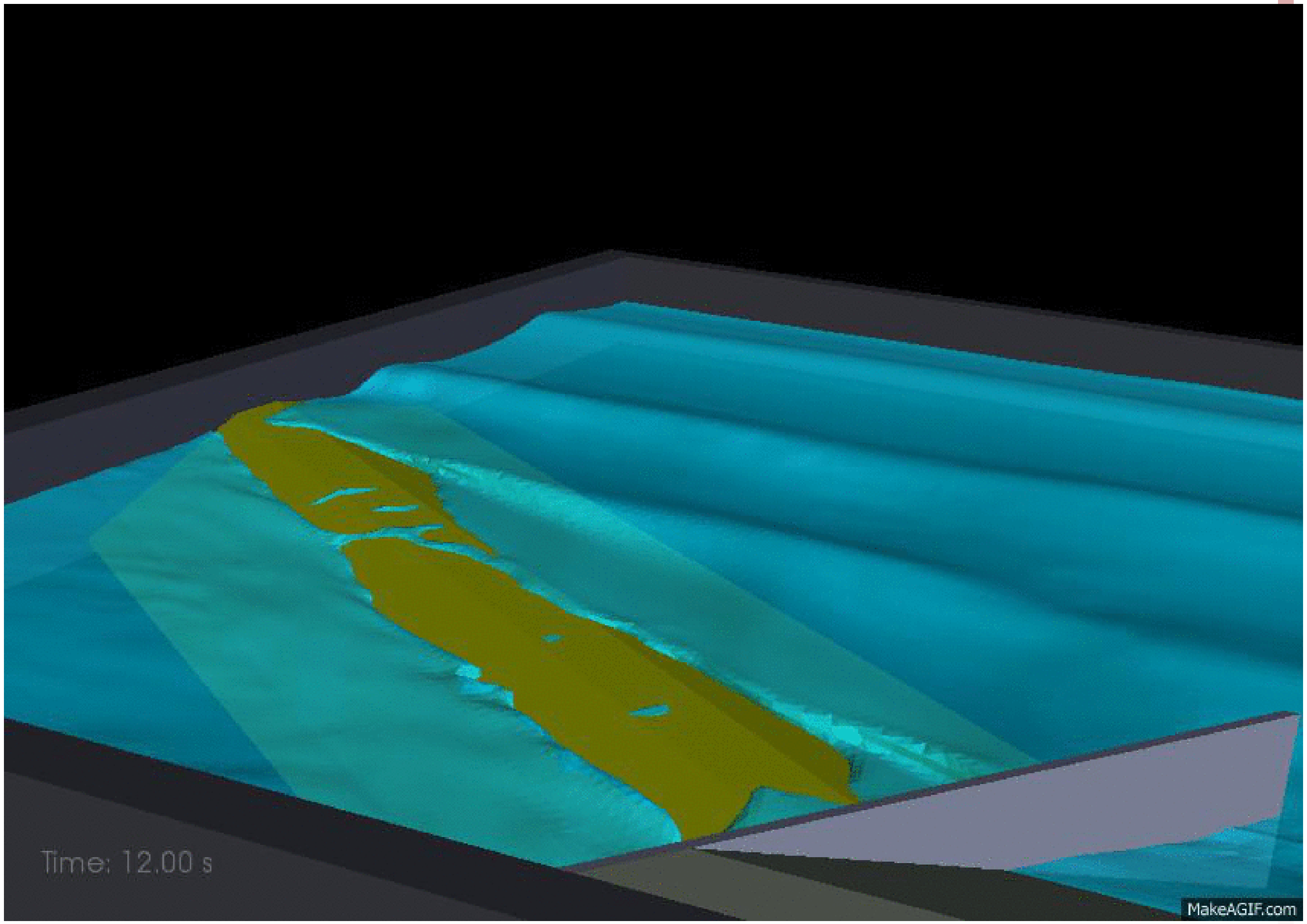
Submerged structures



Dykes


Wave generator, mean po
Wave generator, max pos
Slo
12 m
2.737 m
2.1 m
6.668 m
Gauge
Seaward
Crest
Landward
37.5°
1.5 m
Depth gauges
Overtopping tank
Stone filled gabions
Stone filled gabions
Impermeable
2.739 m
Pump
Q overtop
9.25 m
2.2 m
0.2 m
4.05 m
1.8 m
17.8 m
2 m

Overtopping and improved models



Floating structures

Efford Marsh – Managed realignment

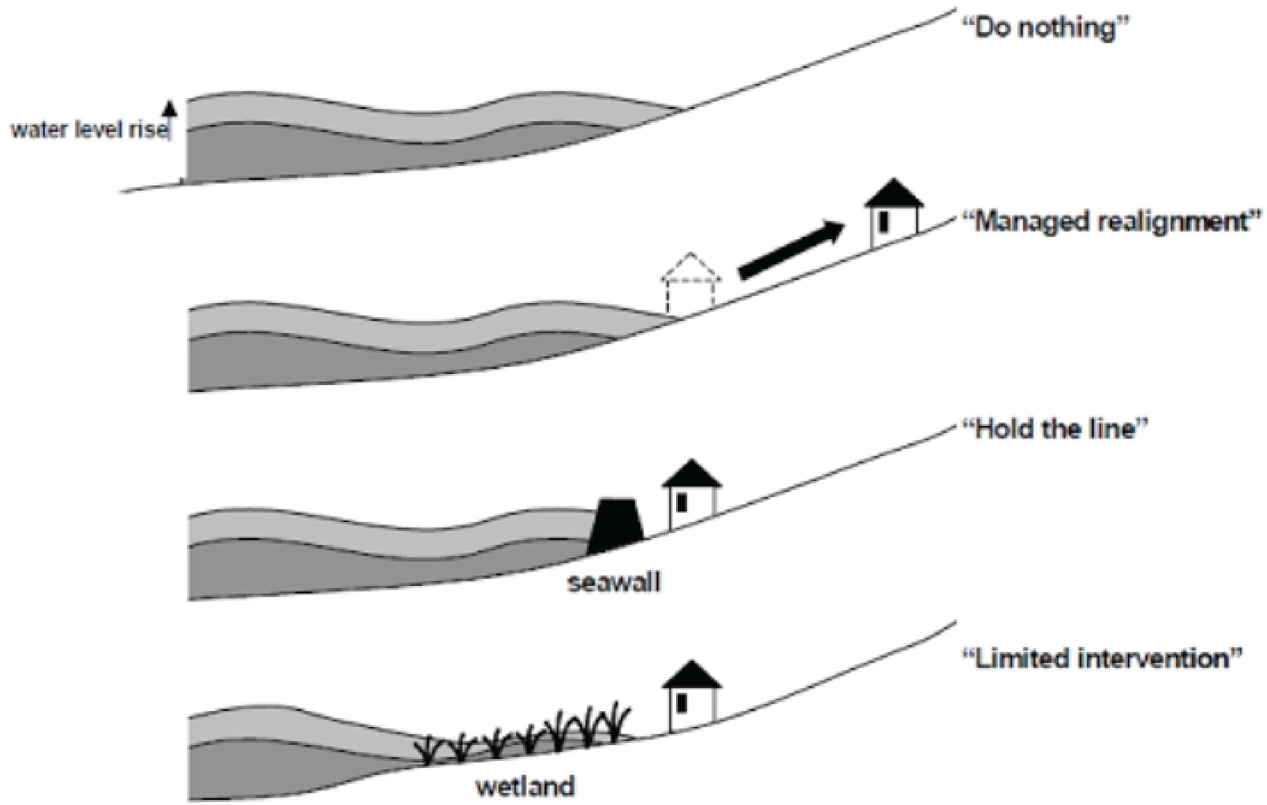
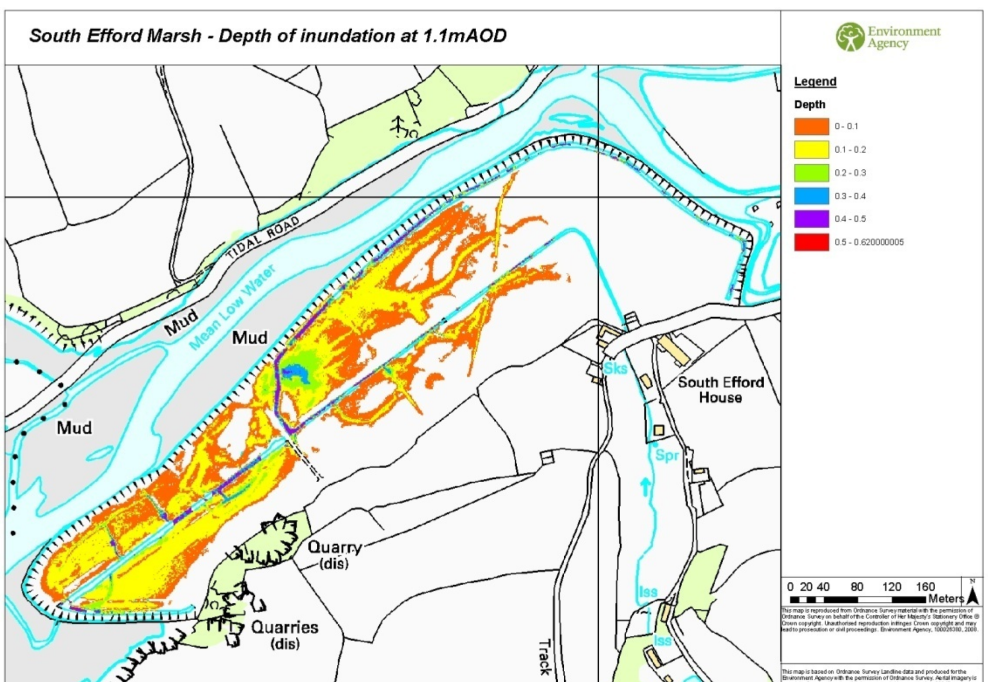


Figure 4.1.: Policy options for coastal management (European Commission, 2004; in Heurtefeux *et al.*, in press)

Efford Marsh – Managed realignment

Site before realignment

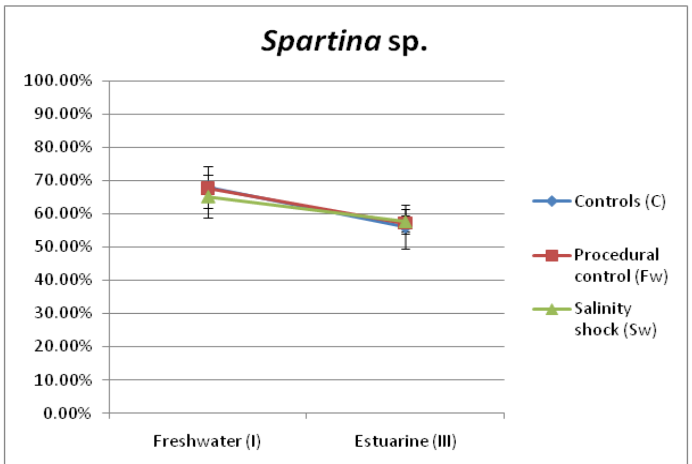
A regulated tidal exchange scheme

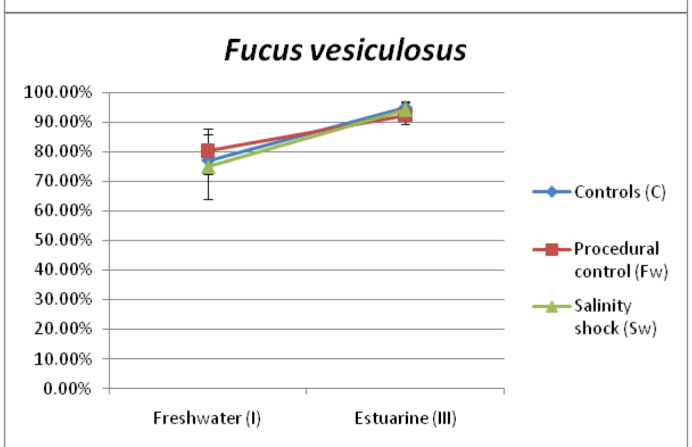


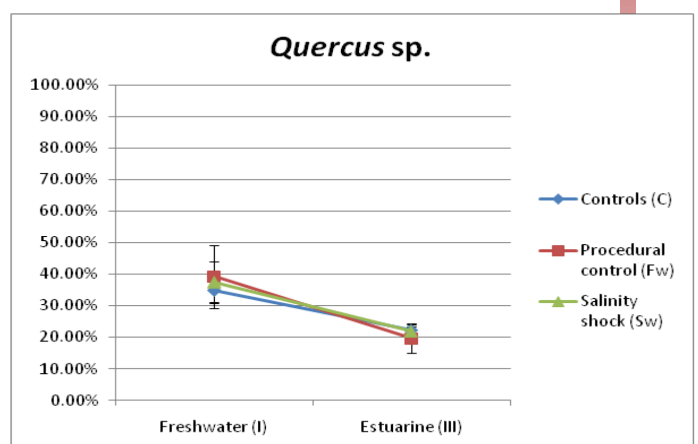
Map showing area and depth of inundation

Effects of salinity shock

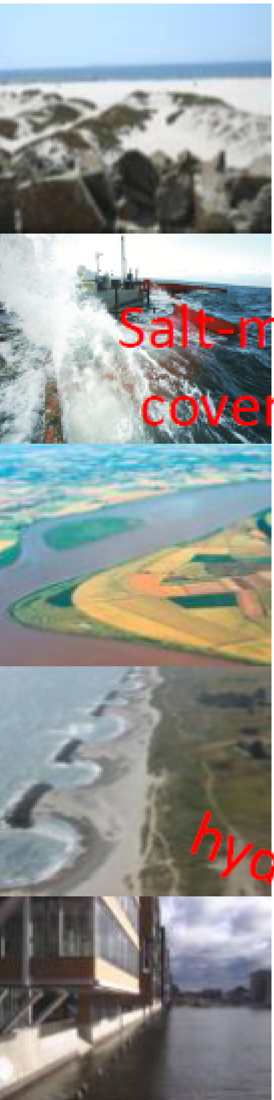
- On decomposition by invertebrates

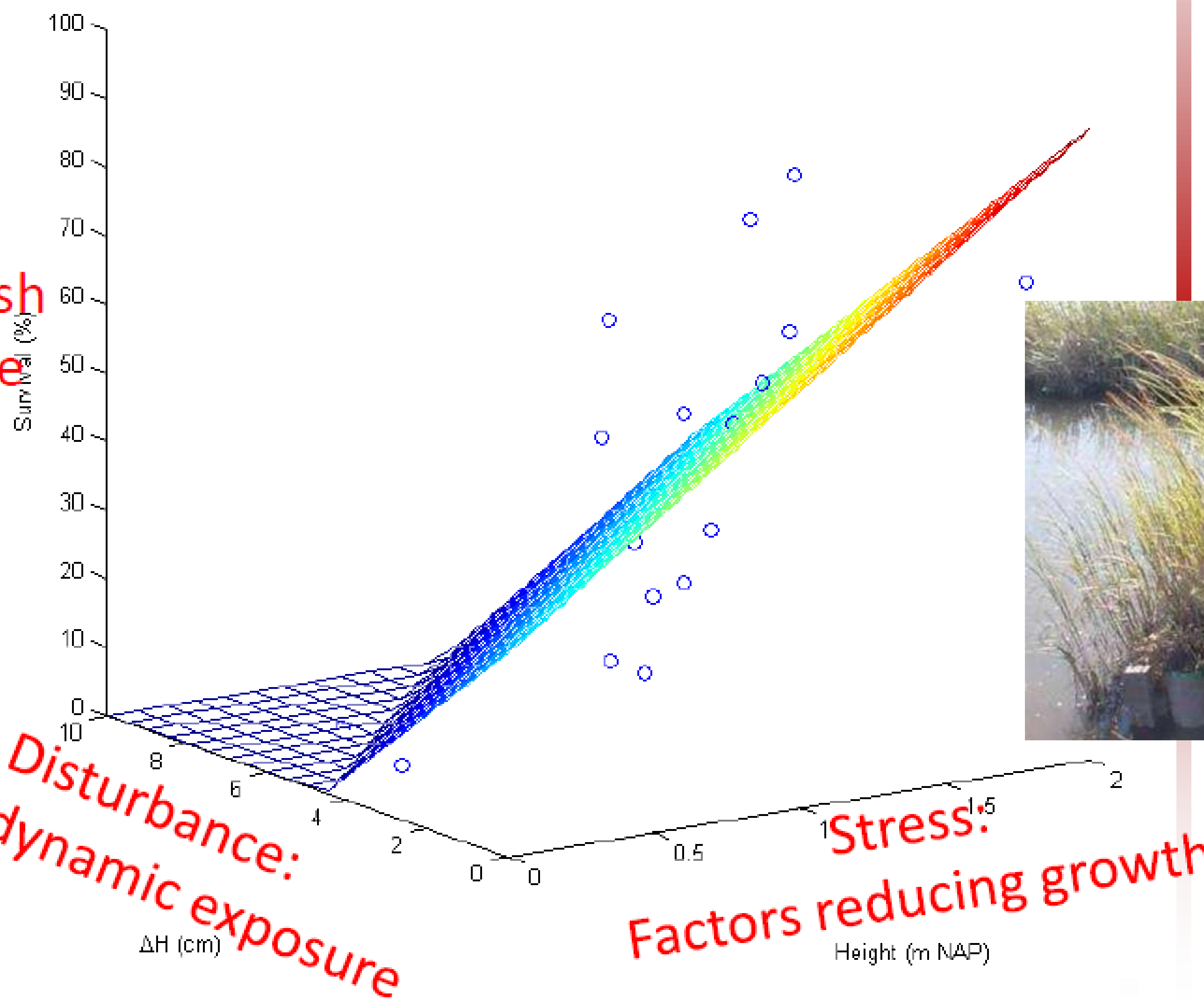






Saltmarshes management



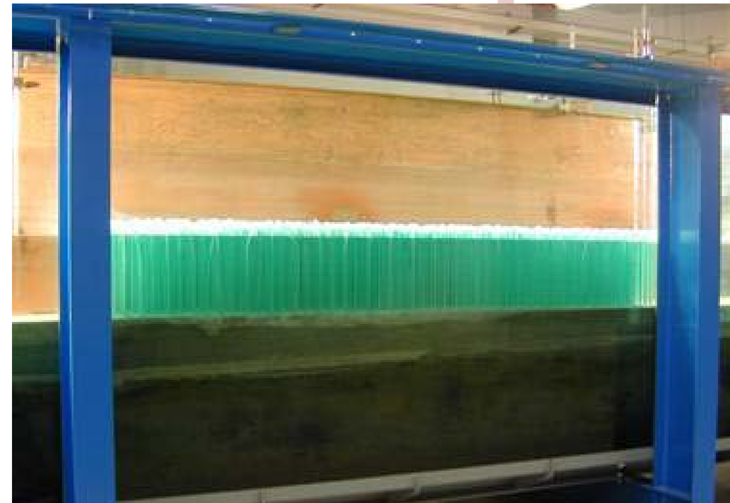


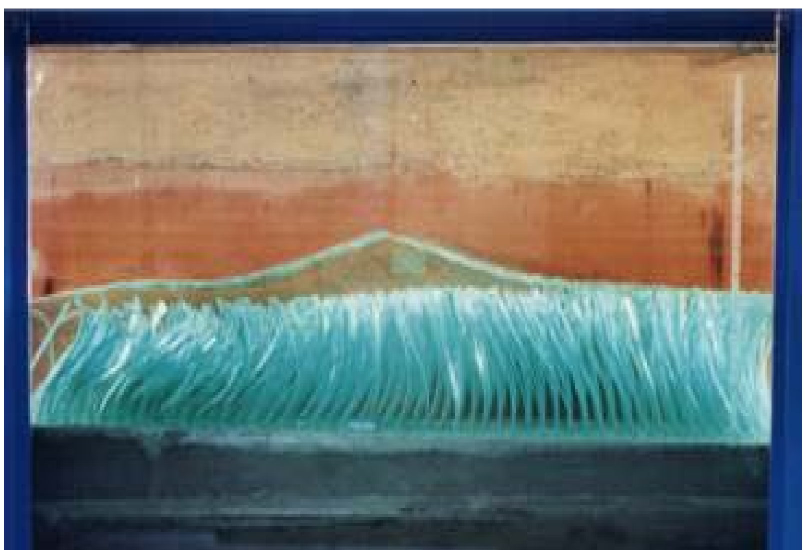
Effects of sewater inundation on biota non extensively characterised

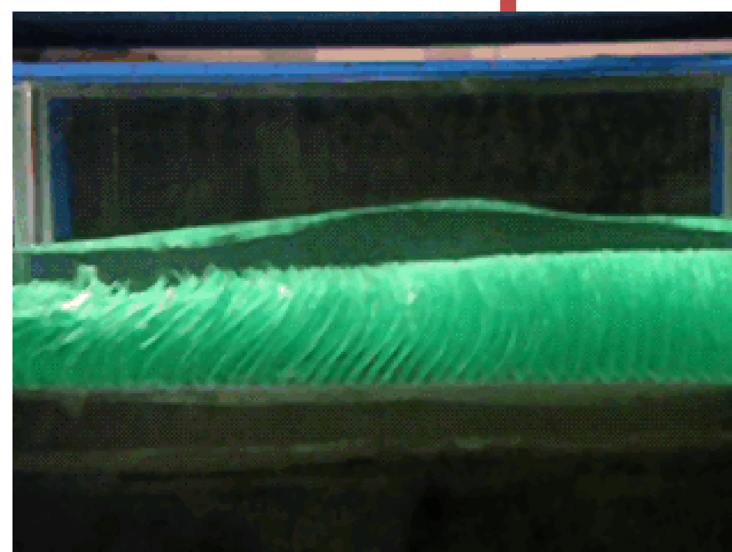
experiments with marsh plants - specialist, generalist, invasive species

Wave attenuation over oysters and mussels

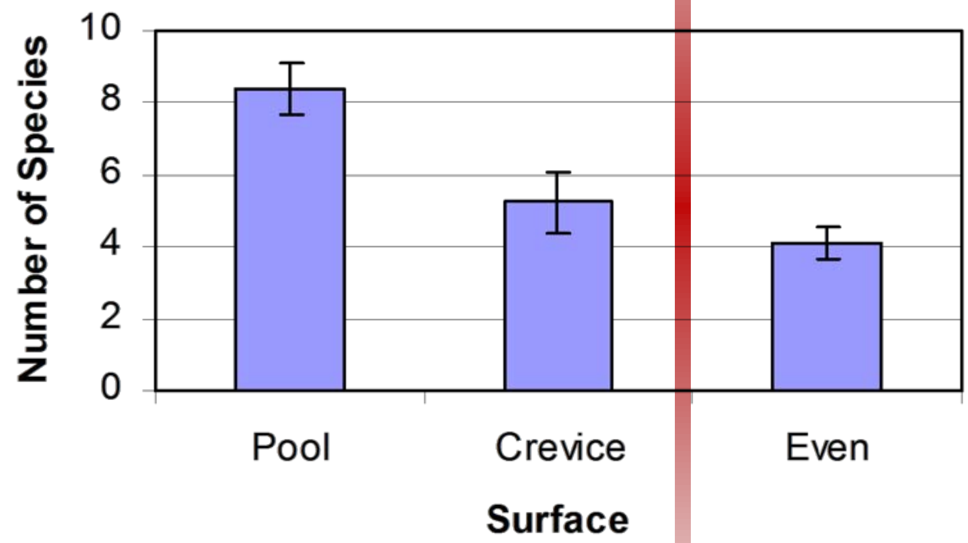
Wave attenuation over sea grass







Ecological desing: enhancement

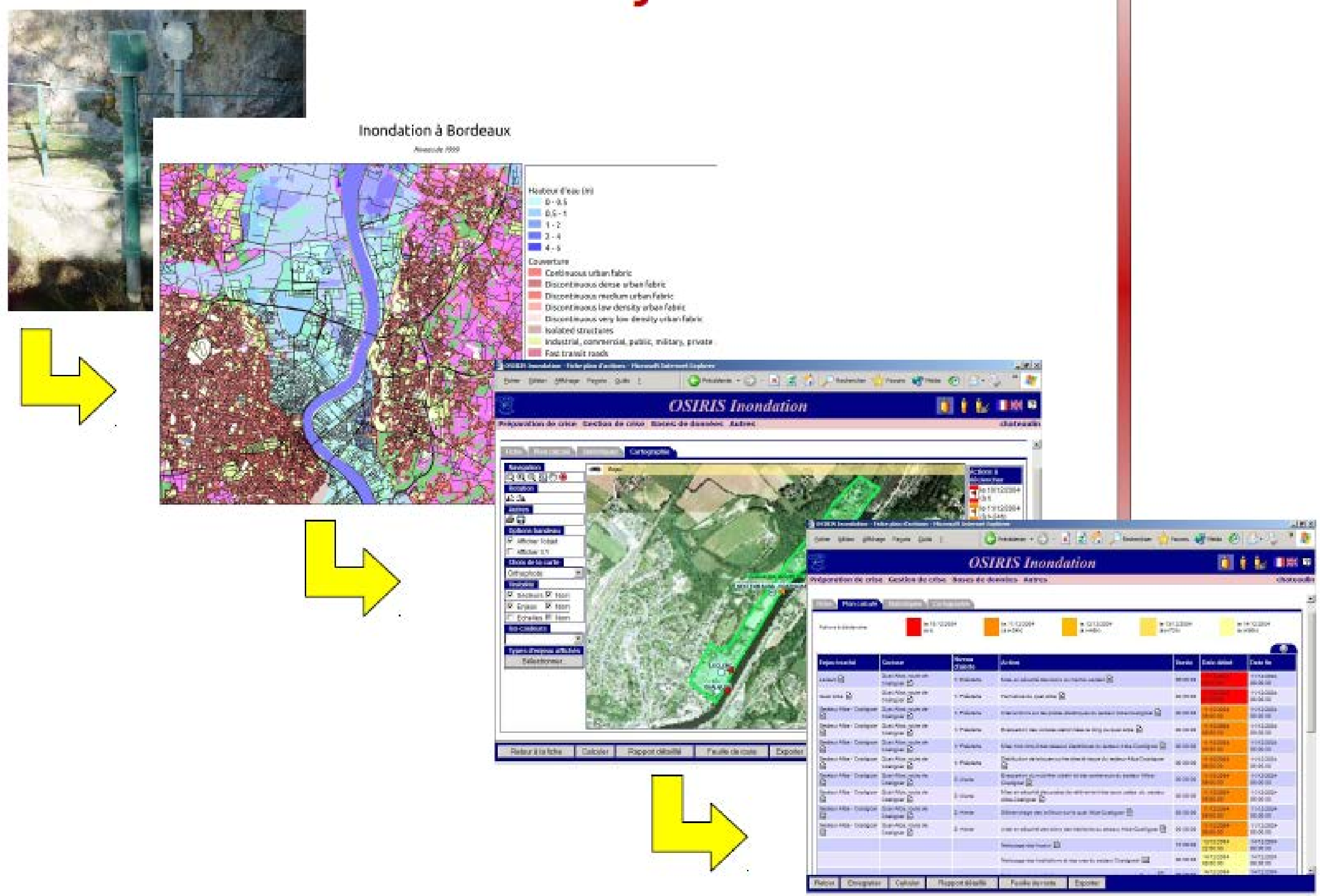


Land use planning and flood proof buildings



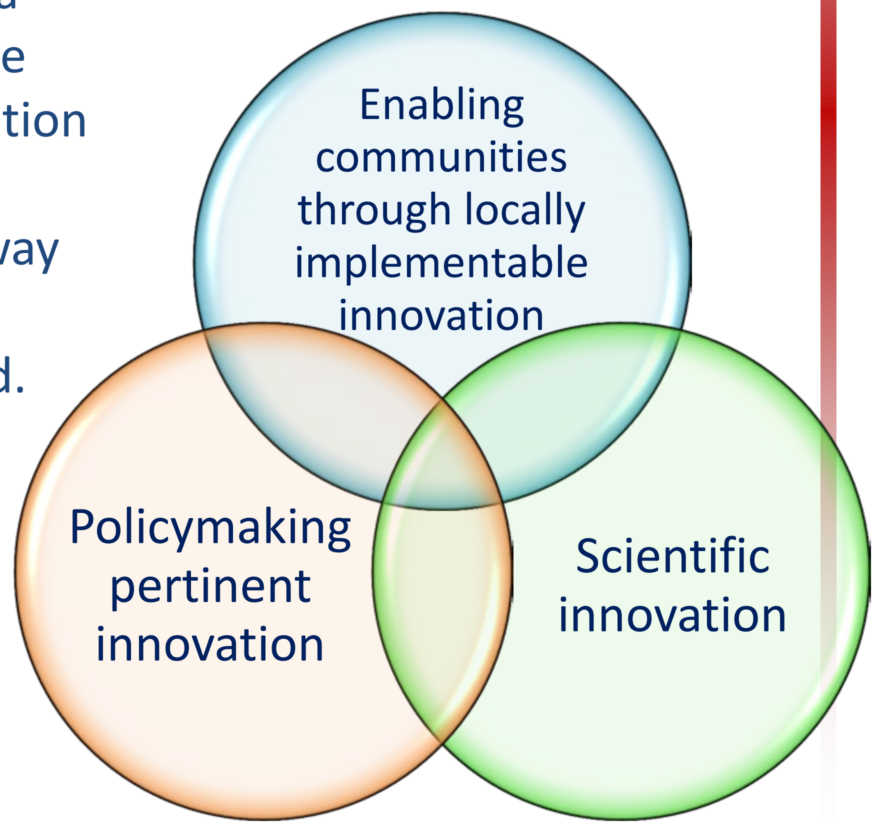


Early warning systems, crisis monitoring and evacuation plans



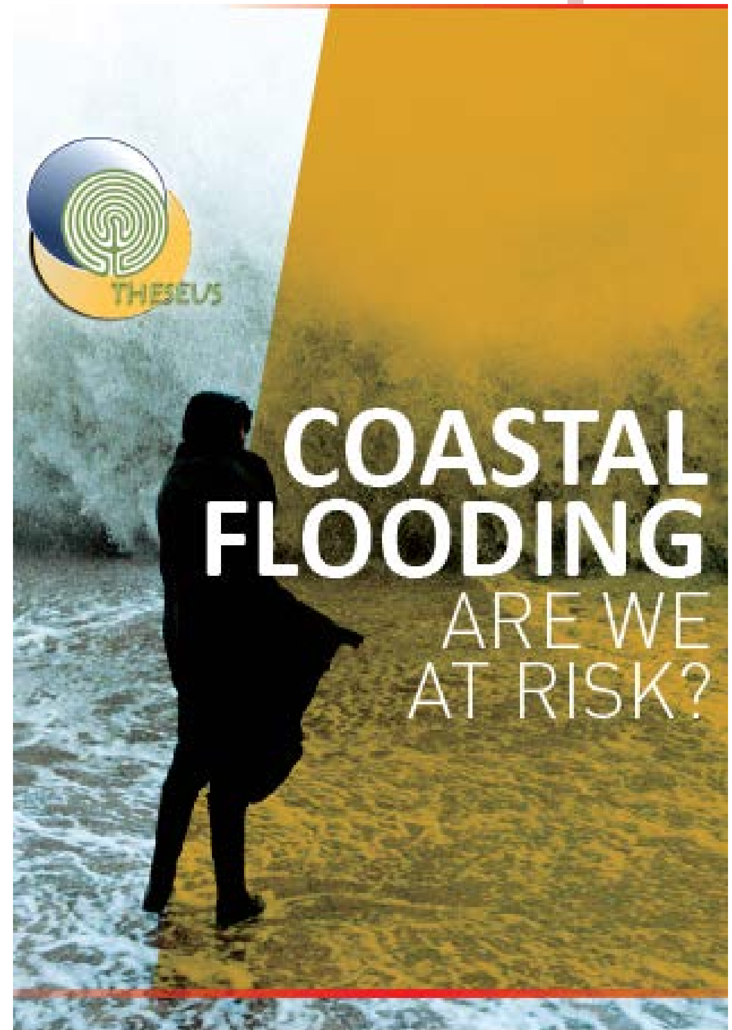
Risk perception analysis

- make the knowledge generation process a process that is integral to the communities' individual and collective experience.
- any assessment of a technological choice or a governance option should include an analysis of the way risks being normatively framed.



Risk communication and education

- Informative booklets to be distributed in the schools, in local language
- Training for MsC and PhD students
- Policy briefs



Thank you