

# The Horizon Regions4Climate project, innovative solutions for climate resilience of coastal communities



Regione Toscana

Luigi E. Cipriani  
Direzione Difesa del Suolo e Protezione Civile  
Settore Tutela Acqua, Territorio e Costa

The future of Coasts and Ports in a changing climate: needed actions and opportunities for a Sustainable Blue Economy | 7th November 2023 | Blue



# Regions4Climate

Building resilient communities

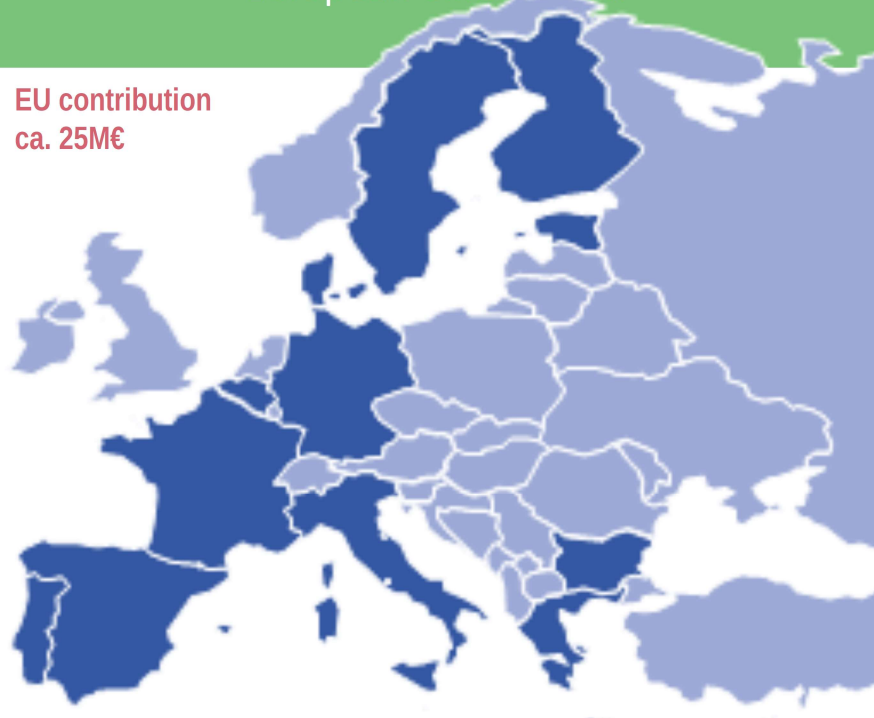


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# Regions4Climate

will systemically demonstrate climate-resilient society, based on full scale technological and social innovations providing reinforced adaptive capacity and minimized vulnerability to climate impacts, in line with the Paris Agreement and European Climate Law

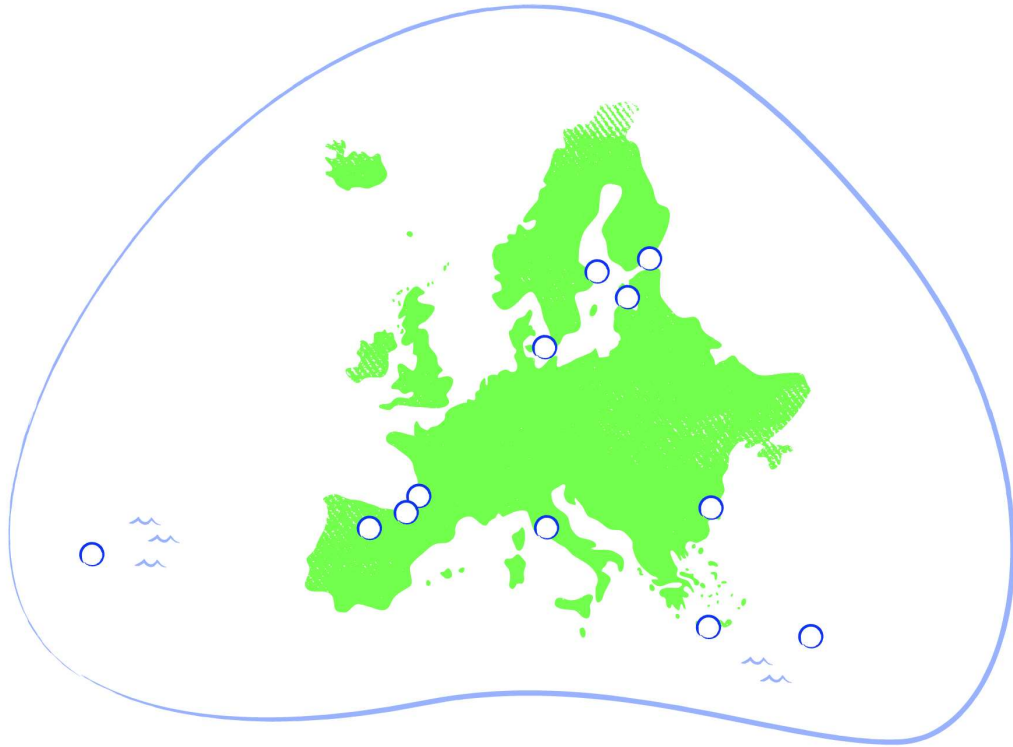
EU contribution  
ca. 25M€



This project will be carried out within Horizon Europe research and innovation programme. | Topic: Large scale demonstrators of climate resilience creating cross-border value (HORIZON-MISS-2021-CLIMA-02-04)

Country	Institution	Country	Institution
BE	Revolve Water	DE	ICLEI Europa Sekretariat GmbH
BG	Risk-Space-Transfer Technology Transfer Office	EL	National Center for Scientific Research "Demokritos"
	Burgas Municipality		Municipality of Sitia
CY	Cyprus Energy Agency	IT	RINA Consulting
	Troodos Network of Thematic Centres		Scuola Superiore di Studi Universitari e di Perfezionamento S. Anna di Pisa
DK	Danish Coastal Authority		Università degli Studi di Firenze
	VIA University College		IRIS S.A.S. - Strategie per l'Ambiente
	Region Hovedstaden		NEMO "Nature and Environment Management Operators" S.R.L.
	Region Sjaelland		Regione Toscana
	Kobenhavns Universitet		ENGINEERING – Ingegneria Informatica S.P.A.
EE	Stockholm Environment Institute Tallinn		PT
	Eesti Keskkonnauuringute Keskus	Universidade dos Acores	
	Sihtasutus Parnumaa Arenduskeskus	Fundo Regional da Ciência e Tecnologia	
	Parnu Linnavalitsus	ES	Fundacion AZTI – AZTI Fundazioa
FI	Teknologian Tutkimuskeskus VTT Oy		Zabala Innovation Consulting, S.A.
	Forum Virium Helsinki Oy		Fundacion Tecnalia Research & Innovation
	Demos Research Institute Oy		Fundacion CARTIF
	Uudenmaan Liitto		Junta de Castilla y Leon
	Almanna Forvaltningen		Sociedad Publica de Gestion Ambiental IHOBE SA
	Helsingin Yliopisto		Consejería de Desarrollo Económico, Sostenibilidad y Medio Ambiente. Eusko Jaurlaritz-Gobierno Vasco
FR	SUEZ Eau France		SE
	Communauté d'Agglomération Pays Basque	<b>44 partners from 13 countries</b>	
	Universite de Pau et des Pays de l'Adour		

# The Regions4Climate project



The **Regions4Climate project** will plan and implement real **climate resilient innovations** created by and for people in response to the **EU mission Adaptation to Climate Change.**

Climate change presents a threat to our livelihoods, well-being and environment. A **transition** towards resilience has become urgent and mandatory.

This need requires that we simultaneously address social inequalities and implement **cross-sectoral innovations** to simultaneously build social, economic and environmental **resilience** to extreme events.

# Objectives



**Develop a comprehensive operational framework.**

**Why?**

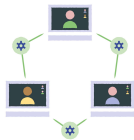
To guide and support a wide range of local and regional stakeholders to co-create, test, optimise and replicate scalable, cost-effective, locally-attuned, multi-sectoral and cross-border solutions for enhanced regional resilience to the impacts of climate change.



**Scale up and deploy innovative socio-technological climate resilience solutions.**

**How?**

Through collaboration among and “twinning” between European regions vulnerable to similar climate change risks and impacts.



**Generate and validate suitable solutions for just societal transformation and building of climate resilience at the regional and local level.**

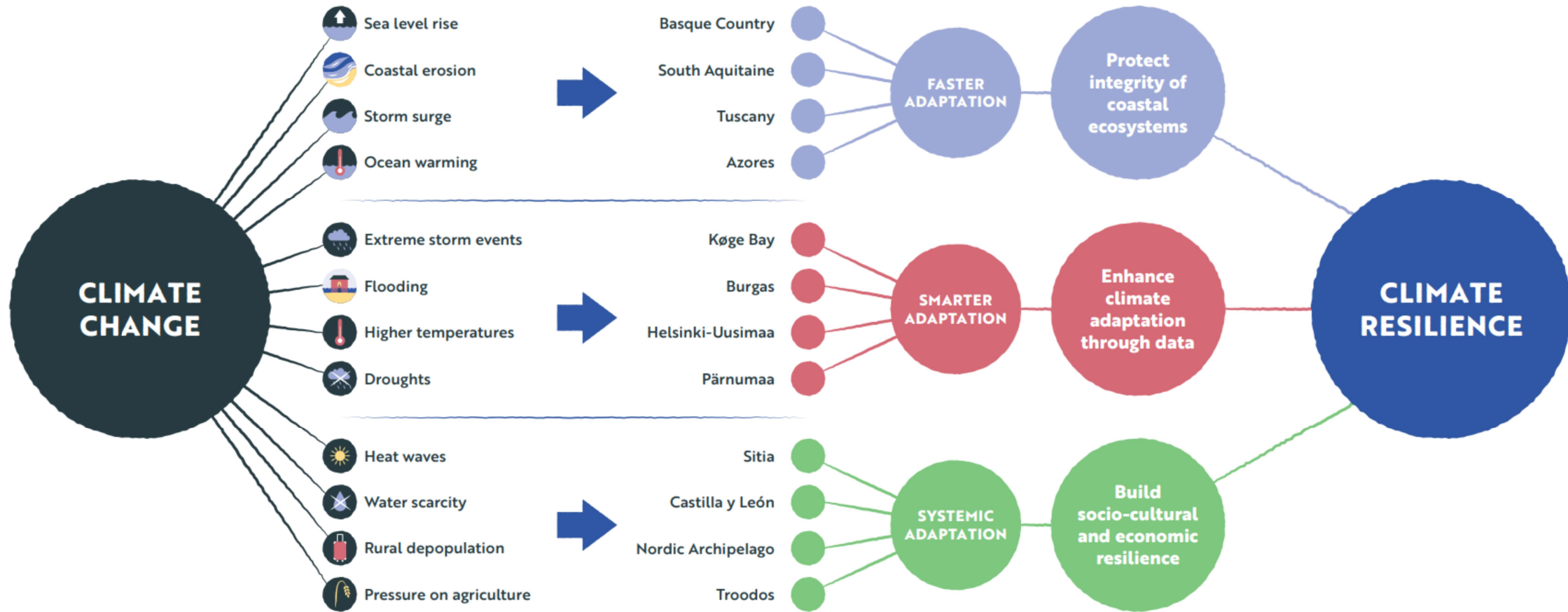
**How?**

Through generation and validation of a suite of tailor-made, user-centred tools and frameworks matching local needs.



**Regions  
4Climate**

# At a glance



# 3 societal innovation themes

**Faster Adaptation:** the story of coastal protection and restoration

**Front runner region:** Basque Country

**Follower regions involved:** South Aquitaine, Azores, Tuscany

**Smarter Adaptation:** the story of twin green and digital transition for climate resilience

**Front runner region:** Køge Bay (The Capital Region of Denmark and Region Zealand)

**Follower regions involved:** Burgas, Uusimaa, Pärnumaa

**Systemic Adaption:** the story of multi-scale, multi-sectoral adaptation to climate change

**Front runner region:** Sitia (Eastern Crete)

**Follower regions involved:** Castilla y León, Nordic Archipelago, Troodos



# Faster Adaptation

All the regions in this cluster are located near the coast and as climate change worsens, its impact on **coastal areas** grows. Coastal impacts of climate change include sea level rise, an increase in storm surges, and coastal erosion.

There is an urgent need for innovative actions that focus on developing and rolling out multi-scale and multi-sectoral adaptation solutions to: **reduce climate-related risk**, **increase climate protection** and **safeguard coastal ecosystem** integrity.

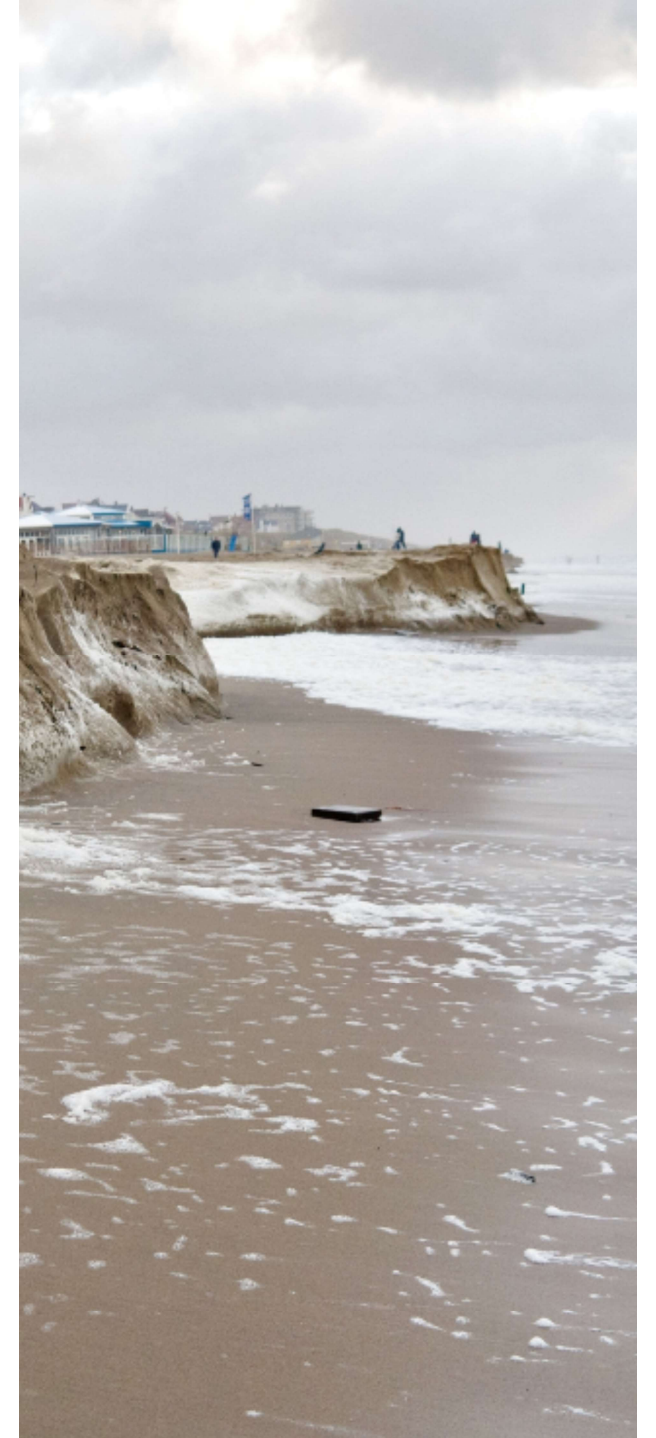
## Core innovation pillars

1. Protect and restore the coasts
2. Examine opportunities for [Blue Carbon Credits](#)
3. Educate and engage citizens towards resilience building
4. Engage in cross-border actions

**Outcomes:** Multi-scale monitoring networks and multi-sectoral adaptation planning to safeguard coastal areas.



Image source: Canva





# Tuscany

## Description of the area

Tuscany is a region in central Italy.

Tuscany has a population of 3.7 million citizens in an area of 2 985 km<sup>2</sup>, or 1 240 inhabitants per km<sup>2</sup>. Tuscany is a popular tourist destination during the summer months.

## Challenges

- Coastal erosion

## Goals

- Restore coastal dune systems in Sterpaia Natural Park
- Create a model to better understand coastal dynamics
- Develop territorial resilience plans based on coastal monitoring data



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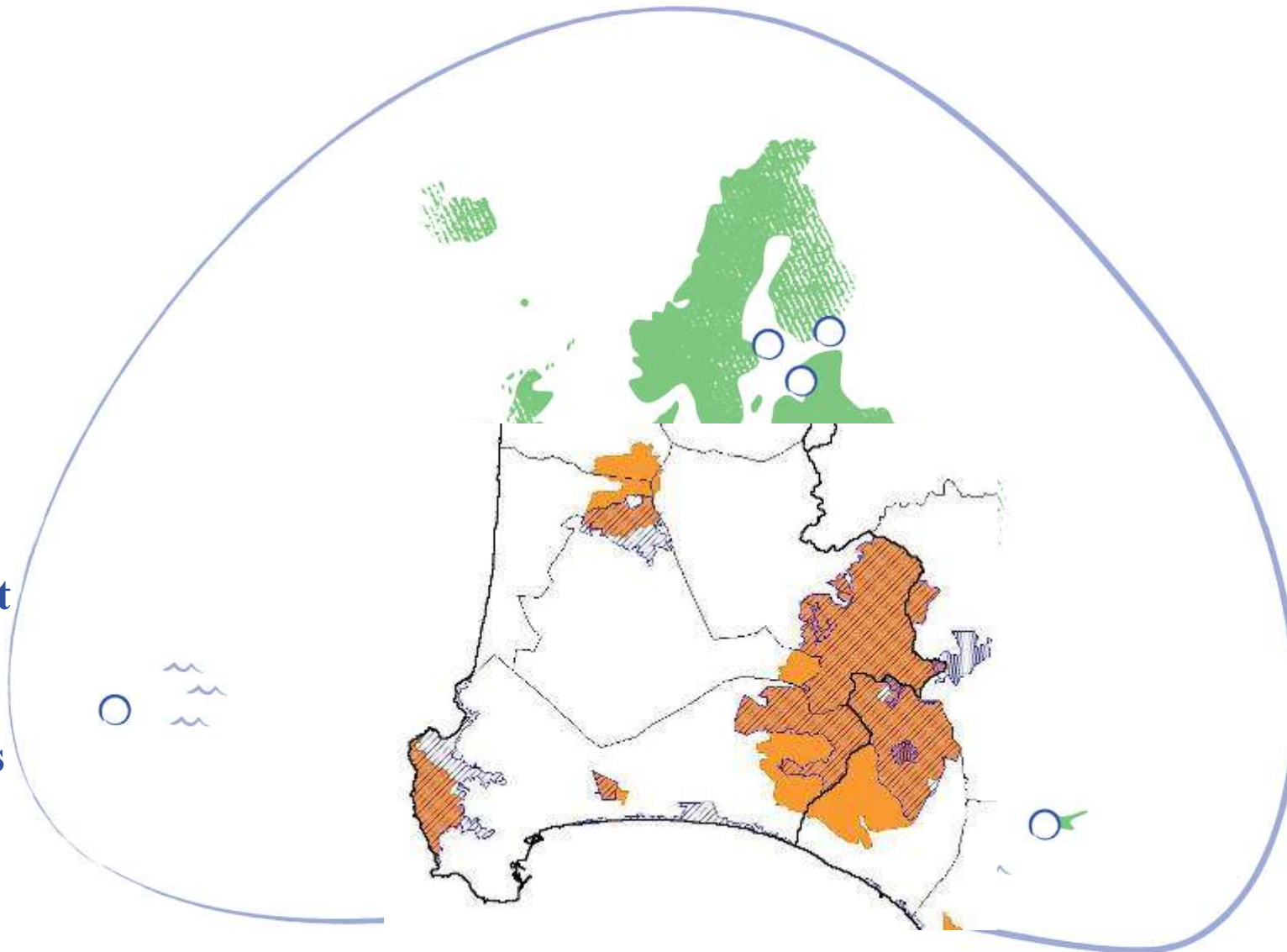
# Project Partners – Tuscan Demonstration





## Protected Natural Area of Local Interest Sterpaia Park

- R4C Site
- Nature-Based Solutions past projects



# R4C Tuscan Demonstration Project



Google Maps, (2023).



# R4C Tuscan Demonstration Project





## Environmental Risks at Pilot site

Frequent Storm and Erosion



Anthropic Dune interruption/trench induced wind erosion channel and storm surges overwash

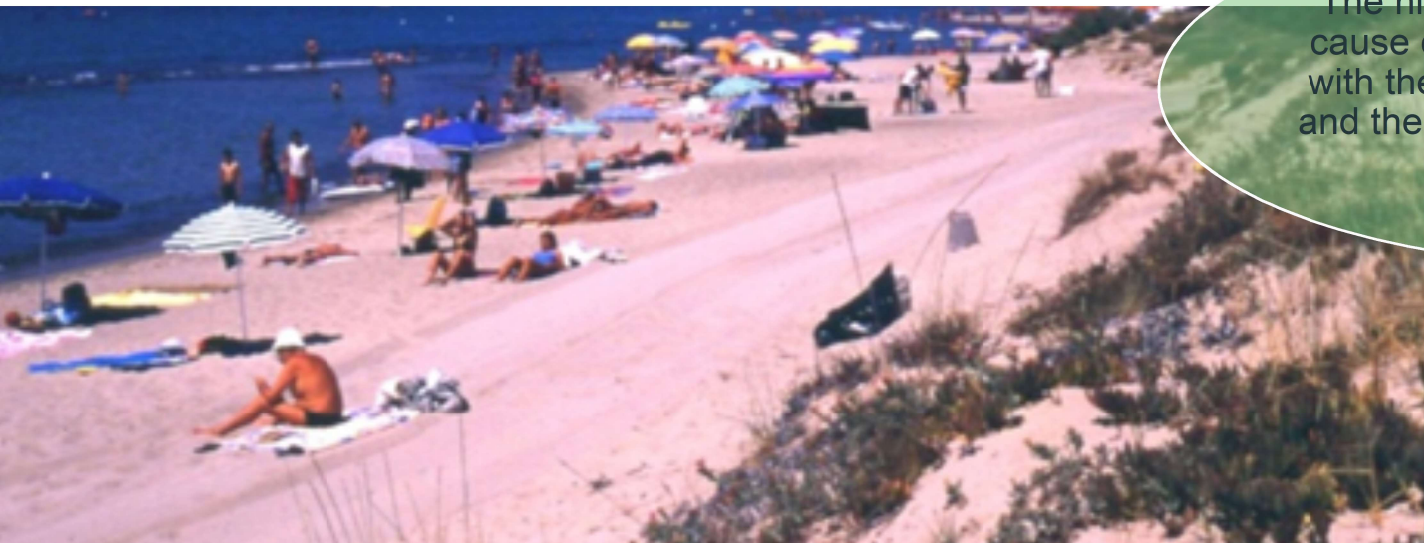


Sand overwashed and deposited inland of coastal dune



Effect of sea water on coastal pine forests

# Coastal Dune Erosion



The high summer **tourist load** is the cause of trenches on dune vegetation with the consumption of dune habitats and the spread of **exotic flora species**

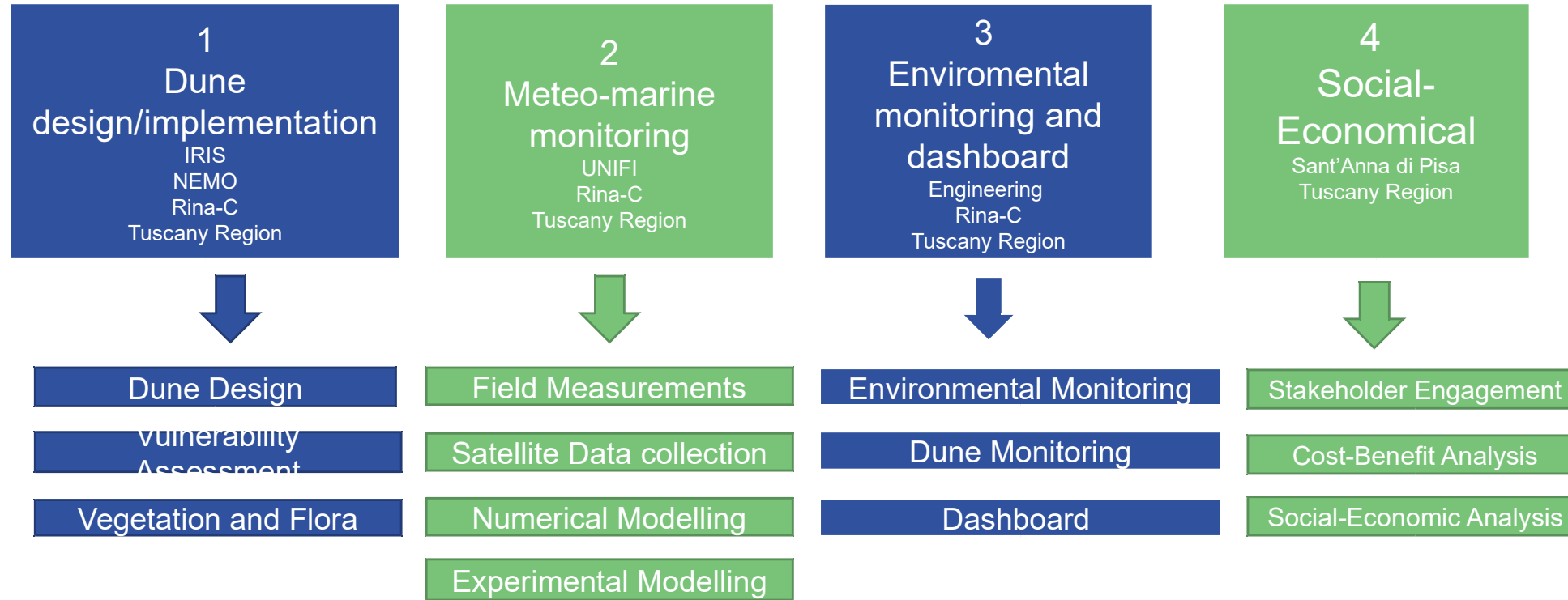
# Summer Tourism Load





# Beach Cleaning by Mechanical Means

# Project Breakdown – Tuscan Demonstration





# LABIMA- Laboratory of Maritime Engineering

## Role: Experimental Model for Dune Design

### Expertise of LABIMA

- Marine Renewables & Marine Energy Converters
- Long Term wave hindcast & Nesting of Wave Models
- Port and Harbour Structures

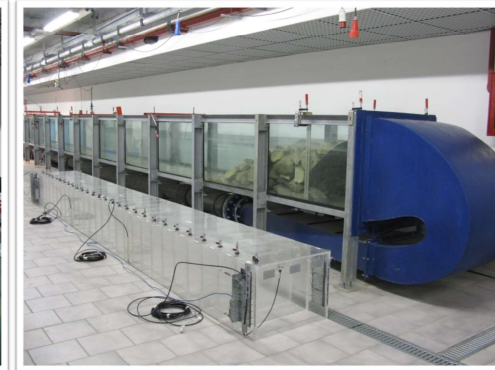


Project Example: Marina di Pisa



### Test Dune Design in Flume

- Design and Test the Dune model
- Calibrate the model with past data
- Test dune resilience to extreme weather
- Test effects of extreme cases of scouring on NBS design

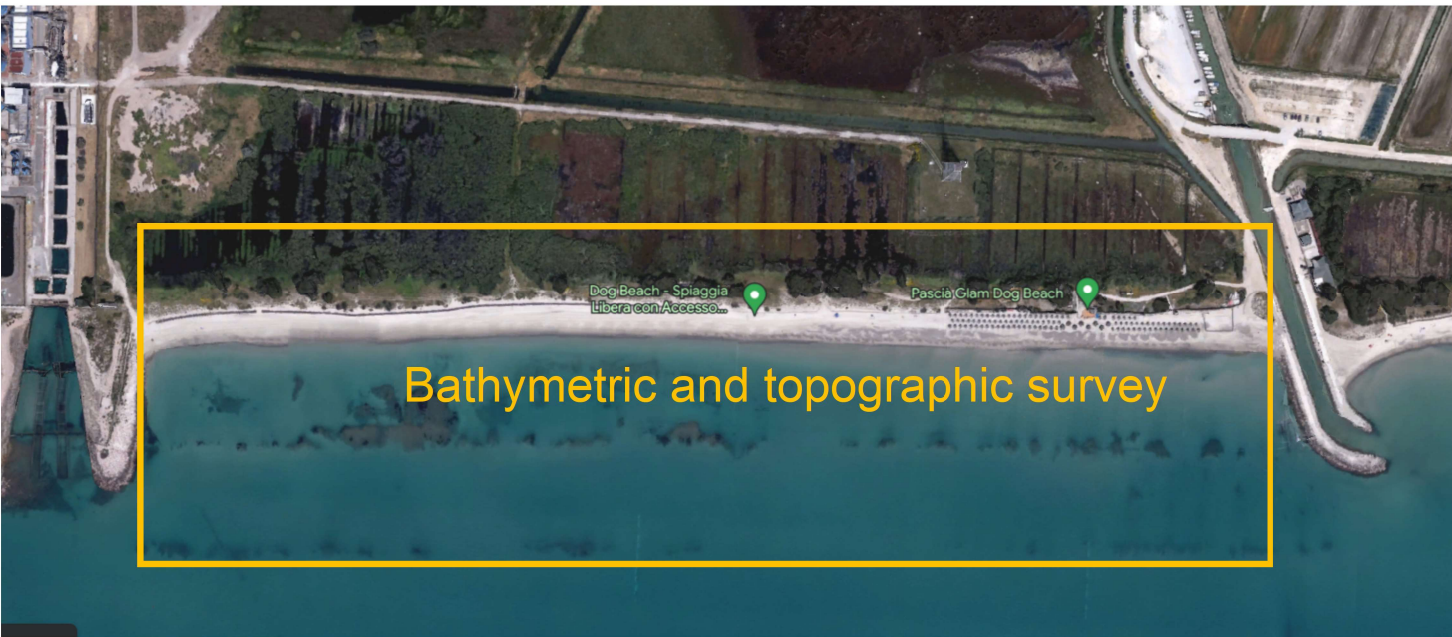


1 year monitoring:

- Meteorological parameters
- Hydrodynamic (wave and current)
- Morphodynamic (evolution of bathymetric profile of submerged beach and shoreline).



Numerical modelling to reconstruct the wave motion at each point in the gulf



### Installation of Wave Buoy

Specifically, the research team of **Sustainability Management Laboratory of S. Anna** will do the following tasks:

- Realization of a cost-benefit analysis of the nature-based solution (NBS) that will be adopted (restored dune belt).
  - The cost-benefit analysis will assess costs and opportunities related to the project solution, also considering the main local stakeholders (local institutions, beach clubs managers, farmers, food service and tourist companies, civil society, NGOs, and mainly environmental NGOs) - **Recognize and quantify the ecosystem services offered to the community and its economic activities by the Sterpaia dune system.**
  
- Realization of a stakeholders engagement activity
  - The aim is to involve all key stakeholders of the area interested in the adoption of the NBS with different kinds of activities (workshops, focus groups, other specific initiatives). **The stakeholder engagement activity will be carried out in line with the Just Transition principles of gender equality and inclusion of vulnerable groups.**

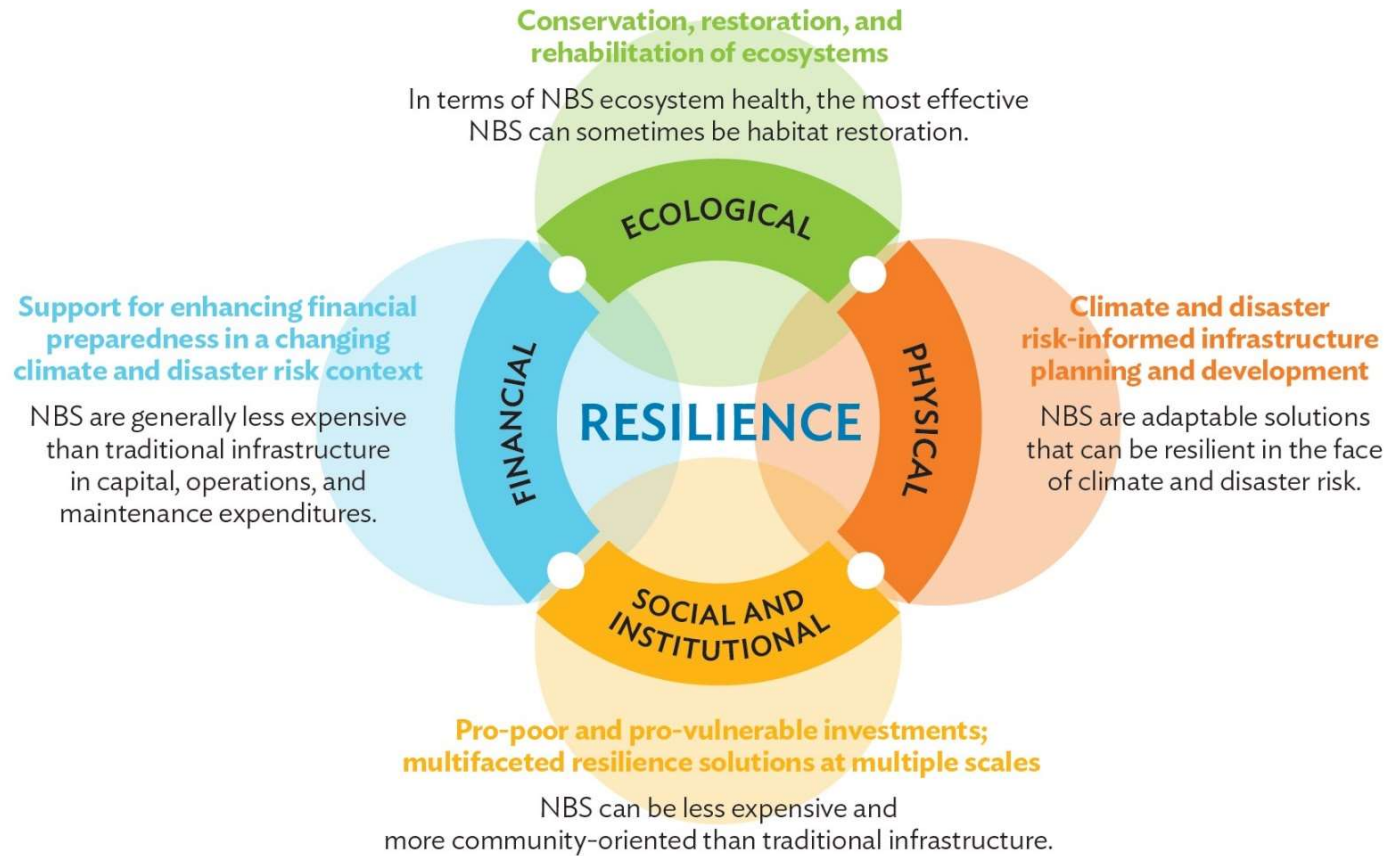
# Nature-Based Solution Past Projects and Inspiration

Protected Natural Area of  
Local Interest Sterpaia Park

Protected area around  
240 ha



**Figure 1: Dimensions of Holistic Resilience and Contributions of Nature-Based Solutions to the Resilience Dimensions**



NBS = nature-based solutions.

Source: Adapted from X. Lu. 2019. Building Resilient Infrastructure for the Future: Background Paper for the G20 Climate Sustainability Working Group. *ADB Sustainable Development Working Paper Series*. No. 61. Manila: Asian Development Bank.

# Shared Rules for Management and Conservation of Area

## Beach Cleaning Techniques



## Beach Organic Material Deposit



Stakeholder  
Engagement

Beach  
Cleaning

Beach  
Access  
through  
dune  
crossing

Protect  
Flora and  
Fauna

Pets,  
Lighting

Green  
Furniture

Facilities  
and  
Services



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# Restoration and Consolidation of the Dune in the Critical Sites

Windows (Viminate) and Palises at the foot of eroding dunes or to close passages.

Wave damping and windbreak action



Viminate built in Marina di Vecchiano (Pisa), for the closure of bow-outs in the dune system. (year 2009).



Viminate built at the foot of the dune in Carlappiano (Sterpaia)

# Nature Based Solution Structure



3 years after



Chestnut Poles for beached biomass Placement



Natural Sand  
Sedimentation Insertion  
of Tamarix L. Plants

# NBS – Demolished Dune (Blow out)



Restoration and Consolidation of the Dune in the Critical Sites



Dune Reconstruction with Reinforced Sand



Coconut Fiber Network  
Tamarix L. Cutting

1.5 Years Later

2015



2022



# Removal of Exotic Vegetation



# Plantation of Local Psammophilus Herbaceous Species



# Post Intervention Monitoring: Vegetational Recovery



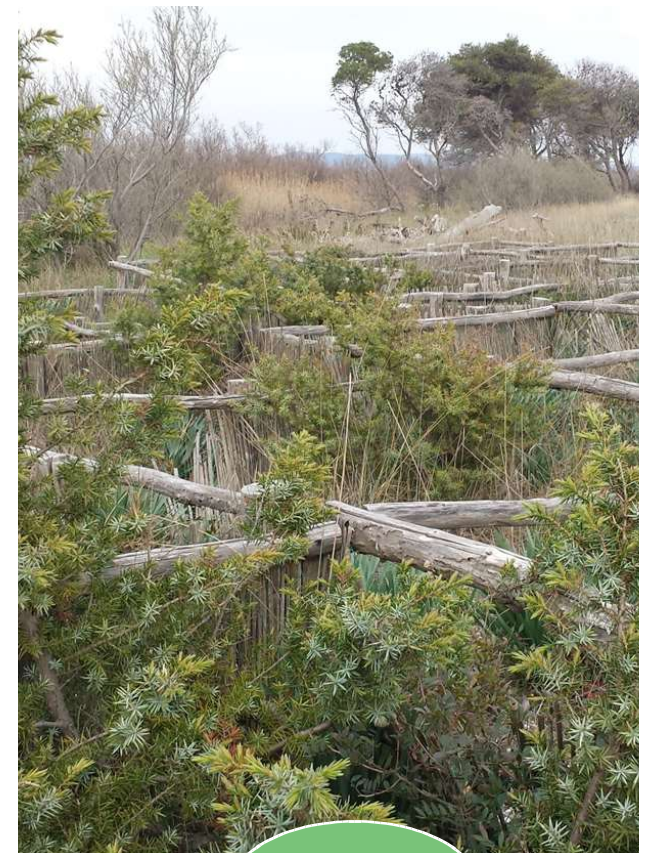
2009



2014



2022



2022

# Mitigating Environmental Impact of Tourism



# Information and Communication





# Stakeholders Engagement

Field visit with beach establishment managers and beach cleaning operators



Workshop for preliminary phase of coastal dune restoration project discussion and participation with local stakeholders



Students Training Environmental Education



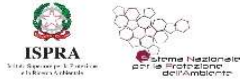
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# Lessons Learned on Stakeholder Engagement

- **The GOAL** is to convince local stakeholders to promote and sell their natural and unique Mediterranean coastal environment instead of fake, brushed and aseptic postcard beaches
- Invest on Environmental Education of local Stakeholders about the importance of maintenance of the natural ecosystem services through nature-based solutions
  - beach establishment managers
  - Lifeguards
  - touristic and environmental guides
  - restaurant and hotel owners
  - beach cleaning operators, etc...
- Knowledge dissemination through word of mouth proved to be extremely valuable



# Beach cleaning (e.g. removal of *Posidonia oceanica*) – ECOLOGICAL BEACH MODEL



## SPIAGGIA ECOLOGICA E POSIDONIA SPIAGGIATA

### POSIDONIA OCEANICA: RUOLO ECOLOGICO, RISORSA E PROTEZIONE DELLE SPIAGGE

L'habitat *Posidonia oceanica* è protetto dalla Direttiva Habitat (92/43/CEE) ed è classificato come habitat prioritario (1120)



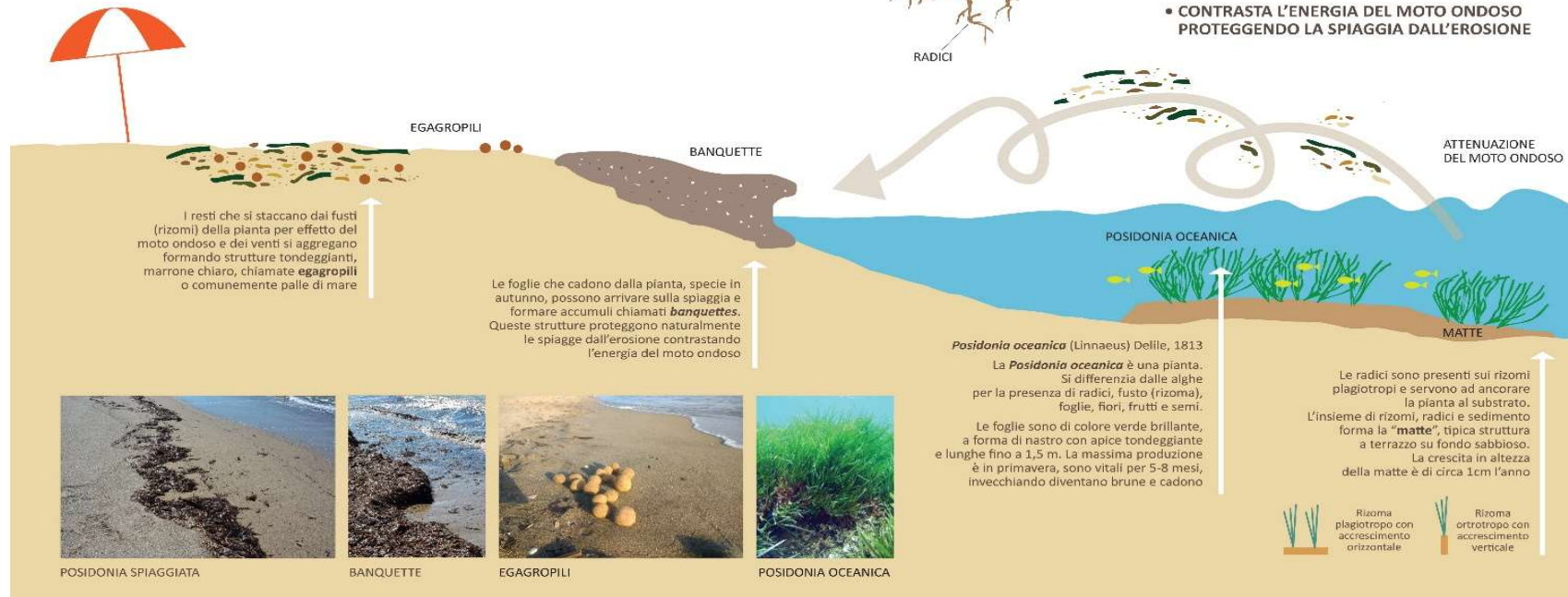
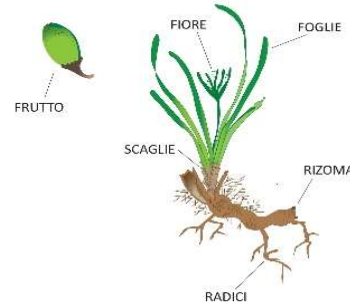
#### SEI SU UNA SPIAGGIA ECOLOGICA SE:

- LA POSIDONIA SPIAGGIATA E LE SUE BANQUETTES SONO LASCIATE SULLA SPIAGGIA ANCHE PER PROTEGGERLA DALL'EROSIONE
- ALTRI ELEMENTI NATURALI QUALI ALGHE, PEZZETTI DI LEGNO, CONCHIGLIE VENGONO LASCIATI SULLA SPIAGGIA
- I RIFIUTI DI ORIGINE ANTROPICA SONO RIMOSI MANUALMENTE
- SONO PRESENTI E SI USANO GLI ACCESSI APPOSITAMENTE SEGNALATI PER EVITARE IL CALPESTIO DELLE DUNE



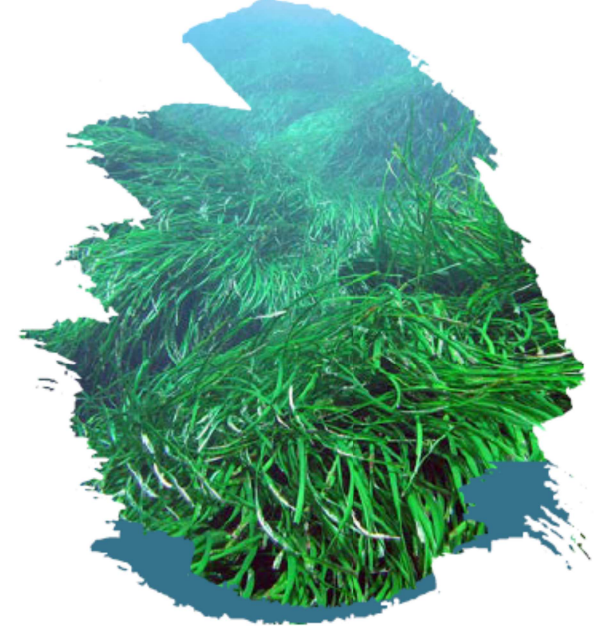
#### *Posidonia oceanica* "una specie protetta"

- È UNA PIANTA, NON È UN ALGA
- VIVE ESCLUSIVAMENTE NEL MAR MEDITERRANEO
- È IL POLMONE DEL MAR MEDITERRANEO
- È L'ECOSISTEMA MARINO A PIÙ ELEVATA BIODIVERSITÀ
- È INDICE DI BUONA QUALITÀ DELLE ACQUE MARINO-COSTIERE
- CONTRASTA L'ENERGIA DEL MOTO ONDOSO PROTEGGENDO LA SPIAGGIA DALL'EROSIONE



## Concept of Dune/Beach/Banquette (BDD) Ecosystem in Mediterranean beaches

Source: Luisa Nicoletti



# Mediterranean ecosystem

## Restoration sites

## NATIONAL GUIDE LINES

By Regional Administrations and River  
Basin Authorities (2016) Version 1.0



Feedback from Academia (2017)



Discussion and implementation by the  
Steering Committee (2018) Version 2.0



[www.erosionecostiera.isprambiente.it](http://www.erosionecostiera.isprambiente.it)

# Thanks for your attention

Luigi E. Cipriani  
Direzione Difesa del Suolo e Protezione Civile  
Settore Tutela Acqua, Territorio e Costa



 Via di Novoli, 26 – 50127 Firenze (IT)

 [Luigi.cipriani@regione.toscana.it](mailto:Luigi.cipriani@regione.toscana.it)

 +39 331 6979706

 [www.regione.toscana.it](http://www.regione.toscana.it) - <https://regions4climate.eu/>

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