LIFE SEC – ADAPT

Coastal risk adaptation and assessment

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**Institute for Environmental Protection and Research*

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1. Coastal environment adaptations

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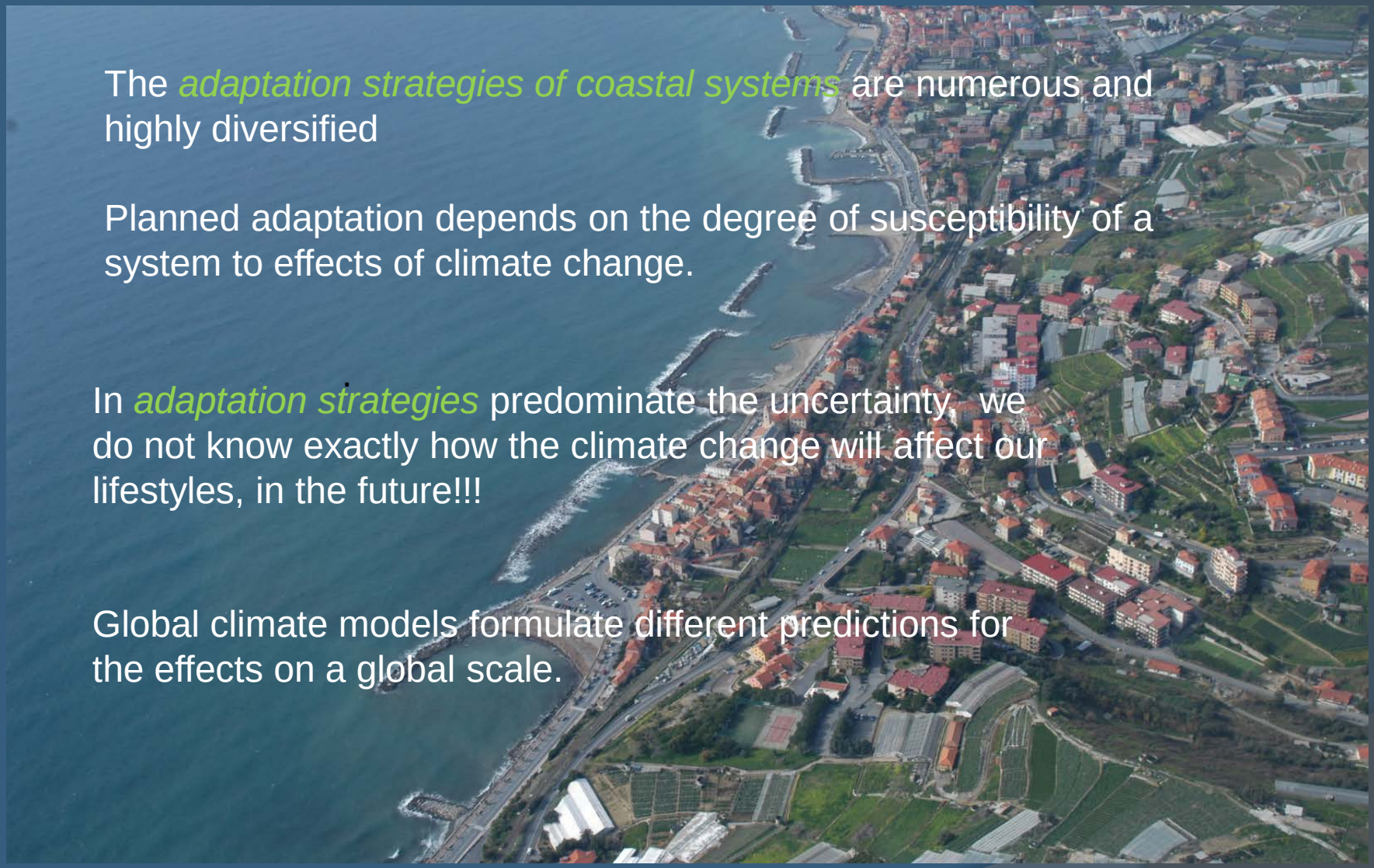

The *adaptation strategies of coastal systems* are numerous and highly diversified

Planned adaptation depends on the degree of susceptibility of a system to effects of climate change.

In *adaptation strategies* predominate the uncertainty, we do not know exactly how the climate change will affect our lifestyles, in the future!!!

Global climate models formulate different predictions for the effects on a global scale.

Coastal zones are extremely dynamic and vulnerable ecosystems!

An intense and growing urbanization has transformed the equilibrium between natural and anthropic resources and has turned the natural coastal dynamism into a serious risk for coastal urban settlements

Some *adaptation strategies* for the economic activities are the retreat to secure areas from flooding, or construction of protection barriers.

Economic effects

in terms of land/soil loss for economic activities, with consequent changes in the value of the remaining land.

Technological actions

Building of coastal defense works, physical protection measures that must be carefully planned in an optimal system, to avoid negative effects on the natural dynamics of the coastal strip

Behavioral measures

Through territorial regulation and urban planning, to induce the modification of some choices, for example recreation, investment in tourist activities not related to climatic conditions, etc.

Management actions

Taking into account the rise in sea level will occur in a fairly long period, it will in some cases be moving some territorial and / or infrastructure functions in safe areas, protected from the effects of flooding, or modification of agricultural practices located in areas at risk, or establishment of monitoring programs, etc.

Policy decisions land management

The realization of planned adaptation measures requires the organization of decision-making processes, based on assessment activities and stakeholder involvement.

Sustainable development can reduce vulnerability to climate change of the territories through the improvement of adaptive capacity and increasing the resilience of human and natural (eco)systems.

Currently, few plans and local and regional instruments for the promotion of sustainability, which explicitly include both adaptation to the impacts of climate change is the promotion of adaptability.

Main critical issues

- Lack of information on the mitigation options risk from climate change.

- Environmental, economic, social, cultural, attitudinal and behavioral barriers which act as a filter to the implementation of adaptation.

In conclusion

there are no established methods / indicators useful for quantitative assessment of the adaptive capacity of a system.

But

Including the mapping of risk from coastal erosion in long-term planning, local and regional decision makers can regulate the development of areas at risk of erosion and flooding and reduce financial investments to compensate damages.

2. Ancona littoral case study

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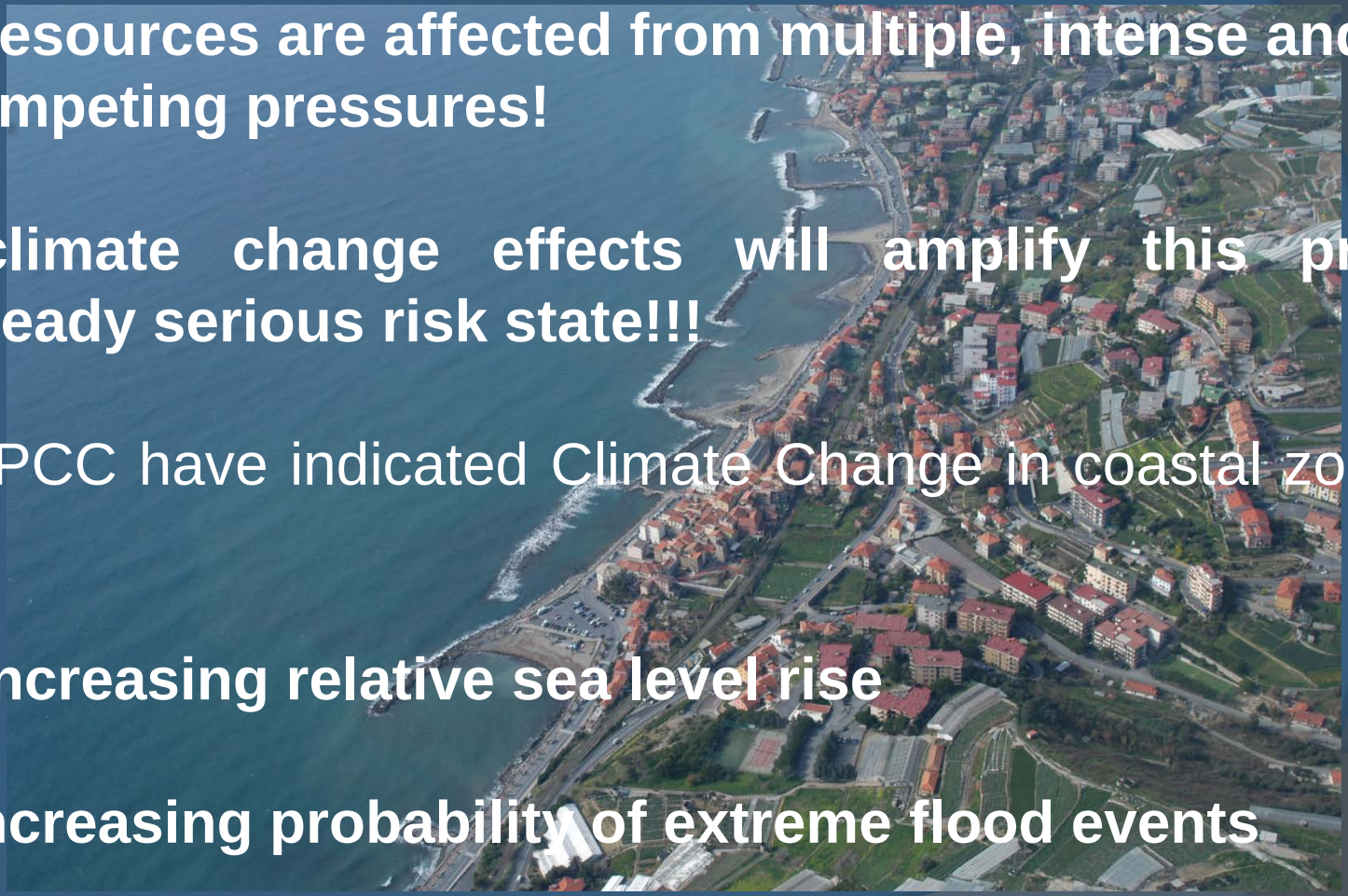
In coastal area



➢**resources are affected from multiple, intense and often competing pressures!**

➢**climate change effects will amplify this problem already serious risk state!!!**

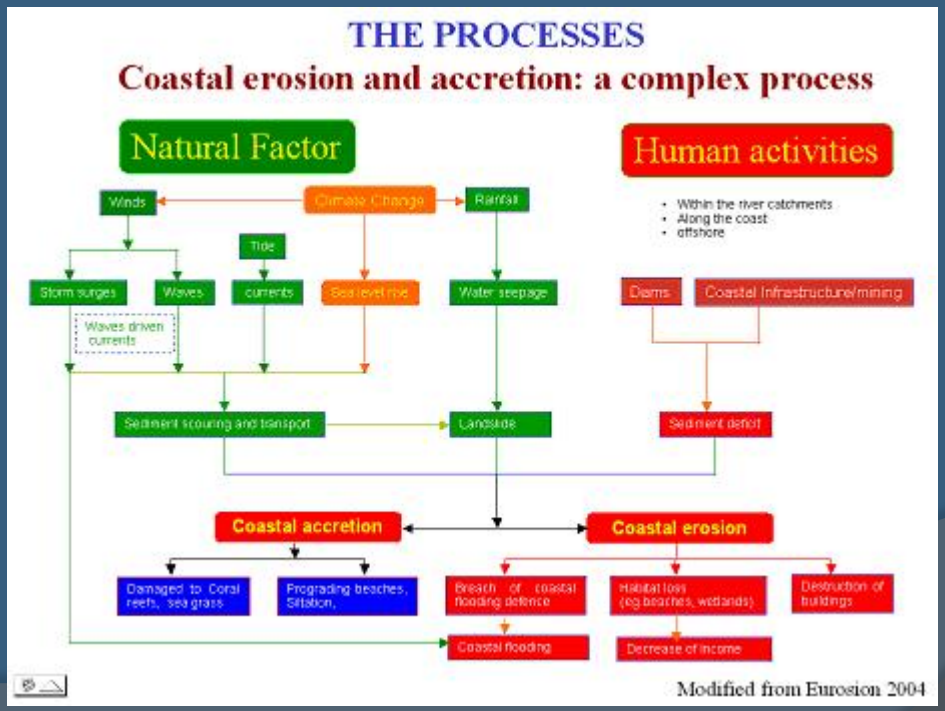
➢IPCC have indicated Climate Change in coastal zone due to

- **Increasing relative sea level rise**
- **Increasing probability of extreme flood events**

Research Objective

To adopt an indicator-based approach to evaluate

the coastal vulnerability to sea level rise on Ancona shoreline (Marche Region, Italy) referred to the Climate Change effects and antrophic pressures



Methodology

✓The methodology assessing

the current and future *physical sensitivity* to coastal erosion and flooding is proposed by the EUROSION project.

✓According to the Eurosion results (2002-2004)

is presented an application of **Coastal Risk analysis, based on numerical indexes development.**

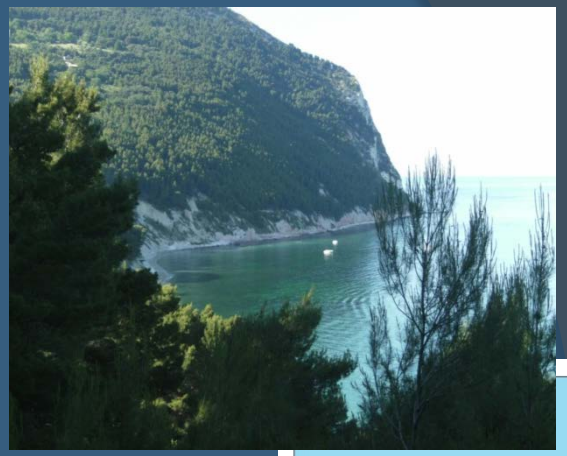
Case study and RICE

The municipality of Ancona is storically affected by an intensive use of coastline and accentuated erosive dynamics of the shoreline

According to the EUROSION project is convenient to introduce the concept of *Radius of Influence of Coastal Erosion (RICE*)

The *RICE* has defined as the terrestrial areas within 500 meters of littoral, under 10 meters of elevation above mean sea level, may potentially be subject to coastal erosion or flooding in the coming period of 100 years.

Step by step methodology



Step 1

the Ancona littoral has been divided in three Phisiografic Units, portions of coastline with homogeneus features:

N.1 Cape (Conero area)

N.2 Port (harbour area)

N.3 Alluvial plan

Step by step methodology

Step 2

Creation of Ancona RICE buffer: areas located within 500 meters from the coastline lying under 10 meters

Assessing Sensitivity

Once defined the area RICE buffer, the pressure indicators in relation with the current and expected future exposure to coastal erosion and flooding at local level are

- **Sea level rise – SLR (best estimate next 100 years)**
- **Shoreline evolution – TEV (erosion or accretion)**
- **Highest water level – HWL (increase level)**
- **Geo morphological coastal type – GEC (susceptibility to erosion)**
- **Elevation of near shore coastal zone - ARICE**
- **Coastal defence works systems – ODC (engineered frontage including protection structure)**

Assessing Sensitivity

The Sensitivity Coastal Index (ISC) has been calculated using the alghoritm listened below:

*ISC= SLR+TEV+HWL+GEC+ARice+ODC

The ISC Index represents the sum of points of pressure indicators calculating for every Phisiografic Unit at local level

Pressure scoring from 0 to 12

Assessing Sensitivity

ISC (Indice Sensitività)	Punteggio
UNITA FISIOGRAFICA PROMONTORIO	**5**
UNITA FISIOGRAFICA PORTO:	**3**
UNITA FISIOGRAFICA PIANURA	**6**

The three physiographic units are characterized by an high index of coastal sensitivity, due to their morphological characteristics.

For the No. 2 - Port Unit, the value of sensitivity is due to the engineerred frontage.

The elevated value of the No.3 unit – alluvial plan - are function of the greater tendency to erosion and the widespread presence in the area of coastal protection systems. The presence of coastal defense systems confirms the level of instability and fragility of these areas already characterized by intense erosion.

Assessing Vulnerability

The Vulnerability Index (IVC) has been calculated using the algorithm

IVC= P Rice+ U Rice + E Rice +U10km

measuring at local level the potential impact of erosion and flooding through impact indicators

IVC is express like sum of points of impact indicators calculating for every Phisiografic Unit.

Pressure scoring from 0 to 8 points

Assessing Vulnerability

The potential impact indicators

- **Population living within the RICE area (P RICE)**
- **% of coastal urbanisation and industrial areas in the *RICE* (U RICE)**
- **% of high ecological value areas in RICE (E RICE)**
- **% of urbanisation of coastal area in 10 Km (U10Km)**

Assessing Vulnerability

Indice di Vulnerabilità Costiera (IVC)	Punteggio
UNITA FISIOGRAFICA PROMONTORIO	**4**
UNITA FISIOGRAFICA PORTO:	**3**
UNITA FISIOGRAFICA PIANA ALLUVIONALE	**4**

For the No. 2 - Port unit, the value of vulnerability index is ***3*** for the presence of harbour infrastructures

The physiographic units Cape and Alluvial Plan show a value of IVC of ***4***

tied for the Cape, at the presence of high ecological value territories (Nature 2000 Network)

for the Alluvial Plan according to the high urbanization and economic settlements index

Risk Assessment

Within the RICE area identified

the characterization of Coastal Risk, not only as a probability of occurrence of harmful events to humans and environment, but as a parameter, according to the following equation:

$$RC = ISC * IVC$$

RC: Coastal Risk
ISC: Sensitivity Coastal Index
IVC: Vulnerability Coastal Index

Risk Assessment

The result of the previous equation don't express numerically the expected damage, but it is a quantitative assessment of the presence of causal factors of events at potential risks for the coast at local level for every Ph Unit

UNITA FISIOGRAFICA	VALORE RISCHIO COSTIERO NORMALIZZATO (IRCN)	CLASSE
Promontorio	20.8	Rischio medio
Porto	9.4	Rischio medio basso
Pianura Alluvionale	25	Rischio medio

Risk Assessment

The data analyzes show that Ancona urban area is characterized by a medium risk in the North sector (the value *25* for the unit - Alluvial Plan) and how about 1093 hectares of municipality Ancona are at risk of erosion and flooding in the next 100 years !!!

THANKS FOR ATTENTION !!

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