2014 - 2020 Interreg V-A
Italy - Croatia CBC Programme
Call for proposal 2017 Standard+

iDEAL - DEcision support for Adaptation pLan

Priority Axis:Safety and resilience
Specific objective:2.1 - Improve the climate change monitoring and planning of adaptation measures tackling specific effects, in the cooperation area

WP3 DEFINITION AND MONITORING OF CLIMATE ADAPTATION PLANS
Activity 3.2 CLIMATE ADAPTATION PLANS

Climate Adaptation Plans
Municipality of Pesaro

Author: Municipality of Pesaro

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- iDEAL technical deliverable:
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1. INTRODUCTION

The iDEAL project overall objective is to support local public administrations to take appropriate decisions related to climate adaptation measures and to develop coherent and appropriate climate adaptation plans for both Croatian and Italian territories. This overall objective has been achieved through a shared process of knowledge construction and through the implementation of a common DSS-Decision Support System, developed by capitalizing the DSS created within the project TERRE (South-East Europe).

The DSS, specific for support Climate Adaptation Plans, defines scenarios, objectives and criteria following decision-makers' priorities and suggestions. The DSS is supported by a GIS-Geographic Information System to observe and manage the spatial processes to which the climate adaptation is linked.

Pesaro has already faced with climate change thematic, developing a SECAP (Sustainable Energy and Climate Action Plan, Covenant of Mayor) in 2019, as update of the original SEAP by 2012. With iDEAL Pesaro has deepen some specific issues and has had the opportunity to test new approach to define actions prioritization (DSS).

2. ANALYSIS

Pesaro is a medium town (95.000 inhabitants, 125 squared km) in Marche Region, in front of the Adriatic SEA and hugged by the hills to both the city's north (San Bartolo, a Regional Natural Park) and south, with mild climate year-round. Pesaro is the he second city for number of inhabitants of the region; the urban area is flat, developed along the main river Foglia, where live 80% of population.

The economy is based on craft and small and medium industries, particularly furniture as kitchen manufacturing and precision mechanics. Pesaro has made hospitality its vocation starting from nineteenth century and still growing, capturing the attention of guests of all types: those in search of uncrowded beaches, lovers of the arts, sports enthusiasts. Pesaro is also a historical centre with elegant streets that offer a particular town-atmosphere among palaces, museums, churches, fortresses, ancient and modern libraries.

Pesaro was dubbed "Cycling friend City" in recognition of its extensive network of bicycle paths and promotion of cycling. It is also known as "City of Music" as it is the birthplace of the composer Gioacchino Rossini. In 2015 the Italian Government applied for Pesaro to be declared a "Creative City" in UNESCO's World Heritage sites.

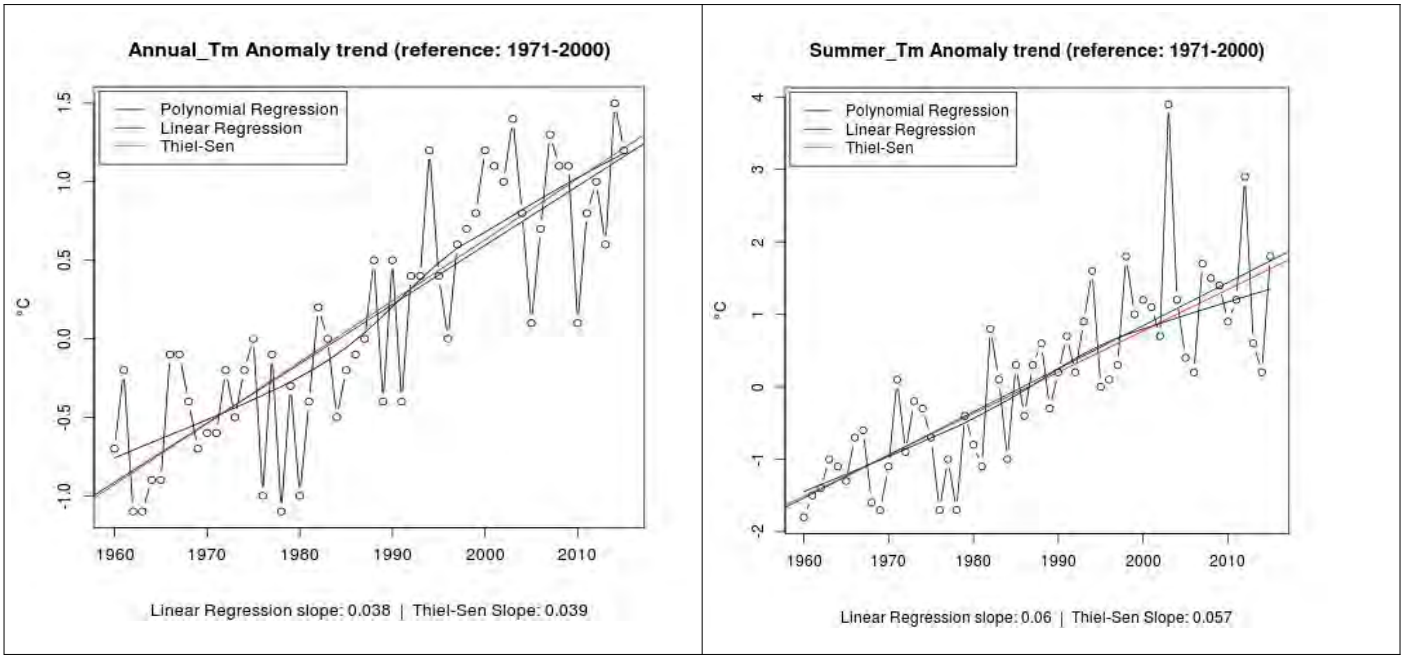
The local climate is considered to be Cfa (humid subtropical climate) according to the Köppen-Geiger climate classification. Based on results of Life SEC ADAPT Project (current baseline report[1]), the CLINO (mean climate 1971 – 2030) is show hereafter.

CLINO 1971 – 2000 Metereological Observatory Valerio Pesaro				
	Media PR	Media Tx	Media Tn	Media Tm
Winter	171.0	8.6	2.5	5.5
Spring	183.4	17.1	8.6	12.8
Summer	170.9	27.3	17.6	22.5
Autumn	264.1	18.4	11.0	14.7
Annual mean	789.4	17.8	9.9	13.9

The analysis of climate trend from 1961 to 2015 (data of the Meteorological Observatory Valerio), defined as anomalies compared to clima normal 1971 – 2000 (percentages for precipitation and difference for temperatures), shown the following result:

- Precipitation trend can't be approximated to a monotonic trend, due to it's high variability on time; anyway, precipitations seem to increase in all seasons, except for the summer season. The most significant percentage increase would seem verified in spring and winter, while moderate appears the decrease of precipitation in summer .
- Temperatures trend (as media, min and max) can be approximated to a monotonic trend. The thermal signal calculated as anomaly on CLINO 1971 - 2000, shows an increase for all seasons in the year, confirming a signal recognized at the Mediterranean basin level. The annual temperature increases vary between 0.033 °C for the min average and 0.045 °C for the max average, with an annual mean average about 0.04 C. Considering the entire period analysed (1960 - 2015), the increase of temperature varies between 1.8 ° C and 2.5 ° C, with an annual average about 2.2 °C.

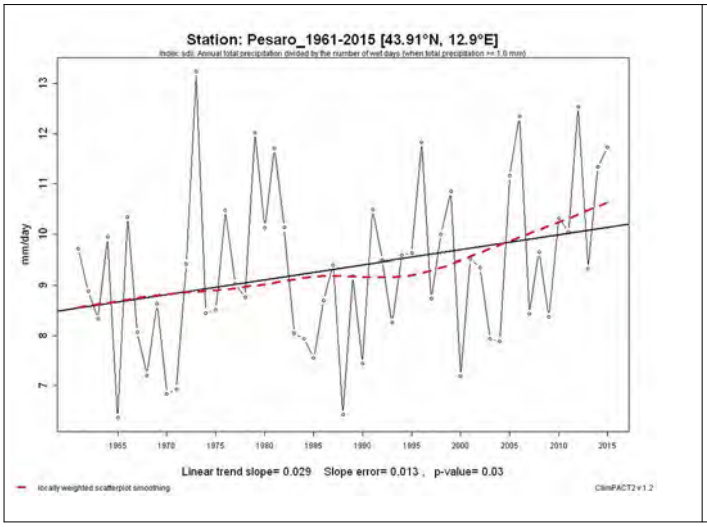
1 Link: http://www.lifesecadapt.eu/fileadmin/user_upload/ALLEGATI_LIFESECADAPT/EXCHANGE/A1_Working_teams_and_climate_baseline_assessment_definition/CLIMATE_BASELINE/italian_municipalities/Pesaro_baseline_report.pdf

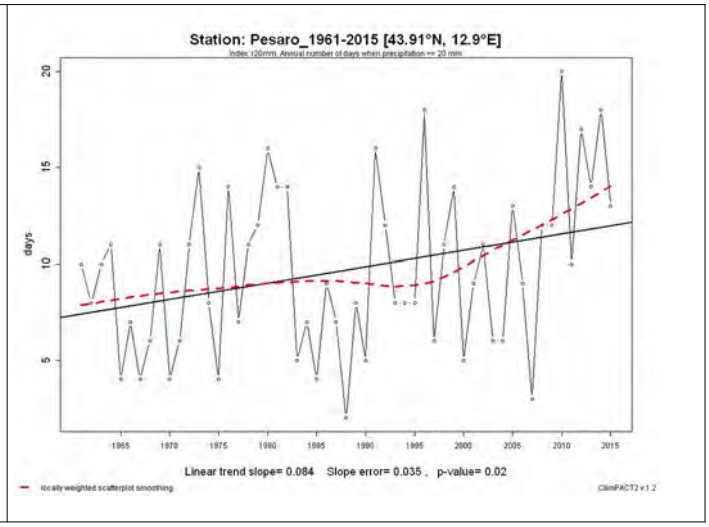


The analysis of climate extreme indices[2] from 1961 to 2015, compared to clima normal 1971 – 2000, shown the following result:

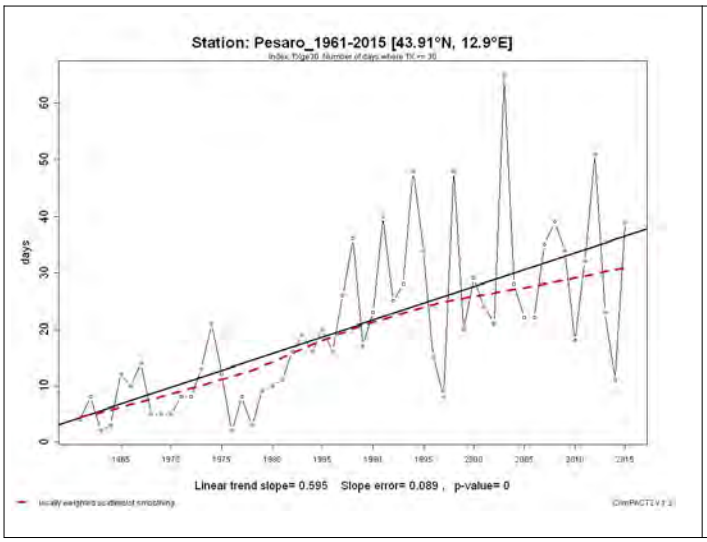
PRECIPITATION EXTREME INDEXIS: Even if variation of daily maximum precipitation (RX1day index) doesn't show well defined trends, the precipitation index very wet days (R95p) shows from the mid-2000s a growing trend of frequencies, similar to the Simple Daily Intensity Index (SDII) and the Very heavy precipitation days index (R20, precipitation> 20 mm). The Consecutive Dry Days index (CDD) does not show a clear trend, although it is slightly growing. Therefore it could be concluded that in the last two decades we can observe an intensification of the frequency of the precipitating events, even if not characterized by exceptional quantities of precipitation.

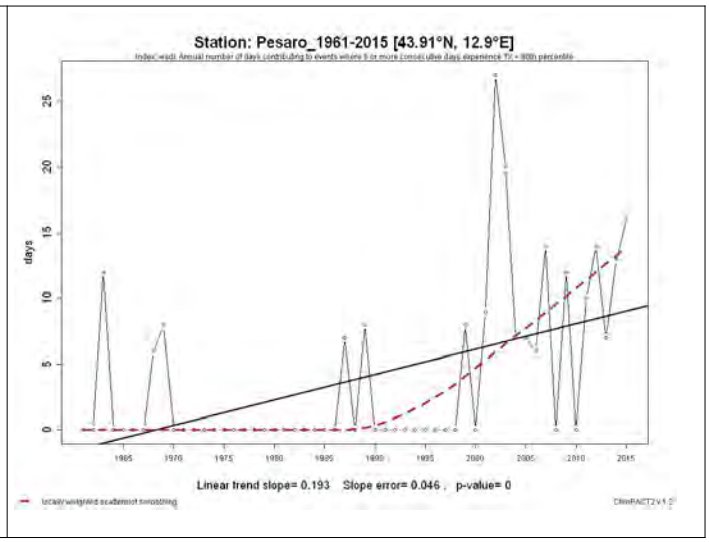
2 Climate extremes Indices, selected by the ET SCI core set of 34 indices defined by the WMO Commission for Climatology (CCl) Expert Team on Sector-specific Climate Indices)





TEMPERAURES EXTREME INDEXIS: The Frost Days Index (FD0) marks a tendency to decrease, a reduction of about 2 - 3 days every 10 years with minimum temperature <0 °C. More significant is the increase of tendency of hot days index (SU25), about 8 days every 10 years of days with maximum temperatures above 25 ° C. Also the Tropical Nights index (TR20), marks a rising trend about 6 every 10 years. Another interesting index is the Very Hot Days Index (SU30), days with a maximum temperature higher than 30 °C; from 1961 to 2015 Very Hot days have risen about 6 every 10 years, equal to 33 days in 55 years. Finally, the Warm Spell Duration Index (WSDI), that estimates the frequency of heat waves, shows as this index is quickly growing since the 90's.





3. PLANNING RECOGNICTION

Hereafter a list of plans, policies, strategies, projects or initiatives, developed and currently ongoing related to Climate Change that affect the local territory of Pesaro Municipality

	Decisionmaker (municipality, regional, state, UE, etc.)	**DD/Month/ YYYY** of implementation	**Name**	**Relation with CC**	**Typology** (plan, policy, strategy, action, tool, project, initiative)	**Condition** (compulsory or voluntary)
1	Italy	July 2017	Proposal National Adaptation Plan to CC	All	Plan	Voluntary
2	Marche Region	Date of plan proposal: 24/09/2018	Integrated Coastal Management Plan	Coastal erosion	Plan	Compulsory
3	Pesaro Municipality	14/11/2016	Adhesion to Covenant of Mayors for Climate and Energy	Climate strategy	strategy	Voluntary
4	Pesaro Municipality	Started 01/09/2015	LIFE SEC Adapt	Climate Adaptation strategy	Strategy/plan	Voluntary
5	Pesaro Municipality	12/05/2016	H2020 Empowering	Climate Mitigation Strategy	Strategy/plan	Voluntary
6	Local municipalities (included Pesaro)	From 2018	Foglia River Contract	water management	Plan	Voluntary
7	Pesaro Municipality	10/04/2019	SECAP	Climate strategy	Strategy/plan	Voluntary

4. SELECTION OF THE IMPACTS

4.1 Summary of the process that led the selection of the most relevant CC impacts

In order to develop an appropriate analysis for each different location, it was decided, in agreement with all partners to focus on 4 main climate change impacts (and related hazards) identified as the most relevant for the pilot areas.

The detection of the hazards and the potential impacts is based on two phases:

a) identification of a broader group of hazards and climate change impacts;

b) the selection of a narrower set of hazards and impacts that are considered to be more relevant for the pilot areas based on local expert's knowledge.

Hazards that contribute to climate change impacts that have been considered in this project are: increasing temperature; decreasing temperature; increasing extreme atmospheric events; increasing windstorms; increasing precipitations; decreasing precipitations; sea level rise. Each of these hazards, singularly or jointly, are considered to insist in different ways and with different intensity on certain macro-areas or sectors. Macro-areas that can be affected by climate change and that have been considered in this project are: agriculture; ecosystem & environment; energy; coastal areas; hydrology & water resources; socio-economic. For each sector, a set of impacts considered more relevant for the Adriatic Region have been identified (Table 1). The larger list of sectors and impacts listed in the following Table was largely drawn from the United States Environment Protection Agency guidelines (EPA, 2018).

Sector	Impacts
Agriculture	Variation in crop yield Variation in livestock production Increased irrigation demand
Hydrology and water resources	Increase of drought Increase of flooding Increased competition for water Increase of urban flooding
Coasts	Increased erosion Coastal flooding Damage to costal human infrastructures Damage to costal natural environments

Energy	Impacts on energy infrastructures (energy plants, etc) Increased energy demand for cooling
Socio-economic	Increased Urban Heat Island effect Impacts on weakest group of people Impacts on commercial activities Impacts on public services Impacts on industrial activities Impacts on transportation network Impacts on tourism sector
Ecosystems and environment	Loss of species Loss of habitat Increased forest fires Increase of invasive species and parasites
Other	Other

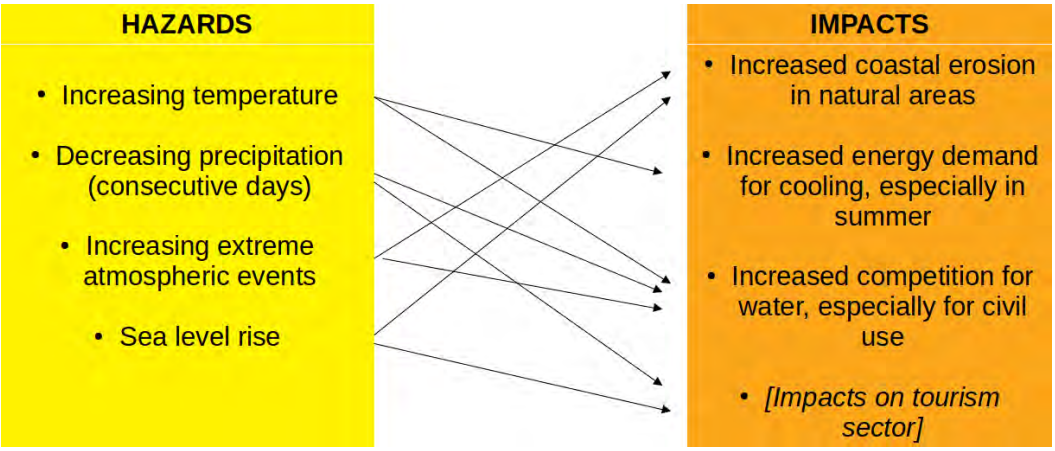
First list of climate change impacts from which the PPs are asked to choose.

Pesaro Municipality identified 4 main CC Impacts to deal with, considering also the results of the previous analysis on hazard realized with LIFE SEC ADAPT Project, in order to deepen some specific aspects of local territory.

The Hazard identified are (see Chapter 2):

- Increasing temperature, especially in summer
- Decreasing precipitation (consecutive days)
- Increasing extreme atmospheric events
- Sea level rise (not analyzed at local level but recognized by national studies)

The related Impacts, as hereafter showed, has been deepen with iDEAL respect some specific aspects: the coastal erosion has been deepen oin particulay respct to the natural areas, the enerny consumption in relation of summer heat waves, the consumption of water for civil use, and finally – as an indirect impact – the possible effect on an economic sector, the tourism.



4.2 Summary and description of the decision-makers and stakeholders identified

Pesaro identified a specific list of stakeholders and decision makers according to the iDEAL strategy approach, as hereafter illustrated.

LIST of DECISION MAKER:

First Name	Claudio
Last Name	Zabaglia
Office/Authority	marche region
Position/role	Ufficio Biodiversità e Rete Ecologica regionale
Power description	The ecological Network of Marche Region (REM) identifies along coastline of Pesaro (low cosat and high coast which is the San Bartolo Park) several area of interest (SIC and ZPS
Resource description	http://www.regione.marche.it/Regione-Utile/Ambiente/Rete-Ecologica-Marche-REM
Hazard/impact	coastal erosion

First Name	Luigi
Last Name	Diotallevi
Office/Authority	Marche Region
Position/role	Paesaggio Territorio Urbanistica Genio Civile / Difesa della costa
Power description	new ICZM 2018 - PIANO DI GESTIONE INTEGRATA DELLE ZONE COSTIERE, defines the area affected by sea flood, and new criteria of management of the local plan, as limitation of soil consumption (art 8 Meditterranean convention)
Resource description	http://www.regione.marche.it/Regione-Utile/Paesaggio-Territorio-Urbanistica-Genio-Civile/Difesa-della-costa
Hazard/impact	coastal erosion

First Name	Michele
Last Name	Ranocchi
Office/Authority	Assemblea di Ambito territoriale ottimale (AAto) n. 1 "Marche Nord – Pesaro e Urbino
Position/role	Director
Power description	gestione dei Servizi idrici nell'Ambito Ottimale
Resource description	http://www.ato1acqua.marche.it/atomarchen1/hh/index.php
Hazard/impact	Increased competition for water

First Name	Ignazio
Last Name	Pucci
Office/Authority	Marche Region
Position/role	Tourism
Power description	Osservatorio regionale del turismo
Resource description	http://www.regione.marche.it/Entra-in-Regione/Struttura-Regionale?StrutturaCode=5396
Hazard/impact	Impacts on tourism sector

First Name	Annarita
Last Name	Santilli
Office/Authority	Pesaro Municipality
Position/role	Energy Manager - Environmental office
Power description	http://www.comune.pesaro.pu.it/ambiente/
Resource description	
Hazard/impact	Increased energy demand for cooling, Increased competition for water

First Name	Mauro
Last Name	Moretti
Office/Authority	Pesaro Municipality
Position/role	Urban planning office
Power description	Planning department,
Resource description	http://www.comune.pesaro.pu.it/urbanistica/
Hazard/impact	Increased energy demand for cooling, Increased competition for water, coastal erosion

LIST of STAKEHOLDERS:

Name/Organization	Parco san bartolo - direttore e presidente
Interests	main natural area of Pesaro, a high cliff area in front the sea that interest half coastline of pesaro, important also for turism
Relations with others	Pesaro city, region Ufficio Biodiversità e Rete Ecologica regionale, environmental associations
Resource description	http://www.parcosanbartolo.it/
Hazard/impact	coast - tourism

Name/Organization	APA (associazione pesarese albergatori)
Relations with others	Pesaro City, Marche region - tourism, sea bath structures
Resource description	main hotels in pesaro are along coastline
Hazard/impact	coast - tourism

Name/Organization	environmental associations: legambiente, lupus in fabula, wwf, sentinelle dell'energia, lipu
Relations with others	Pesaro, Parco San bartolo, AATO1, Marche Region
Hazard/impact	Increased competition for water, Increased erosion, Increased energy demand for cooling

Name/Organization	sea bath structures associations (associazioni bagnini) "baia - levante - ponente - sottomonte"
Relations with others	Pesaro, APA, Marche Region Touris , Marche Region Coast Defence
Hazard/impact	coast – tourism

Name/Organization	professional associations (architects engineers, etc)
Relations with others	Pesaro, Marche Region Touris , Marche Region Coast Defence
Hazard/impact	Increased energy demand for cooling, Increased competition for water, coastal erosion

4.3 Results of the interviews

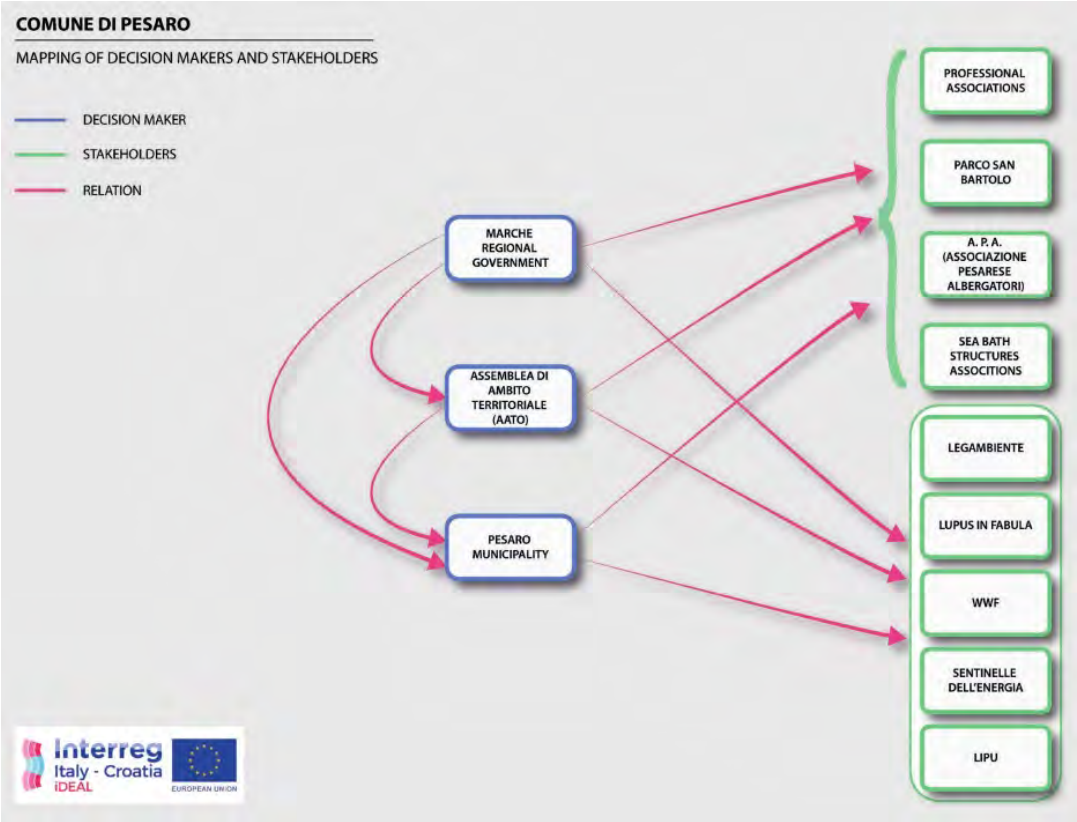
In order to have a clear vision of what is the governance system for each project area, it has been proposed an interview module that each PP spread through its network.

Hazards, macro-areas and specific impacts have been organized in the format of a questionnaire. The questionnaire has been than submitted to local experts for each pilot areas. The local experts have been asked to complete the questionnaire indicating which hazard and (no more than 4) impacts are more relevant for their territories, also linking each selected impact to the most relevant hazards.

The questionnaire has been divided into two parts, the one dedicated to the stakeholders and the other to the decision makers. The differences between the questions posed to the one category and the other are related to the need of identifying the field of interest of each subject and in which way it is linked to the others.

Moreover, the interviewees were asked to describe also their inner resources and the main hazard/impact that they consider to be related to their activity.

The output of the process is the maps reported below, where are proposed the different hierarchy of governance. The governance map is used to describe the hierarchy of the governance system of each territory, and it is used inside this assessment to identify the decisionmakers and the stakeholders who have been asked to answer the questionnaires.



Pesaro's answers come from Stakeholders for the 44% and from Decisionmakers for the 56% . The survey reveals, in general, a high level awareness about territory exposure to Climate Change Impacts, and willingness to cooperate with others in order to find adaptation solutions.

.Pesaro's general selection of main impacts points out "Increased erosion" the most important one, then "Impacts on energy infrastructure" , "Increased energy demand for cooling" and, lastly,"Impacts on tourism sector" .

About the indicators importance, the most important one is related to environmental sector (while the others have more oe less the same importance).

The main environmental indicators highlighted are (in order): Coastal erosion, Water Consumption, Habitat Maintainance.

For more dettails see the project deliverable *WP 4 – 4.1.2 A report on selected indicators - Assessment tools and approaches.*

5. METHODOLOGY

5.1 Methodology and the data sheets

Based on the results from the first round of climate change impacts identification, the methodology of data selection and collection activities were initiated. All Project Partners (PPs) were asked to provide data and information that were considered necessary in order to proceed with the development of the risk and vulnerability assessment.

Data and information requested were specific for each areas and they were a consequence of the impacts identified. Data requested to each partner vary from climate data (e.g. historical series of precipitation and temperature), to cartographic data to be used in GIS environment (e.g. shape files of buildings, transport networks, land use, hydrology, etc…). The vulnerability and risk assessment are meant to be based on a GIS environment in which vulnerability and risk are geographically spatialised and visible in a set of maps. However, this is not possible for those impacts that are not possible to link to specific geographic areas.

The bulk of data and information that were initially considered useful for the analysis and that were therefore requested to the PPs were:

- DSM (Digital Surface Model) and/or
- DTM (Digital Terrain Model) (raster)
- Land Cover (.SHP)
- Land Use (.SHP)
- Protected Areas, ZPS, SIC (.SHP)
- Soil Type and geological map (.SHP)
- Administrative unit boundaries (.SHP)
- Population census data (.SHP, DATA)
- Buildings and infrastructures (street and railway, etc.) (.SHP)
- Slow mobility network
- Hydrology map (.SHP)
- Beach Nourishment Plan (.SHP, DATA)
- Cadastral data (commercial tourism activities, residential etc.) (.SHP)
- Cultural and Natural Heritage
- Tourist numbers data
- Tourist infrastructures and buildings (.SHP)
- Water consumption by sector (as detailed as possible)
- Energy Performance Certificate for Building
- Agriculture typology map
- Daily Precipitation and temperature data 1990 – 2017

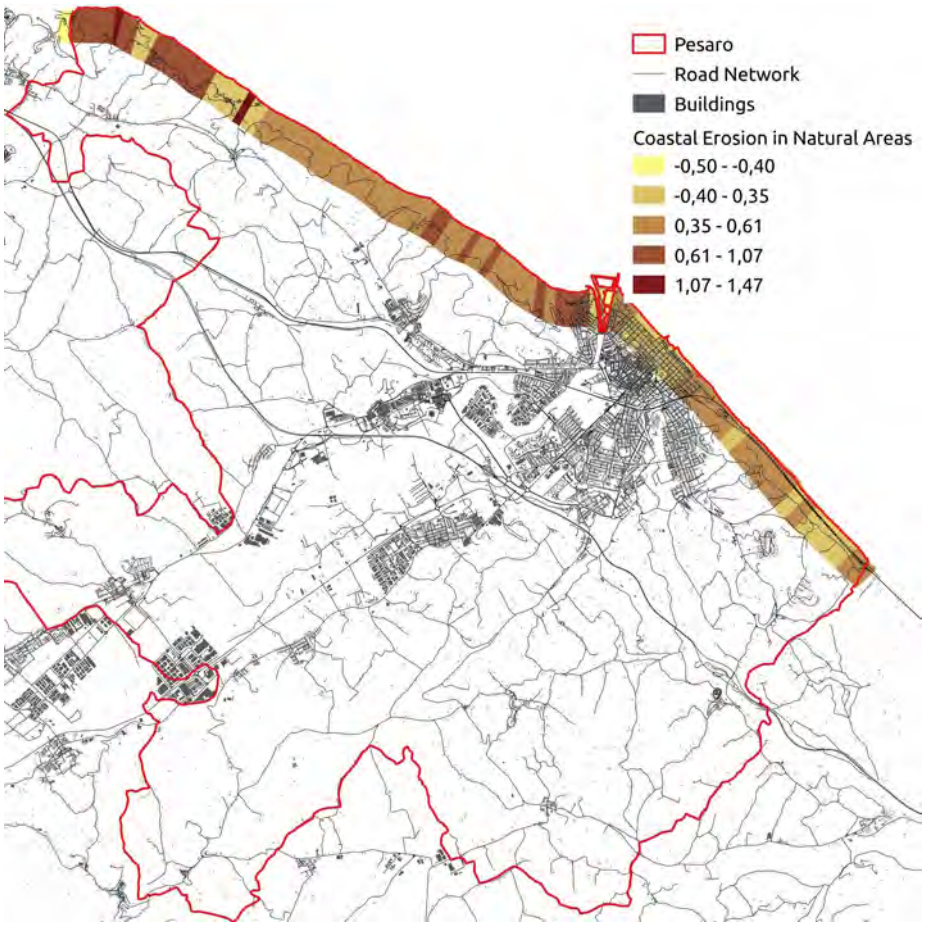
After this phase of data selection and collection some first challenges emerged particularly in the case of the Croatian pilot areas. In some cases, data required were not available in GIS file format or they were not

available at all. The impacts that would be possible to analyze were then reconsidered and discussed with PPs

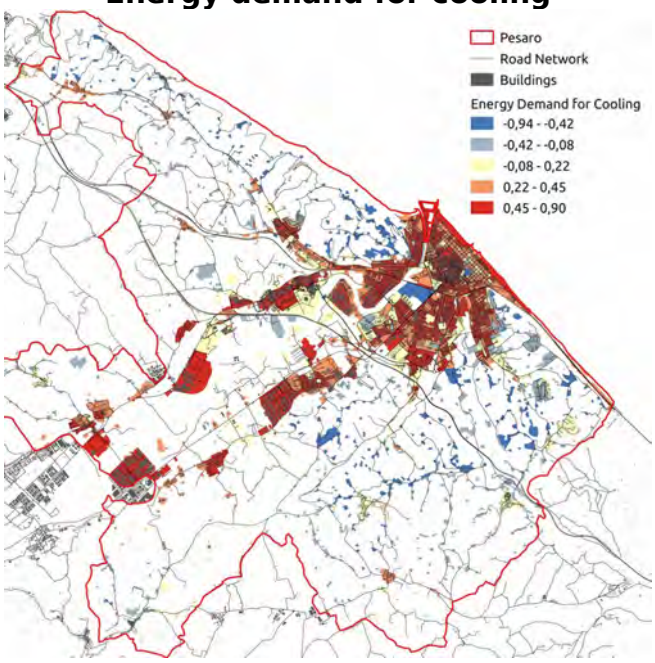
For Pesaro, the data has been available by the Municipality departments and the main decision makers engaged, also as results of previous analysis realized with other projects (as LIFE SEC ADAPT). A dettail of the data analyzed, and the impact GIS Maps produced, are available in the project deliverable W*P 3 – 3.1 CLIMATE VULNERABILITY AND RISK ANALYSIS*

Hereafter the main maps realized, related the the main CC impact selected (see chapter 4.1):

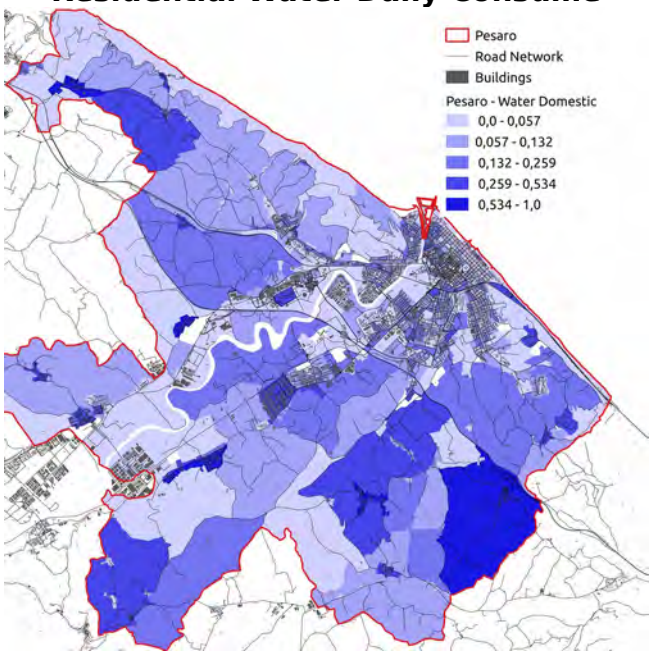
Coastal erosion in natural areas



Energy demand for cooling



Residential Water Daily Consume



5.2 Indicators for action evaluation (DSS)

From the indicators presented in the project TERRE, 25 of them were selected to describe the territories and the necessities of each Project Partner. Maintaining the same "aspects" described in the previous deliverable, here are reported the unity of measurement and the indicators chosen after the meeting that took place in Ostuni /Pesaro) on the projects meeting. The evaluation of each indicator was made in relationship with the four tailored impacts selected by each PP.

Thus, through the inteviews proposed to the stakeholders and the decisionmakers, a further weighing has been made with the purpose to adjust the DSS. This elaboration will allow the project partner to use their tailored decision support system to analyze the validity - and the performances - of the adaptation measures that they would use to cope with the climate change effects.

According to the result of the survey of decision makers and stakeholders, and the availability of data as well, Pesaro selected its own set of indicators, as shown hereafter. The unit of measurements of the indicators with suffix " * " has been adapted considering the local data avialable.

In particular the possible effect of "Uhi reduction" will be assessed as indirect effect of tree cover increase increase, "Energy use reduction" as direct reduction of energy consumption per year, and the others indicators by a qualitative approach.

Aspect	Indicator	Unit of measurement	Choosen by Pesaro
A. Environmental	Soil coastal erosion	m^2	**x**
	Soil drought	m^2	
	Impermeability ratio	m^2	
	Flooding area	m^2	
	Collected rain water	m^3/year	
	Reused water	m3/year	**x**
	Water consumption	m3/year	**x**
	Habitat maintenance	m2	**x**

Aspect	Indicator	Unit of measurement	Choosen by Pesaro
	Uhi reduction *	% tree canopy density	x
	Energy use reduction *	Mwh/year	x
B. Social	People who will benefit from the actions n. Of people) *	low-medium-high	x
	Most vulnerable people who will benefit from the actions	n. Of people	
	New job created by the actions	n. Of job	
	Km - upgraded infrastructure	km	
	New infrastructure	km	
C. Economic	Implementation cost	€	x
	Management cost *	low-medium-high	x
	Revenues	€	
	Revenues distribution	n. of actors	
	Enterprises supported	n. of enterprises	
	New enterprises	n. of enterprises	
	Traditional crops	ton/year	
D. Legal, institutional and perceptional	Legal feasibility	low-medium-high	
	Required permits	n. of permits	
	Procedural time *	low-medium-high	x
	Life time	days	
	People acceptability	low-medium-high	
	Political acceptability	low-medium-high	

This set of indicators is connected to the set of impacts that each partner has identify. Below are proposed the four group of impacts selected for each of the partner.

Pilot area	Impacts
Misano Adriatico	Increased coastal erosion
	Increased energy demand for cooling
	Impacts on transportation network
	Impacts on tourism sector
Pesaro	Increased competition for water
	Increased coastal erosion in natural areas
	Increased energy demand for cooling
	Impacts on tourism sector
Parco delle Dune Costiere	Variation in crop yield
	Increase of drought
	Increased coastal erosion
	Loss of habitat
Dubrov nik	Urban heat Island
	Urban flooding
	Sea level rise
Rovinj, Vrsar, Poreč	Urban heat Island
	Urban flooding
	Sea level rise

Ultimate list of impacts for each pilot area

6. ACTIONS

6.1 Development of actions packages

In this chapter is presented the final list of the actions identified by Pesaro, containings all specific information needed to be applied in the DSS.

ACTION EVALUATION: n° 1:

TITLE	*Greening brownfield area / Nature-based Solutions*	**CENSUS AREAS**	*n° 269*
GENERAL DESCRIPTION	The action concerns the construction of a green area in the "EX AMGA" area located in Via Morosini 12, subject to a environmental remediation procedure Originally the area was interested by a building intervention; during the start-up of excavation, some settling tanks (which had been cemented and buried underground for a long time, related to a previous activity of gas production from coal distillation in the '60) have been accidentally broken. In 2010, the safety procedure was activated through the pumping and treatment (pump & treat) of groundwater. Following the first reclamation interventions (emptying and demolition of the tanks, excavation and removal of contaminated soil, etc.), the procedure concludes with the unsuitability of the area to host residential buildings, and the need to continue with reclamation with bioremediation techniques. The new vegetation planting, in particular of new trees, will contribute to the more general environmental mitigation also in bioclimatic terms of the area, in which residences and commercial activities are present in the nearing. The usability of the area will initially be limited by a elevated pedestrian walkway; following the monitoring results, other forms of direct use will be evaluated.		
TECHNICAL INFORMATION	The preliminary proposal of remediation through bioremediation (biostimulation and bioaugmentation) , presented at the beginning of 2019, foreseen the development of		

a green area .

The plant of new vegetation (trees, shrubs and herbaceous) is functional to the increase of the microbial flora able to degrade soil contaminants. Indigenous species (eg poplars, ash trees) will be used with proven applicability in the field of phytotherapy.

For the groundwater the Pump & Treat system will be coupled with the phyto-purification and the purified water will be conveyed to a biolaghetto, which will house purifying aquatic plants and fish specialized in mosquito control.

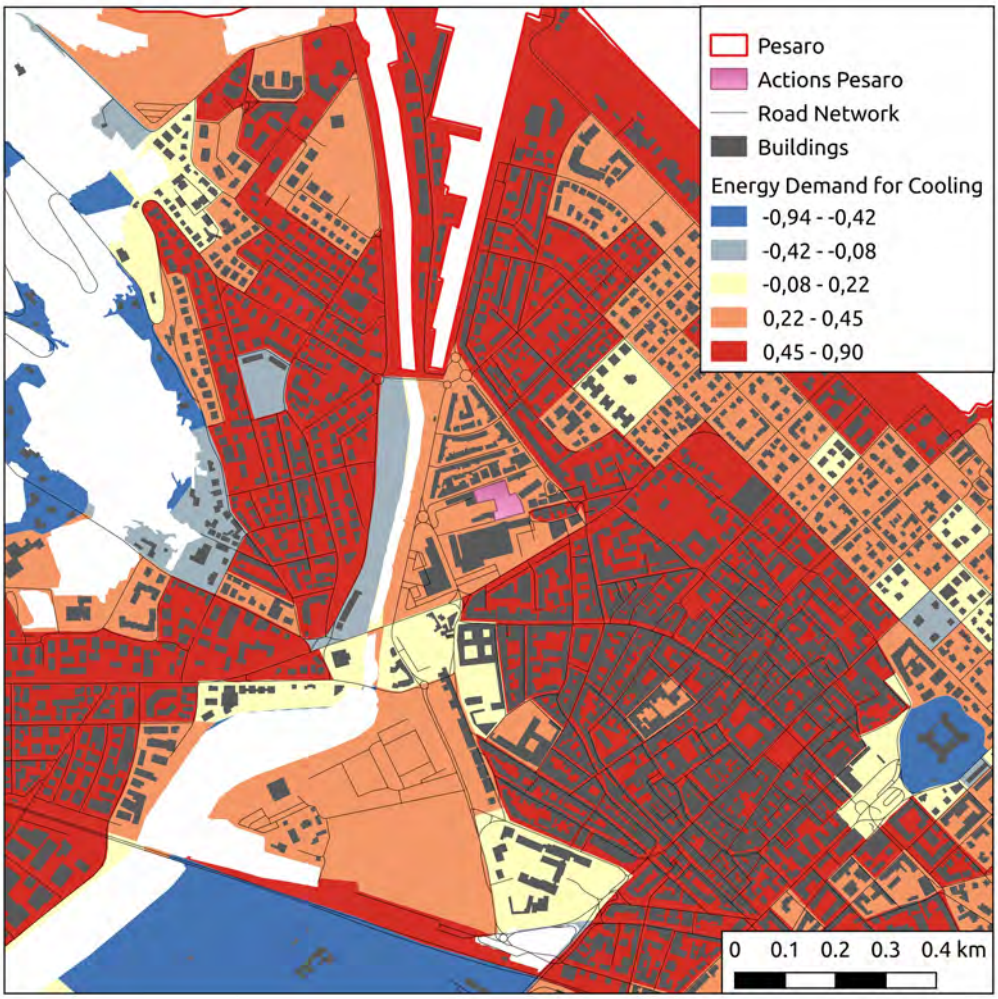
With regard to greening, the planting of 147 first- size trees, 90 second-size trees, 83 shrubs and 375 perennial herbaceous species is planned .

KEYWORDS *#brownfield restoration, #heat stress, #Nature-based Solution*

LOCATION *Address via Morosini*

Area: 4.000 m^2

Geographic coordinates 331857.033, 4864460.847 *(WGS 84/UTM zone 33N)*

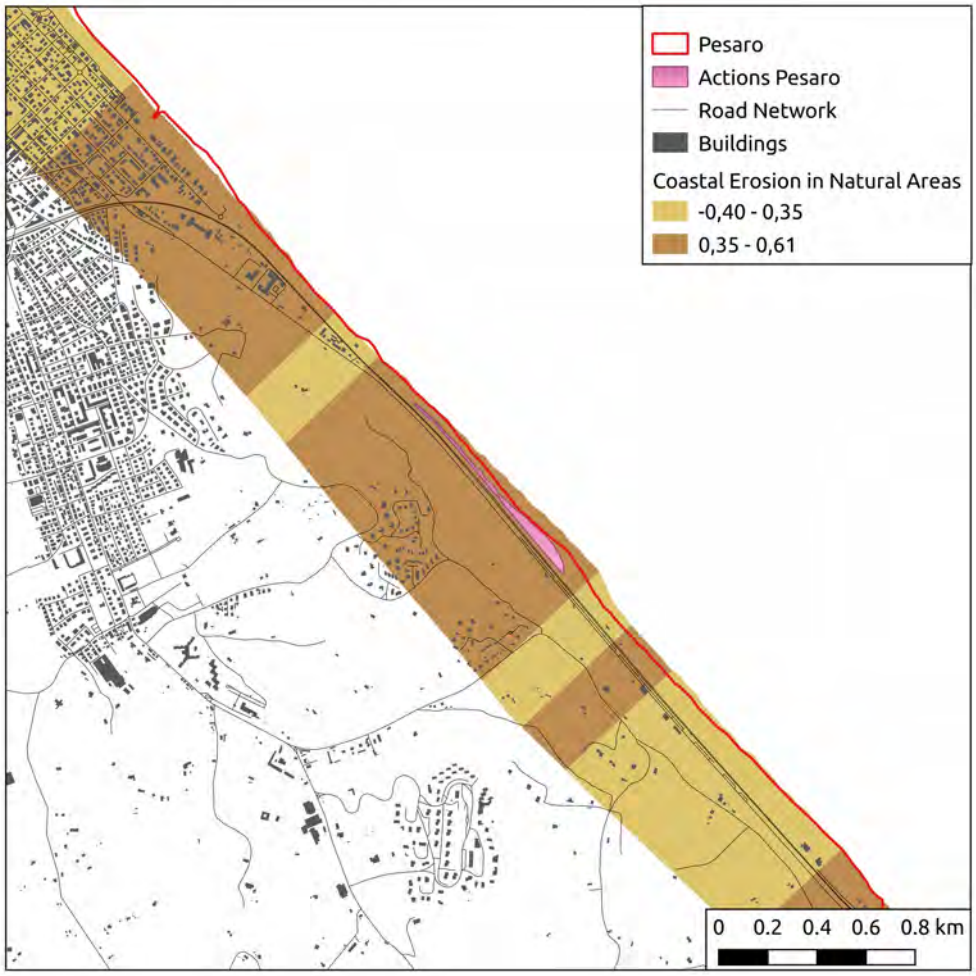
MERGE WITH VULNERABILITIES	
RELATED IMPACT THAT THE ACTION MITIGATES	*Energy demand for cooling*,
PROJECT INITIATOR/PROMOTER	*Pesaro Municipality – Environmental department*

STAKEHOLDERS INVOLVED	*ARPAM, Tuscia University*
BENEFICIARIES/ TARGET GROUP	*people, local inhabitant*
TIME OF START/IMPLEMENTATION	*From 2020 to 2021*
INDICATORS OF EVALUATION	
A-ENVIRONMENTAL	1. Soil coastal erosion: --- m2 2. Reused water: --- m3/year 3. Water consumption: --- m3/year 4. Habitat maintenance: 2000 mq 5. UHI reduction: 70% increase of trees canopy density 6. Energy use reduction: --- Mwh/year
B-SOCIAL	7. People who will benefit from the actions: low
C-ECONOMIC	8. Implementation cost; 300.000 € (first overall estimate of all remediation interventions through bioremediation) 9. Management cost: medium
D-LEGAL, INSTITUTIONAL & PERCEPTIONAL	10. Procedural time: medium

ACTION EVALUATION: n° 2:

TITLE	*Recovery dune coastal environment of "Area Sottomonte"*	**transect**	*n° 142-143-144-145*
GENERAL DESCRIPTION	This action aims to protect and encourage the development of a natural dunal environment, present in the past and nowadays disappeared along the Pesaro and Marche Region coasts, and at the same time limit the erosion of the beach. The presence of dune vegetation on the beaches limits storm erosion and effectively acts against wind transport, thus creating a natural recharge source of sediment for the beach. The intervention is therefore a *Natural Based Solution* able to increase the adaptive capacity of the coast compared to the expected increase of sea level and intensity of storm events. the area, inside a Natura 2000 Special Protection Areas (SPAs), in 2017 was classified as a floristic area ID 106 "Sotto il monte Ardizio". The dunal environment is characterized by the presence of the following habitats: annual vegetation of marine deposit lines and mobile embryonic dunes. It is one of the greatest area with this characteristic in Marche Region. To date, two initial interventions have been carried out in this area: laying walkways to avoid trampling and information signs relating to the floristic area.		
TECHNICAL INFORMATION	To ensure the recovery of the existing dunes, the following necessary steps are identified : **eradication** of invasive species, in order to ensure the ecosystemic rebalancing of the natural environment of the dune by favoring the recovery of native spontaneous vegetation. The eradication of the invasive species is to be carried out directly by hand or with suitable manual tools		

	planting dune species (in particular Ammophila Arenaria). Planting is preferable to seeding in order to avoid excessive irrigation and reduce time. The plant will have to guarantee a useful density for dune consolidation and development **protection** system . In the initial phase it is possible to create protection systems such as windbreak barriers in order to favor the establishment of the pioneer vegetation (to be evaluated during the final design phase) periodic **monitoring** of the entire system for two to three years, in order to control the engraftment of the plants planted
KEYWORDS	*#coastline defense*, *#Nature Based Solution*
LOCATION	*Area sottomonte Ardizio (along railway, SS16)* *Area: 20.000 m^2* *Geographic coordinates 334791.032, 4862409.236 (WGS 84/UTM zone 33N)*

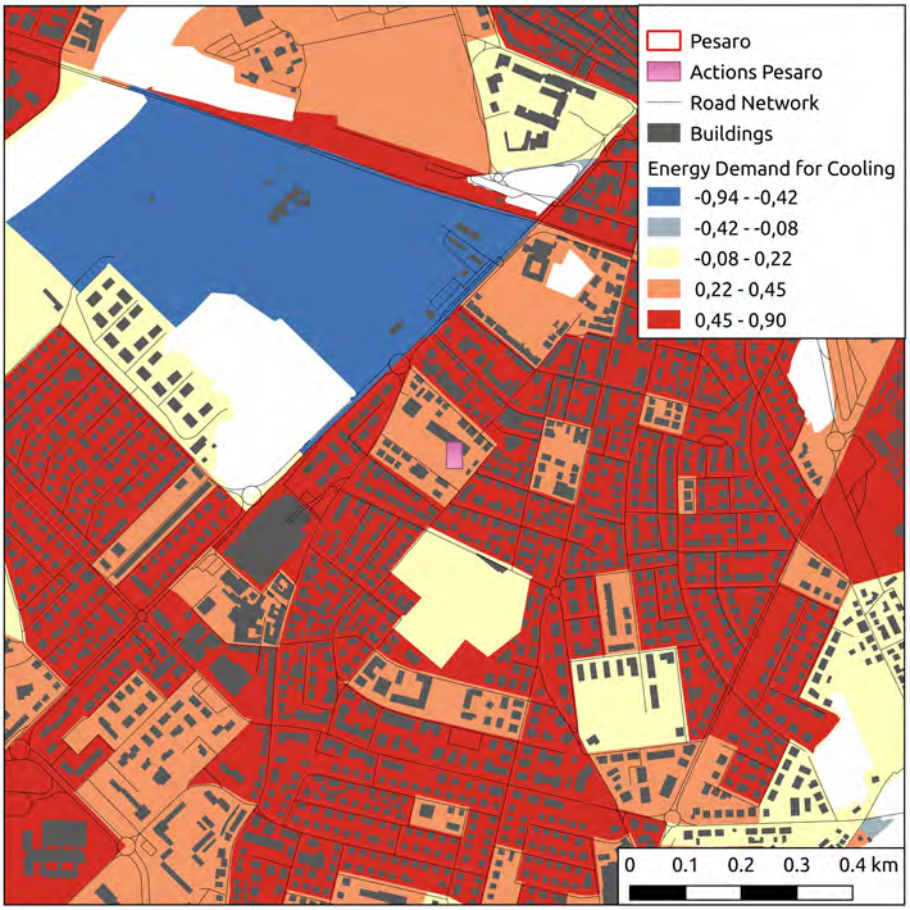
MERGE WITH VULNERABILITIES	
RELATED IMPACT THAT THE ACTION MITIGATES	*Coastal erosion in natural areas*
PROJECT INITIATOR/PROMOTER	*Pesaro Municipality – Environmental department*
STAKEHOLDERS INVOLVED	*local environmental associations, Centro ricerche botaniche-vegetazionali - Rete Natura 2000 - Aree protette (Provincia PU)*

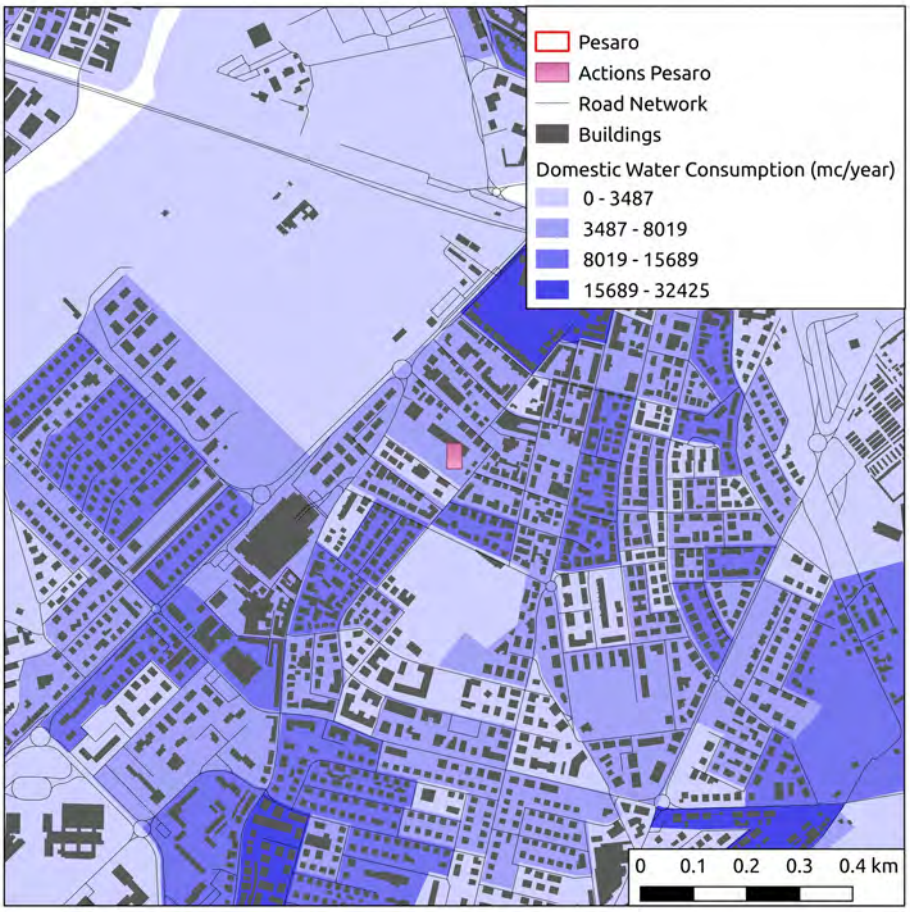
BENEFICIARIES/ TARGET GROUP	*tourists, inhabitants,*
TIME OF START/IMPLEMENTATION	*From 2020 to 2021*
INDICATORS OF EVALUATION	
A-ENVIRONMENTAL	*1)* Soil coastal erosion: 15.000 mq *2)* Reused water: --- m3/year *3)* Water consumption: --- m3/year *4)* Habitat maintenance: 20.000 mq *5)* Uhi reduction: --- *6)* Energy use reduction: --- Mwh/year
B-SOCIAL	*7)* People who will benefit from the actions: medium
C-ECONOMIC	*8)* Implementation cost; 10.000 € *9)* Management cost: low
D-LEGAL, INSTITUTIONAL & PERCEPTIONAL	*10)* Procedural time: low

ACTION EVALUATION: n° 3:

TITLE	*Implementation of a New school NZEB, with NbS.*	**CENSUS AREAS**	*n° 500*
GENERAL DESCRIPTION	The intervention consists of the creation of a school with high energy performance and reduced water consumption, classified as NZEB (Nearly Zero Energy Building). Of particular interest is the choice to build the envelope (transparent and opaque elements) with high thermal inertia in order to limit energy consumption in summer, also guaranteed by the green roof (sedum cladding), as well as the use of bioclimatic design in order to increase the positive gains in the winter period and limit the heat supply in the summer period. The green areas contribute to microclimatic mitigation, whose irrigation is guaranteed by the reuse of rainwater. The choice of a school building is also a model for the population, in particular for the younger generations, for the dissemination of good practices to be implemented in the local context.		
TECHNICAL INFORMATION	About energy performance, the building complies the NZEB criteria with an EP glnren equal to 33.60 kw / sqm, replacing a building with EP glnren of 169 kw / sqm. The winter air-conditioning system will be a floor radiant panel powered with low temperature water produced by modular heat pump units. Energy consumption from renewable sources is guaranteed by the photovoltaic system. Regarding water saving, a 50% saving in consumption is expected (compared to standard, expected saving 1974 mc of water); 100% saving of water for irrigation is expected thanks to the limitation of lawn areas in favor of bushes and shrubs with low water needs, and to **the rainwater collection tank** able to supply irrigation water even in the most drought summer periods . The extensive **green roof** in sedum has zero water requirement (excluding the first rooting period) The intervention is financed by GSE founding “Conto Termico”		

KEYWORDS	*#Water consumption reduction, #reuse rainwater, #decrease energy consumption, #NZEB*
LOCATION	*Address: via Lamaroma* *Area: 1346 m²* *Geographic coordinates 331779.474 4863092.840* *(WGS 84/UTM zone 33N)*
MERGE WITH VULNERABILITIES	





RELATED IMPACT THAT THE ACTION MITIGATES	*Energy demand for cooling, Water competition*
PROJECT INITIATOR/PROMOTER	*Pesaro Municipality – Nuove Opere department*
STAKEHOLDERS INVOLVED	*school, GSE*

BENEFICIARIES/ TARGET GROUP	*students, local inhabitants .*
TIME OF START/IMPLEMENTATION	*From 2019 to 2021*
INDICATORS OF EVALUATION	
A-ENVIRONMENTAL	1) Soil coastal erosion: --- m2 2) Reused water : 255 m3/year 3) Water consumption : 1974 m3/year (reduction) 4) Habitat maintenance: ---m2 5) Uhi reduction: --- 6) Energy use reduction: 244 Mwh/year
B-SOCIAL	7) People who will benefit from the actions: medium
C-ECONOMIC	8) Implementation cost: 3.000.000 (costo intera scuola NZEB) 9) Management cost : low
D-LEGAL, INSTITUTIONAL & PERCEPTIONAL	10) Procedural time : medium

ACTION EVALUATION: n° 4:

TITLE	*New residential Area*	**CENSUS AREAS**	*N° 1205, 1150*

GENERAL DESCRIPTION	The present action concerns the development of a new residential area in the Villa Ceccolini district, an intervention falling within a Detailed Plan of private initiative. The action promotes the recovery and reduction of water consumption, in particular through the reuse of rainwater for the irrigation system of the green area, and the development of the tree cover for the improvement of the local microclimate. About the hydraulic invariance of the area, there are channelling basins that act as hydraulic absorbers during heavy raining, holding temporarily the water flow intercepted on impermeable surfaces, thus avoiding overloads to the final receptors.
TECHNICAL INFORMATION	This Action provides the construction of resuse rainwater system, intercepting the rain from the roofs of buildings, and increasing the tree cover in the area able to improve the local microclimate the Plan foresees, within the land surfaces of the private lots, the installation of possible rainwater storage tanks. Regarding the development of greening, from the green project emerges an increase in trees of 104 first-class plants, 175 second-class plants, 93 third-class plants, plus 308 forest trees Pending the development of the final plan, the following indices are estimated: • Net surface residential area 17,256 sqm • Surface covered for rainwater collection: 7406 sqm

- total green areas 39.415 sqm; green irrigated area: 22600 sq.m.
- tree cover 21.209 sqm

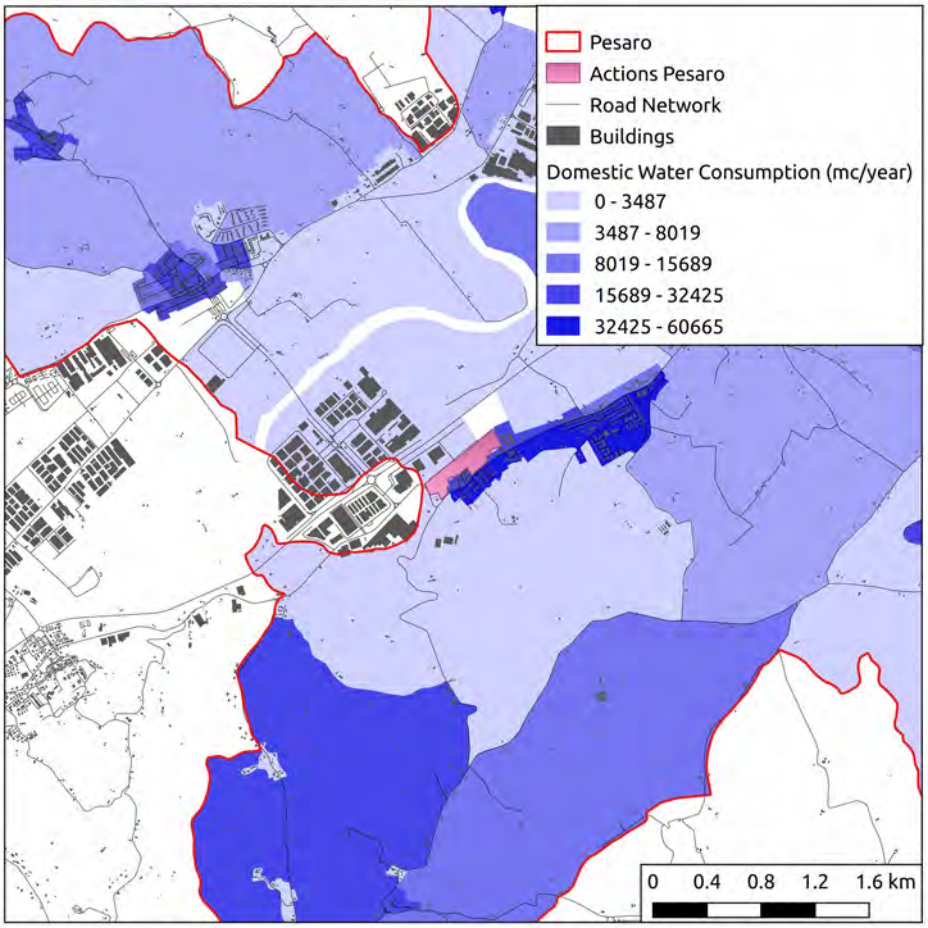
KEYWORDS *#Water consumption reduction, #reuse rainwater, #greening*

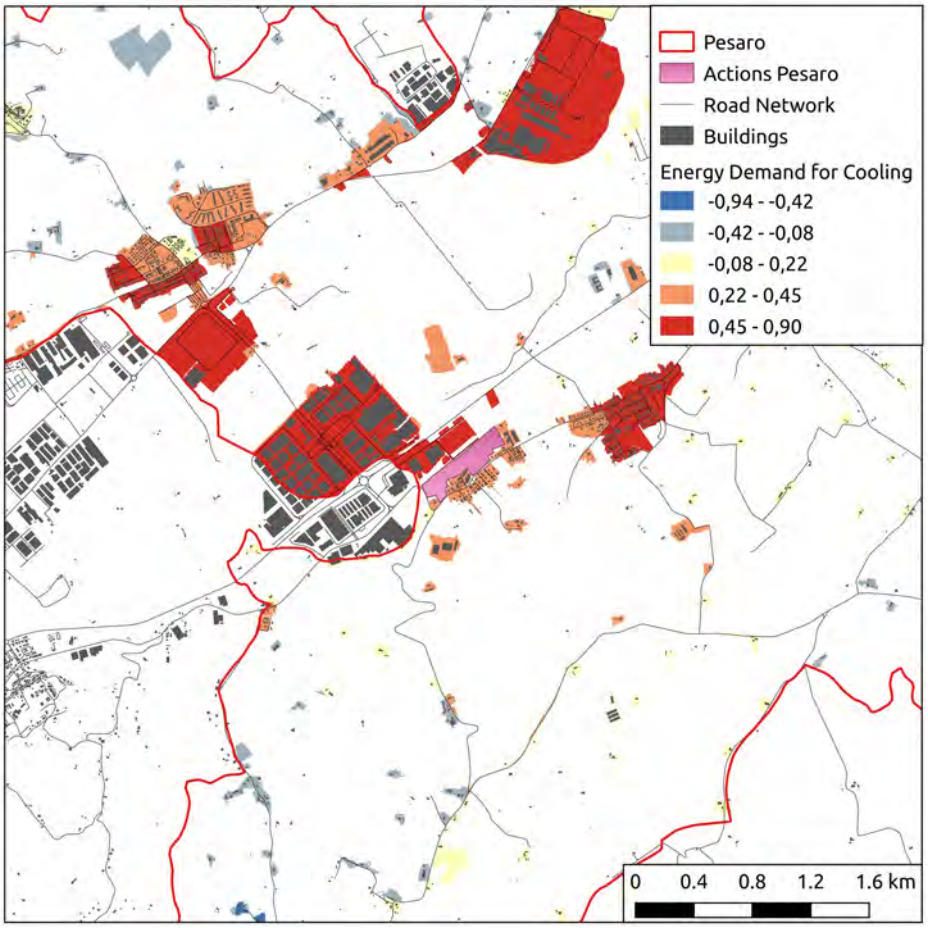
LOCATION *Address: Via Lago Maggiore, Villa Ceccolini*

Area: 82900 mq

Geographic coordinates 325308.429 4858928.878 *(WGS 84/UTM zone 33N)*

MERGE WITH VULNERABILITIES



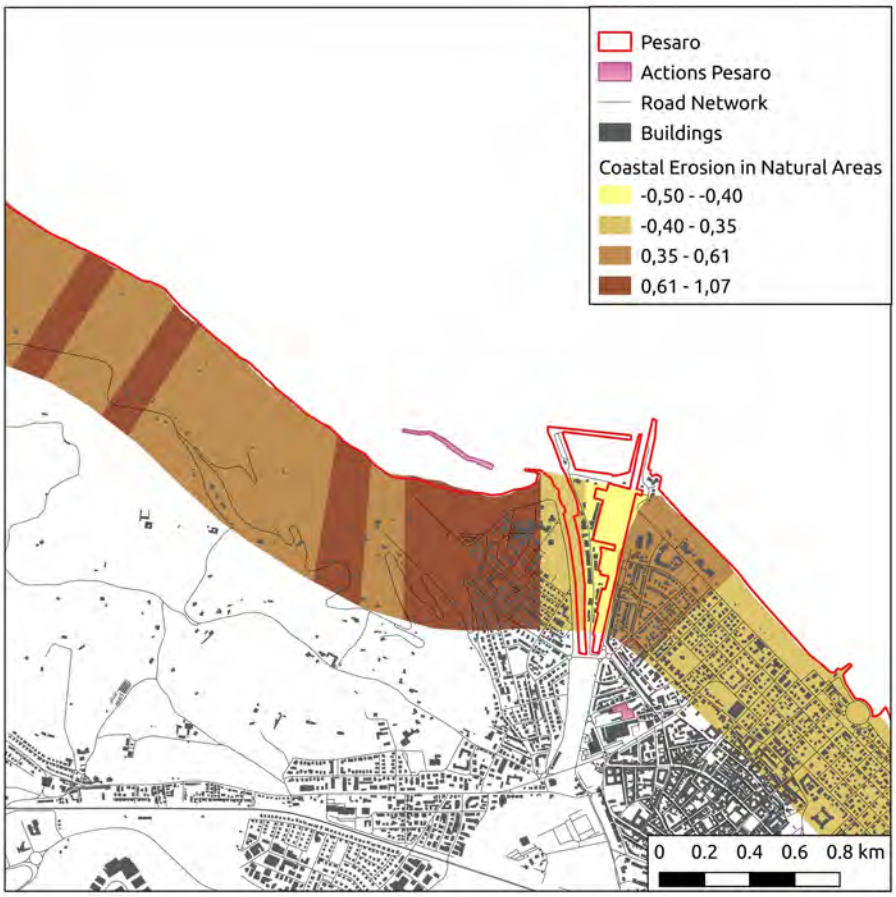


RELATED IMPACT THAT THE ACTION MITIGATES	*Water competition, Energy demand for cooling*
PROJECT INITIATOR/PROMOTER	*Pesaro Municipality – Servizio Urbanistica, private stakeholders*
STAKEHOLDERS INVOLVED	*: private stakeholders, private enterprise,*
BENEFICIARIES/TARGET	*Inhabintats,.*

GROUP		
TIME OF START/IMPLEMENTATION	From 2020 to 2030	
INDICATORS OF EVALUATION		
A-ENVIRONMENTAL	*1)*	Soil coastal erosion: ---m2
	2)	Reused water : 4520 m3/year
	3)	Water consumption: --- m3/year
	4)	Habitat maintenance: ---m2
	5)	UHI reduction: 54% increase of trees canopy density
	6)	Energy use reduction: --- Mwh/year
B-SOCIAL	*7)*	People who will benefit from the actions: high
C-ECONOMIC	*8)*	Implementation cost: --- €
	9)	Management cost : high
D-LEGAL, INSTITUTIONAL & PERCEPTIONAL	*10)*	Procedural time : high

ACTION EVALUATION: n° 5:

TITLE	*Restoring cliffs functionality*	**transetto**	*N° 105, 106, 107, 108, 109*
GENERAL DESCRIPTION	Although the coast of Pesaro is 70% protected by rigid works (emerged cliffs, submerged cliffs, brushes), most of these were built bwtween the 1960s - 1980s and their protective action has progressively decreased to date, due to insufficient resources for maintenance. The possible effects of expected climate changes, ie increase in the frequency and intensity of storm surges, associated with an increase of the sea level, will amplify the erosive effect on the coast. In this context it is strategic to plan and identify the necessary resources for the maintenance of rigid works. The municipality of Pesaro has activated several interventions of extraordinary maintenance in recent years, but has not yet intervened in the emerged cliffs of Baia Flaminia, which protect a stretch of beach (partly free) classified as Natura 2000 site.		
TECHNICAL INFORMATION	The emerged cliffs of Baia Flaminia were built in the late 1970s and reconfigured in 2007 with the addition of four new cliffs and the construction of a brush on the left bank at the mouth of the Foglia River. The north foranea cliff was replaced in 1992 by two submerged; another submerged is present southest of the four cliffs emerged. The planned intervention involves the realignment of 4 emerged cliffs (the further cliffs to the north and south are submerged) to protect the Baia Flaminia beach in order to restore the protective function on storm surges. This intervention is also identified as necessary by the regional ICZM plan (Integrated Management of Coastal Zones), even if not yet covered by regional financial resources.		

	Considering the total length of the intervention site, from transept 79 to transept 82, the lenght is equal to 0.64 km
KEYWORDS	*Protection coastal erosion*
LOCATION	*Address: Baia Flaminia* *Area: 43.000 mq (beach subtended by cliffs)* *Geographic coordinates 331070.420 4865639.864* *(WGS 84/UTM zone 33N)*
MERGE WITH VULNERABILITIES	
RELATED IMPACT THAT THE ACTION MITIGATES	*Coastal erosion in natural areas*

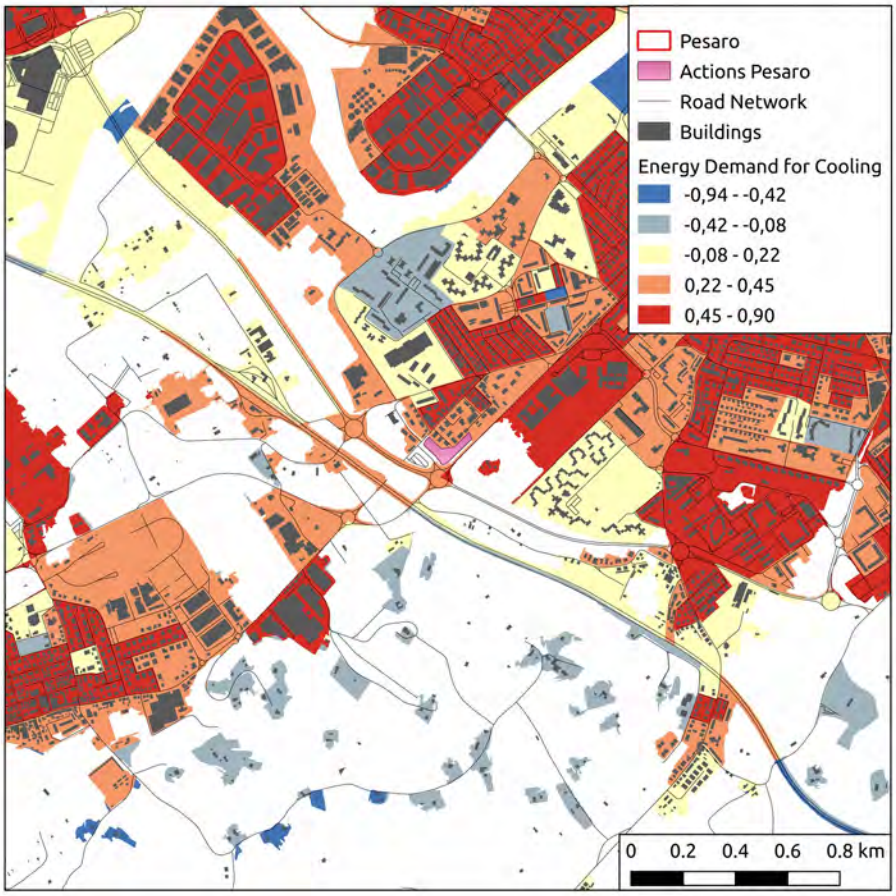
PROJECT INITIATOR/PROMOTER	*Marche Region – servizio difesa della costa*
STAKEHOLDERS INVOLVED	*Pesaro municipality,*
BENEFICIARIES/TARGET GROUP	*Inhabintats, tourist, stabilimenti balneari*
TIME OF START/IMPLEMENTATION	from 2021 to 2029
INDICATORS OF EVALUATION	
A-ENVIRONMENTAL	Soil coastal erosion: ---25000 m2 Reused water : --- m3/year Water consumption: ---m3/year Habitat maintenance: --- m2 UHI reduction: --- increase of trees canopy density Energy use reduction: --- Mwh/a
B-SOCIAL	People who will benefit from the actions: high
C-ECONOMIC	Implementation cost: 1.940.000 € (based on Regional ICZM plan cost parameters) Management cost: high
D-LEGAL, INSTITUTIONAL & PERCEPTIONAL	Procedural time: high

ACTION EVALUATION: n° 6:

TITLE	*Afforestation*	**CENSUS AREAS**	*N° 667*
GENERAL DESCRIPTION	The afforestation intervention is located near residential buildings in the neighborhood of Villa Sa Martino, contributing to the improvement of local microclimate. The intervention is part of the development of 19 hectares of wooded areas in the urban-perurban area, as compensatory action for the construction of the third lane of the Highway.		
TECHNICAL INFORMATION	The affected area, currently uncultivated, has a total area of about 8000 square meters and is located next to Solferino street, at the intersection with Pertini street In order to allow the implementation of the intervention, which will be borne by Autostrade SPA (including maintenance for the period of plants rooting), Pesaro Municipality realized a change of classification of the area - in the municipal Regulator Plan - applying the class "Woodland", thus constraining the area from possible future building increase. Waiting the final Afforestation Plan by Autostrade SPA, the trees canopy cover is estimated at 60%, considering the definition of the class "Woodland" of the municipal Regulator Plan (between 40 and 60% for "open" formation, and between 70 and 100%, for "closed" formation)		
KEYWORDS	*#Greening, #reduction heat stress, #natural cooling*		
LOCATION	Address: via Solferino, villa San Martino Area: 8000 mq		

	Geographic coordinates 331070.420 4865639.864 (WGS 84/UTM zone 33N)
MERGE WITH VULNERABILITIES	
RELATED IMPACT THAT THE ACTION MITIGATES	*Energy demand for cooling*
PROJECT INITIATOR/PROMOTER	*Pesaro Municipality – Servizio Pianificazione Urbanistica*
STAKEHOLDERS INVOLVED	*Autostrade SpA,*
BENEFICIARIES/TARGET GROUP	*Inhabintats*

TIME OF START/IMPLEMENTATION



From 2020 to 2021

INDICATORS OF EVALUATION

A-ENVIRONMENTAL

1) Soil coastal erosion: --- m2
2) Reused water: --- m3/year
3) Water consumption: --- m3/year
4) Habitat maintenance: 8000 mq
5) UHI reduction: 60% increase of trees canopy density

	6) Energy use reduction: --- Mwh/a
B-SOCIAL	*7)* People who will benefit from the actions: low
C-ECONOMIC	*8)* Implementation cost; --- €
	9) Management cost : low
D-LEGAL, INSTITUTIONAL & PERCEPTIONAL	*10)* Procedural time : low

6.2 DSS: action evaluation

iDeal project aims to support local public administrations to make appropriate decisions related to climate adaptation measures and to develop coherent and tailored climate adaptation plans for both Croatian and Italian territories.

This overall objective will be achieved through a shared process of knowledge construction and the implementation of a common Decision Support System. DSS is a system that can support decision-making activities. It is an interactive system able to analyze through different criteria a set of information and support an administration in the governance process, based on the datasheets and parameters (as weights) derived from the activity with decision makers and stakeholders.

The prevention, or at least reduction, of most diffuse effects of climate change affecting Italy-Croatia regions (overall extreme weather events, intensification of fires, drought, flooding, landslides) should be supported by a public sector better organized in the field of data and information available and their integrated elaboration in order to develop an awareness choice of policies - actions developed in the territory, and if these are effective with respect to the potential impacts of climate change.

Climate change adaptation, together with mitigation, is a long term effort that requires alternative makers with a Decision Support System enabling informed and knowledge-based decisions. Thus, into iDEAL a more informed decisions, based on data storage linked to geographical location, evaluation of different alternatives and scenarios as well as their different socio-economic impacts, will be allowed by the envisaged DSS.

Pesaro applied the DSS tool to the 6 actions, described in chapter 6.1, scoring the weigth of main objectives (that include the specific indicators) according to the results of the survey to decision makers and stakeholders:

OBJECTIVES	
name	*weight (b)*
A. Environmental aspect	0,4
B. Social Aspect	0,15
C. Economic Aspect	0,15
D. Legal, institutional and perceptional aspects	0,1
E. Adaptation, Mitigation and Resilience	0,2

With the same principle, the weight inside each group of indicators has been applied.

Finally for each indicators selected has been defined the min- max thresholds. While for qualitative indicator these are defined according to the min – max values of the range (eg 1 and 3), for the quantitative indicators the thresholds have been chosen by specific criteria.

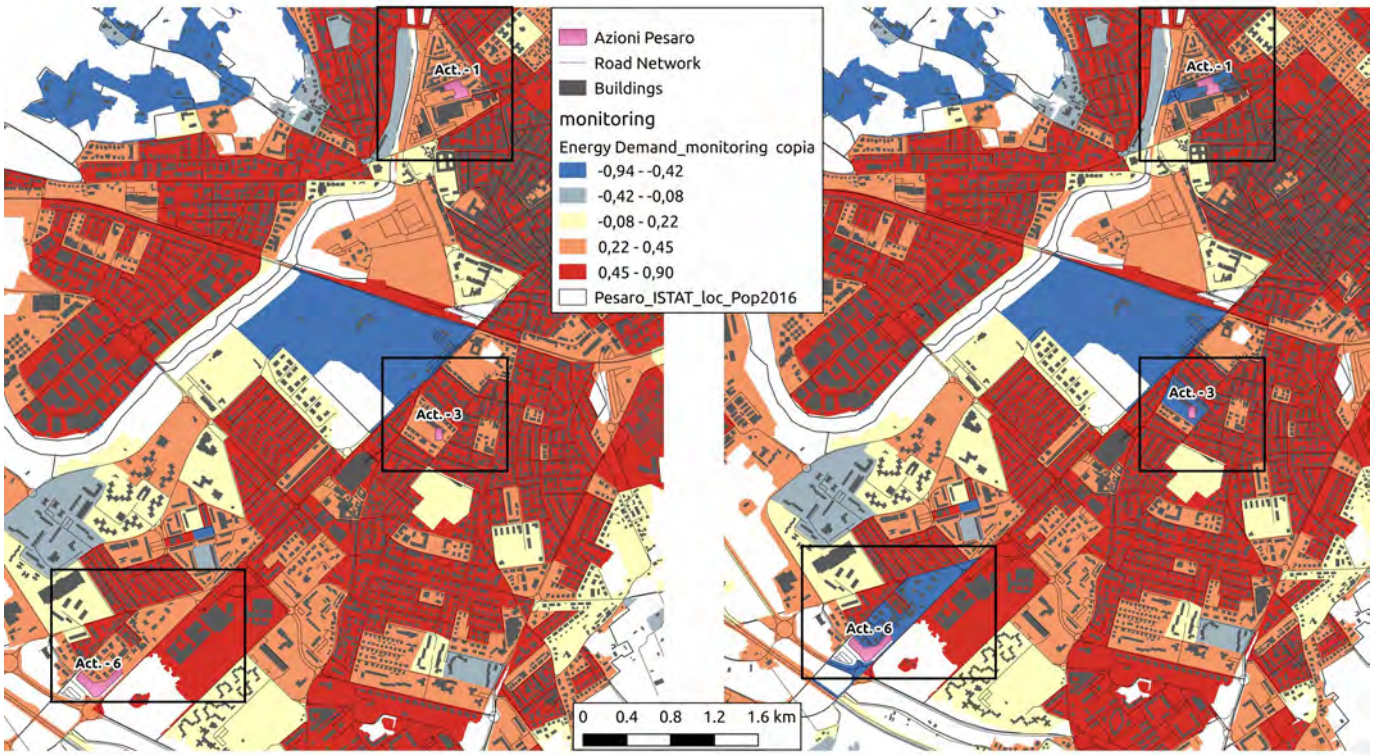
For example, indicators related to land extension, like “Soil coastal erosion ” or “Habitat maintenance”, the thresholds reflect the tipical dimension of possible interventions. For indicator “Uhi reduction”, measured as “% tree canopy density” (an indirect measure of the effect), thresholds are identified according to urban forest classification of the Local City Plan.

Hereafter the DSS tool apllied to one action:

ACTION 2:	Recovery dune coastal environment of Area Sottomonte		**Localization:**	142-145				**Result:**	GOOD	
OBJECTIVES			**CRITERIA**							
name	*weight (b)*	*result*	*name*	*unit of measure*	*function*	*threshold Min*	*threshold Max*	*weight (a)*	*data*	*result*
A. Environmental aspect	0,4	acceptable	A. 1 Soil coastal erosion	m2	to min	1000	100000	0,75	15000	acceptable
			A. 6 Reused water	m3/year	to max					
			A. 7 Water consumption	m3/year	to max					
			A. 8 Habitat maintenance	m2	to max	1000	100000	0,25	20000	acceptable
			A. 9 Uhi reduction	% tree canopy density	to max					
			A. 10 Energy use (reduction)	Mwh/year	to min					
B. Social Aspect	0,15	acceptable	B. 1 People who will benefit from the actions	low-medium-high [1/2/3]	to max	1	3	1	2	acceptable
C. Economic Aspect	0,15	good	C. 1 Implementation cost	€	to min	1	20000	0,5	10000	acceptable
			C. 2 Management cost	low-medium-high [1/2/3]	to min	1	3	0,5	1	good
D. Legal, institutional and perceptional aspects	0,1	good	D. 3 Procedural time	low-medium-high [1/2/3]	to min	1	3	1	1	good
E. Adaptation, Mitigation and Resilience	0,2	good	E. 1 The target of the Action is an area exposed to a Climate Change Impacts and its aim is to reduce the phenomenon.	Vulnerable/Not Vulnerable	yes/no	Not Vulnerable	Vulnerable	1	vulnerable	good

For each Action has been also realized an updating of the GIS vulnerability map in order to visualize the possible effect in case of realization of the action.

This approach could be useful to better explain to non – technical audience the effect of the action at local event, measured as reduction of vulnerability. Hereafter it's reported the variation of the vulnerability respect the item "Energy Demand" on case of realization of actons 1, 3, 6.

Variation of Vulnerability "Energy Demand" Action 1, 3, 6	
Vulnerability map – current status	Vulnerability map – possible positive effect of the action
	

6.3 Action selected for the implementation

The final result of DSS apllication show that all 6 actions reach the result “good”, understood as weighted mean of the evluation of each group of indicators aggregated respect to each objective. This can be explained considering that:

- the actions selected are very different from each other; this aspect made difficult to apply all the set of indicators to each action.
- All values fallen inside the thresholds, so the result “not acceptable” it’s never been reached.
- some indicators are qualitative and non quantitative; this aspect limit the range of different results (as the possibility to evaluate the indicators out of the thresholds).

As lesson learned, we can state that to reach a meaningful classification's difference, the DSS tool will better work if applied to similar actions and / or with a list of common indicators always applicable, better if quantitatives.

Objectives:	**ACTION**					
	1	2	3	4	5	6
A. Environmental aspect	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
B. Social Aspect	Acceptable	Acceptable	Acceptable	Good	Good	Acceptable
C. Economic Aspect	Acceptable	Good	Acceptable	Acceptable	Acceptable	Good
D. Legal, institutional and perceptional aspects	Acceptable	Good	Acceptable	Acceptable	Acceptable	Good
E. Adaptation, Mitigation and Resilience	Good	Good	Good	Good	Good	Good
Final result (weighted mean)	Good	Good	Good	Good	Good	Good

Anyway, looking with more attention the result reached through the DSS tool, we can appreciate that the result reached respect to each specific objective it's diffeferent among the actions. This means that the final decision maker has an instrument that can help to guide the choice.

The aim of a DSS Tool is mainly to understand how to prioritaize the inteventions, but the tool offers also the capability to understand - inside of specific circumnstances - which possible actions have better chance to be realized, considering their level to satisfy the objectives.

In case Decision Makers want to implement the social awareness related to climate change adaptation, the Action 4 and 5 can better reach this aim. In case of budget limitation or difficults related to procedural issues, actions 2 and 6 can became more affordable rather than delaying the implementation of other actions.

7. MONITORING SYSTEM

The monitoring systems are useful evaluation tools based on the effects foreseen by a specific project. These systems allow us to consider how the environmental variables vary based on what has been achieved. Moreover, the monitoring phases allow evaluating, from a quantitative point of view, the effectiveness of the single-action concerning the chosen impacts.

In the case of the iDEAL project, it was decided to provide the PPs with a monitoring system specific to their set of identified actions. This system can only be used after the partial or complete implementation of iDEAL actions. This phase helps the understanding of the results, as well as the achievement of the set objectives, through graphs that allow an immediate understanding by decision makers and stakeholders.

The monitoring system's principle is based on the same algorithms used in the GIS environment to provide the initial impact analysis, while the realization of an easy graphic interface was carried out in excel spreadsheets.

Hereafter it is reported, as example, the monitoring tool applied to one action.

WP4 - MONITORING implementation - Municipality of Pesaro

ACTION n° 1	TITLE:	Greening brownfield area/ Nature-based Solutions

RELATED IMPACT THAT THE ACTION MITIGATES	ENERGY DEMAND FOR COOLING

ID Census area	LST_mean	Vegetated surface	Impermeable surface
410440000269			

Index starting point	Index monitoring point
0,41	**0,23**