Torino 21 giugno 2017



Il clima cambia. Riduciamo i rischi.

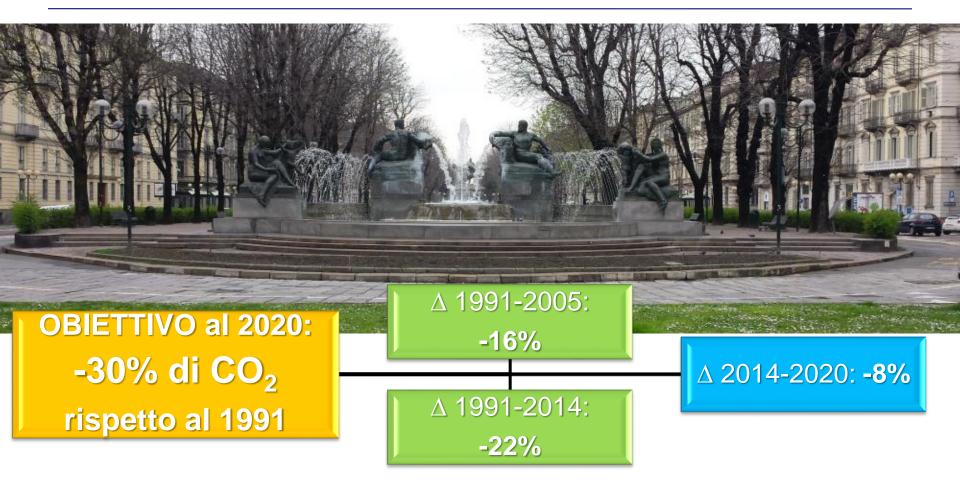
### **RESILIENT TORINO**

# Turin and Climate Change

### **Main Steps**



### Objectives and Results





### **Main Actions**





### Turin and Adaptation

### **Main Steps**



### New prospective



Presentato dal Commissario Miguel Arias Cañete come "la più vasta iniziativa urbana su clima ed energia al

**mondo**", il Patto dei Sindaci per il clima e l'energia vede coinvolte migliaia di autorità locali e regionali impegnate su base volontaria a raggiungere sul proprio territorio gli obiettivi UE per l'energia e il clima.

Con il loro impegno, i nuovi firmatari mirano a ridurre le emissioni di CO<sub>2</sub> di almeno il 40% entro il 2030 e ad adottare un approccio



### Life DERRIS





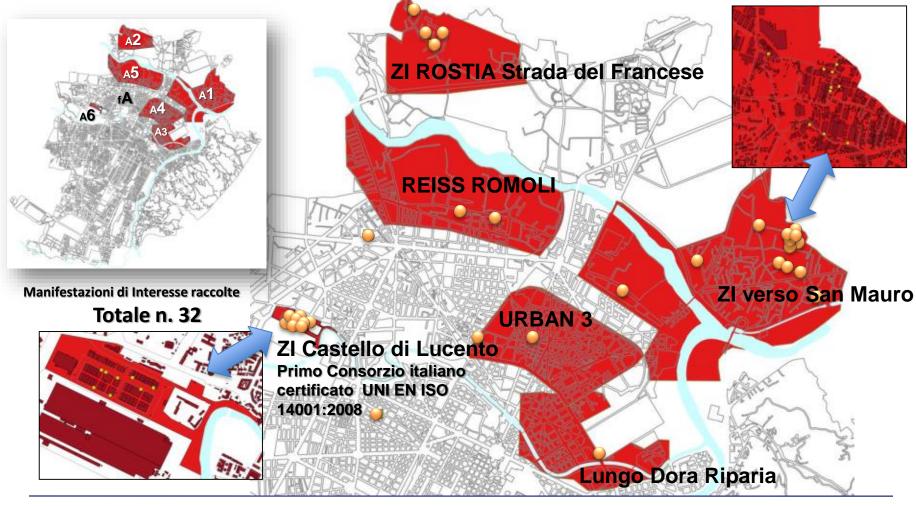






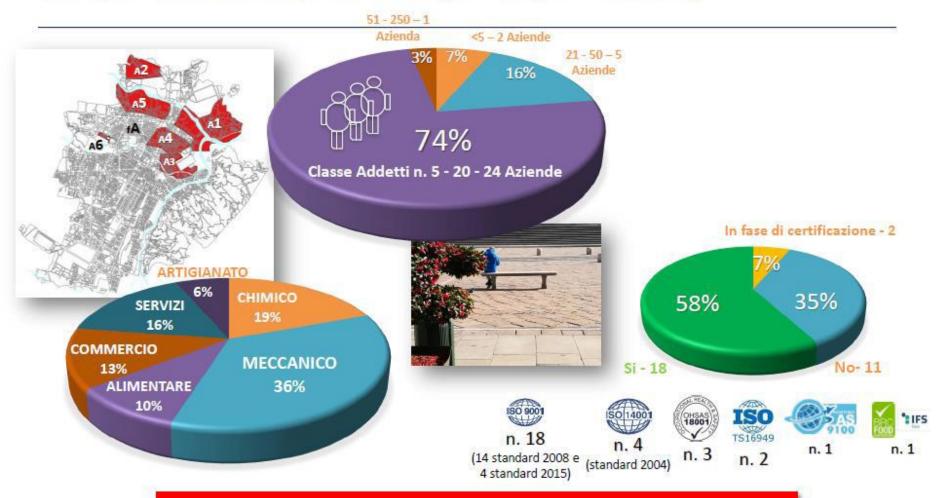


### **SMEs Localization**





### DATI AGGREGATI ADDETTI, SETTORI, CERTIFICAZIONI



FATTURATO: Classe 1-5 ml € - 64% - n. 20 Aziende CESPITI: Classe fino ad 1 ml € . 55% - n. 17 Aziende





# **Training PMI**





- Training for self-assesment and impact analysis on climate change
- 2 visit at the site with expert
- Industrial District Adpatation Plan development







### Stakehoders Involvement





### Internal

Aree del Comune di Torino coinvolte nel percorso: AMBIENTE (Aria; Rifiuti; VAS; Bonifiche; Mobilità nuova; GPP); URBANISTICA e PIANIFICAZIONE; PROTEZIONE CIVILE; URBANIZZAZIONI E RIQUALIFICAZIONE SPAZIO PUBBLICO; MOBILITA'; VERDE; PONTI E VIE D'ACQUA; LL.PP; PATRIMONIO e COMUNICAZIONE – UFFICIO STAMPA

### **External**

GTT - IREN - AMIAT (IREN) - SMAT - ARPA PIEMONTE

### **ALCUNI NUMERI**

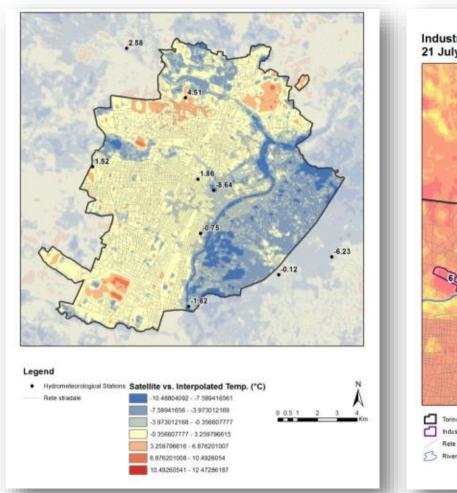
**8** Training Days

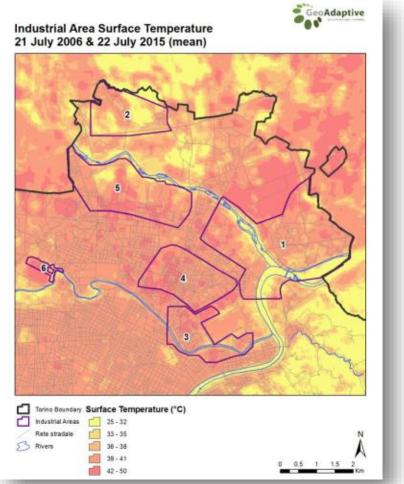
**26** Department Engage

**57** Director and Operational Position



### Local Climate Profile – Heat Waves







### Presentazione del lavoro



### Sviluppo e sistematizzazione di una valutazione multi-pericolo

- Definire i due rischi significativi per la realta torinese e piu aggravati dai cambiamenti climatici (isola di calore urbano e inondazione);
- Raccogliere e armonizzare i dati di pericolo esistenti per i rischi selezionati;
- Sviluppare un modello e una caratterizzazione multi-pericolo.

### Analisi dell'esposizione

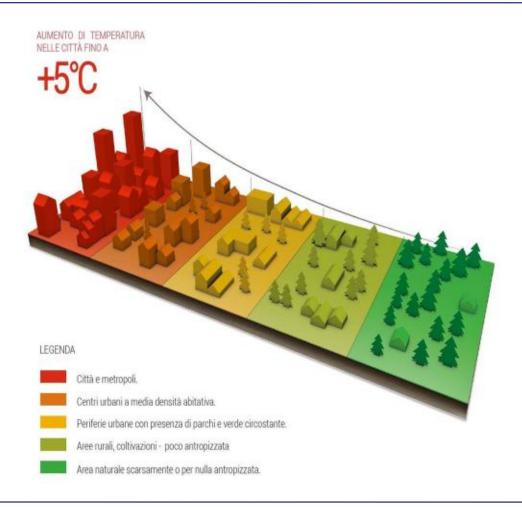
- Sviluppare un inventario di elementi potenzialmente esposti relative alle infrastrutture critiche e alle aree residenziali e commerciali.
- Sviluppare il calcolo delle perdite previste per i portfolio selezionati.
- Sviluppare il processo di **mainstreaming** tecnico e istituzionale al fine di fornire strategie condivise e prioritizzate.

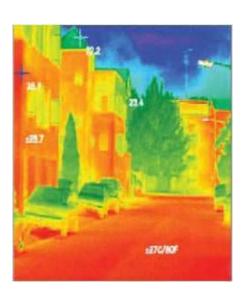




### **Urban Heat Island**



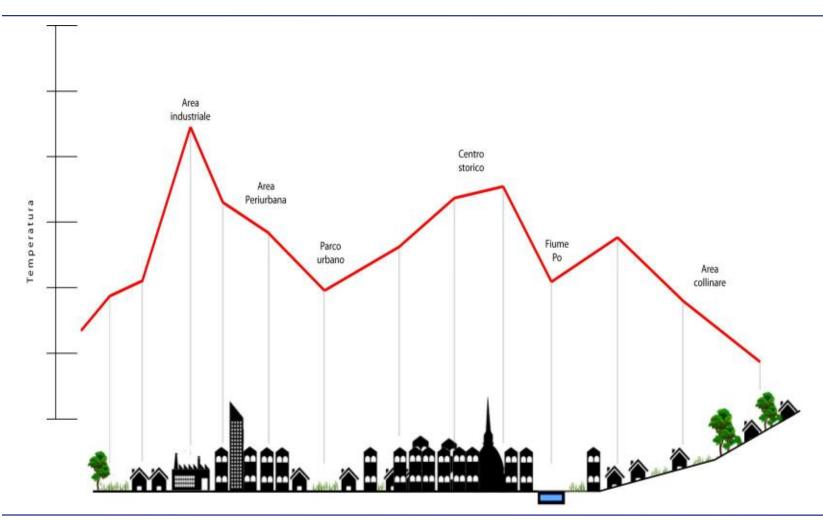






### Urban Heat Island (qualitative profile)







### **Historical Heat Waves**

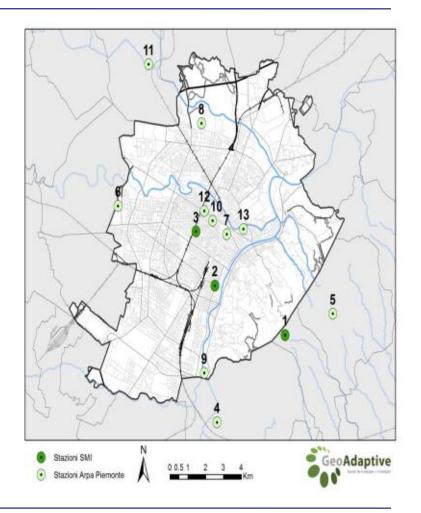


Analisi della temperatura massima registrata dalla rete di stazioni meteorologiche attorno a Torino

(ARPA e SMI)

n.	Nome stazione	Ente
1	Bric della Croce	SMI
2	Istituto di Fisca dell'Universita	SMI
3	Sede IUPO	SMI
4	Baudicchi	ARPA
5	Pino Torinese	ARPA
6	Alenia	ARPA

n.	Nome stazione	Ente
7	Giardini Reali	SMI
8	Reiss Romoli	SMI
9	Vallere	SMI
10	Via della Consolata	ARPA
11	Venaria Ceronda	ARPA
12	<b>Buon Pastore</b>	ARPA
13	Italgas	ARPA





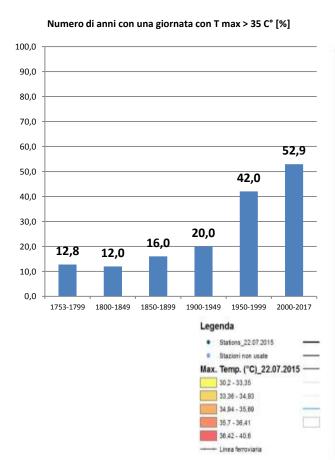
GeoAdaptive

### **Historical Heat Waves**

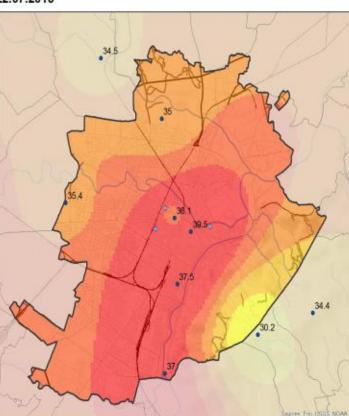


# Extreme temperature event in time

Extreme Event		
Data	T (C°)	
11August 2003	41,6 C°	
23 July 1945	38,4 C°	
21 July 2015	38,1 C°	
29 July 1771	38,1 C°	
2 August 1928	38,0 C°	
8 August 1802	37,5 C°	
6 July 2015	37,4 C°	
20 June 1858	37,3 C°	



### Temperature massime (C°) 22.07.2015





# Analisi delle immagini satellitari



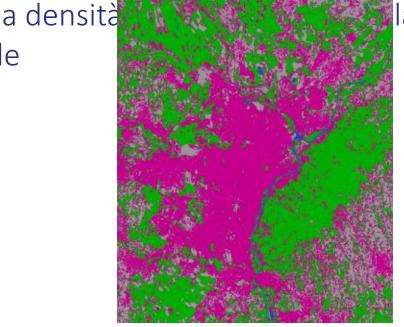
I satelliti Landsat e ASTER raccolgono bande visibili e infrarossi termiche

Le immagini elaborate possono consentire di calcolare la

te



False color composite (2006)

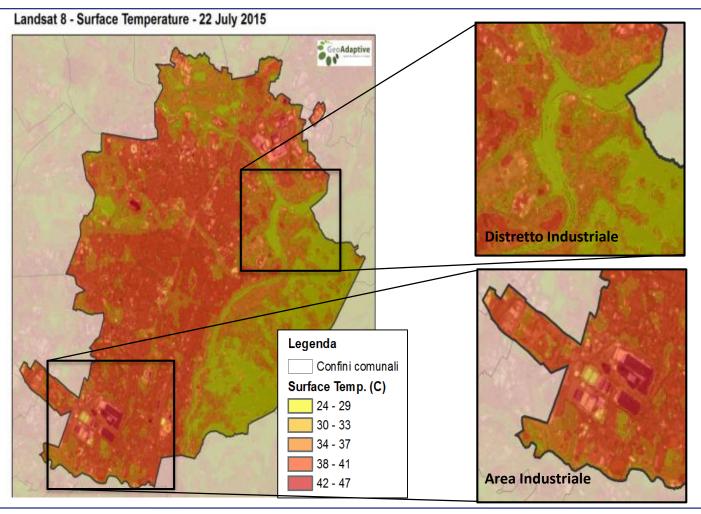


Simplified land cover (2006) purple = developed, green = vegetated, blue = water



### **Satellite Picture**







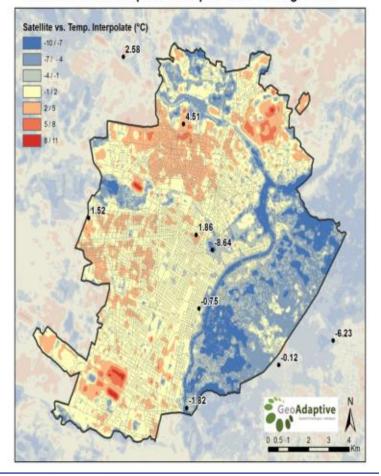


### Calibrazione dei risultati



- Differenza calcolata tra la temperatura derivata dal satellite e le letture dalle stazioni meteorologiche (vedi a destra)
- I risultati di analisi satellitare evidenziano aree più calde nelle zone industriali e aree più fredde nelle zone con

#### Validazione della temperatura superficiale - 22 Luglio 2015





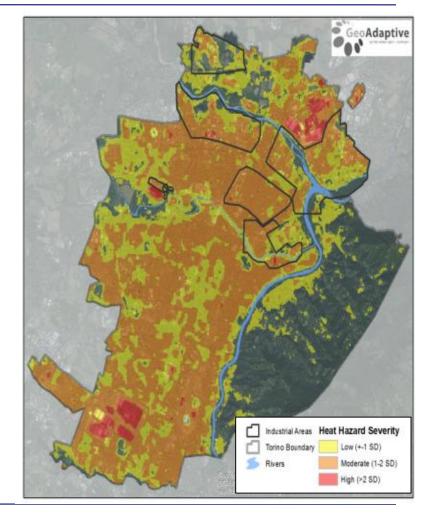


# **Mapping UHI**



- Basso pericolo: Temperature comprese entro una deviazione standard superiori alla media
- Moderato pericolo: Temperatura comprese tra 1 e 2 deviazioni standard superiori alla media
- Perice le vato: Temperatura

  super de via zi d

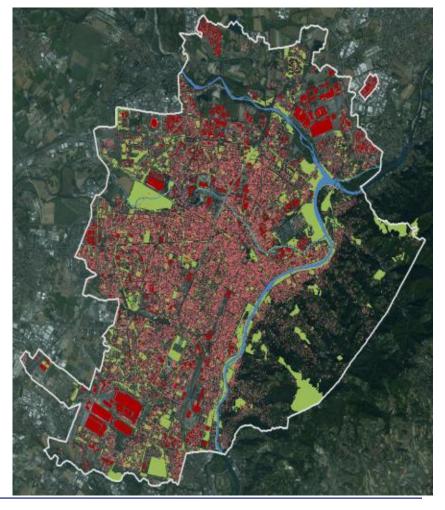




### **UHI** different use of land

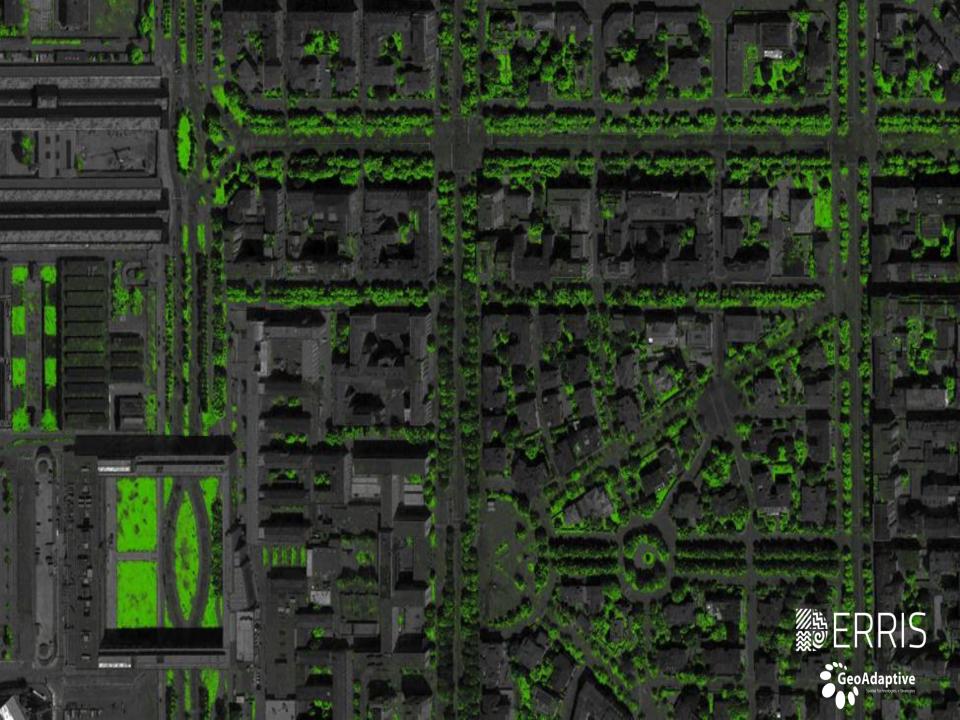


Use of Land	Туре	TEMP. MEDIU M(°C)	AREA (HA)
Building	Industrial	41.5	757.03
Dullullig	Residential	39.2	1930.73
	Green Area in School	39.2	186.22
	Green line on street	38.4	63.43
	Green Square	38.3	31.46
	Garden	38.1	252.37
Green	Various Green	38.1	69.30
Area	Sport Green	38.1	12.77
	Walkside with tree	38.1	179.96
	Park	34.3	543.95
	Riverside	32.6	22.96
	Dense Green Park	29.1	60.79
Water	River	31.4	237.46











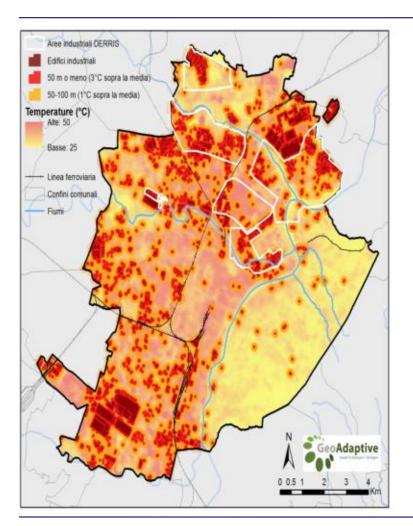






### **UHI industrial Areas** (DERRIS)

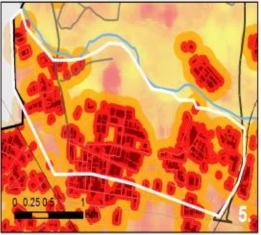




**Lungo Dora Riparia** 



**Reiss Romoli** 



- Aumento della temperatura di 3
   C° a distanza di 50 m dalle aree industriali, di 1 C° a distanza compresa tra 50 e 100 metri
- 48% dell'area della citta' interessata da queste aree



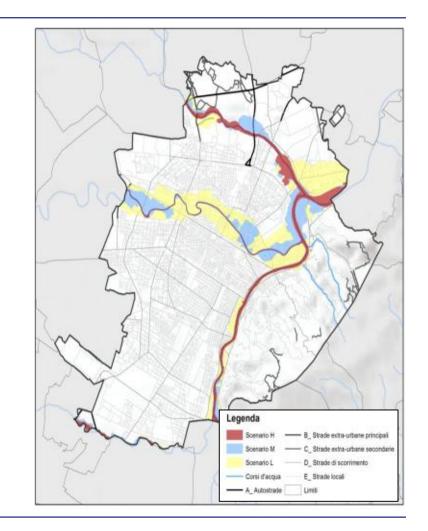


# **Flooding Analysis**



FonteDirettiva Alluvioni 2007/60/CE quadro metodologico per la valutazione e la gestione del rischio di alluvioni

- Basso pericolo (L): Tempo ritorno fra 20 e 50 anni, ossia alluvioni frequenti
- Medio pericolo (M): Tempo ritorno fra 100 e 200 anni,







LIFE **DERRIS** - DisastEr Risk Reduction InSurance info@derris.eu - www.derris.eu

### **Analysis Multi Hazard**

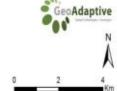


Isola di calore urbano sovrapposte con le zone di inondazione fluviale per determinare le aree di sovrapposizione, dove residenti e diverse infrastrutture possono essere esposti a inondazione + a caldo estremo.

Le aree di maggiore esposizione sono concentrate lungo le sezioni più basse della Dora Riparia e della Stura di Lanzo.

nonché lungo l fiume Po, vicin sources









### Multi-Hazard Analysis (DERRIS)



### Parco della Confluenza (ZI verso San Mauro)

# Geo Adaptive

Torins Boundary Multi-Hazard Susceptibility
Industrial Areas Law
Potent structure
Module

Floor



- Confluenza Stura di Lanzo nel Po + ampia area industriale.
- Aree rosse ed arancioni prevalentemente residenziali.



### Dora Riparia e Cimitero (Lungo Dora Riparia)



- Torins Boundary Multi-Hazard Susceptibility
  Industrial Areas
  Rele stradare
  Intolory
  - nos \_\_\_\_ Lav

    in \_\_\_\_ Medium

    High

- Presenza del fiume Dora Riparia area caratterizzata da un edificato fitto
- assenza di ampie aree verde





# **Exposure analysis**

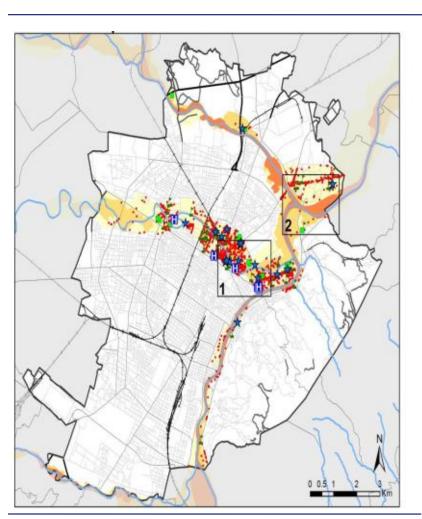


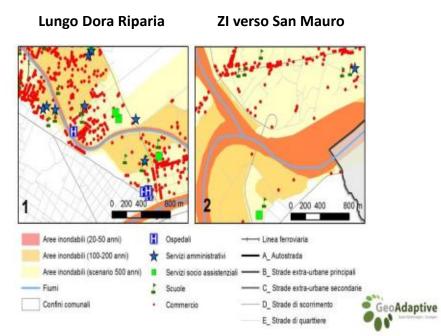
Indicator	Source	Type of Hazard
1 Population		
1.1 Over 65	ISTAT	UHI, Flooding, Multi
1.2 Under 5	ISTAT	UHI, Flooding, Multi
1.3 Women over 65	ISTAT	UHI, Multi
2 Fisica		
2.1 Relevant Infrastructure	GEOPORTALE	UHI, Flooding, Multi



### Ground Exposure (DERRIS)





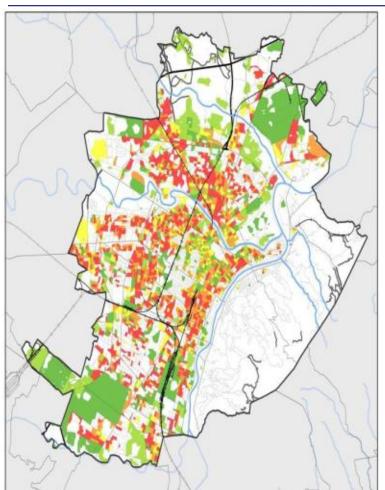


	Urban Heat Island	Flooding	Multi- Hazard
Hospital	24	6	5
Administrative Service	133	22	7
Social Service	93	16	23
School	444	53	65
Shops	23.503	2.458	1.426



# Human Exposure (UHI)





	Urban Heat Island	Flooding	Multi- Hazard
Popolaz. over 65	141.116	17.411	10.444
Donne over 65	90.750	(10.299)	7.036
Popolazi. under 5	28.200	4.108	2.838
TOTALE (over 65 + under 5)	260.066	31.818	20.318





# Risultati appresi, prossimi passi Geo Adaptive

### Risultati

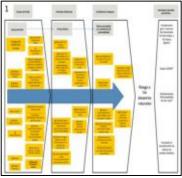
- Priorita' rivolte alle zone industriali e all'aree circostanti
- L'importanza di ridurre l'esposizione fisica delle infrastrutture e della popolazione piu'

### Mainstreaming

- Validazione di analisi attraverso un processo partecipativo
- Identificazione delle aree prioritarie per l'implementazione delle strategie
- Definizione di un possibile elenco di strategie

Prioritizzazione delle strategie secondo una







## **OPEN 011**





## Best practise



#### **GREEN ROOF**



Parco Colonnetti – La Casa del Parco



## DRAINAGE PAVEMENT WATER COLLECTOR





Il clima cambia. Riduciamo i rischi.

#### LIFE DERRIS

DisastEr Risk Reduction InSurance

info@derris.eu www.derris.eu



With the contribution of the LIFE financial instrument of the European Community





# Milan Resilient City

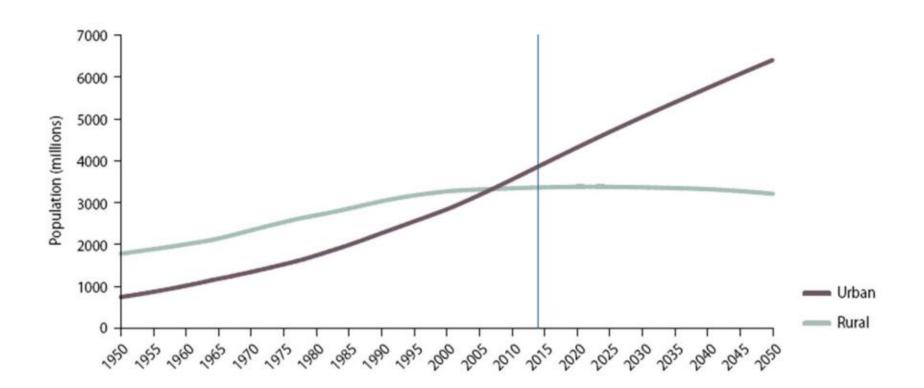


# Introduction



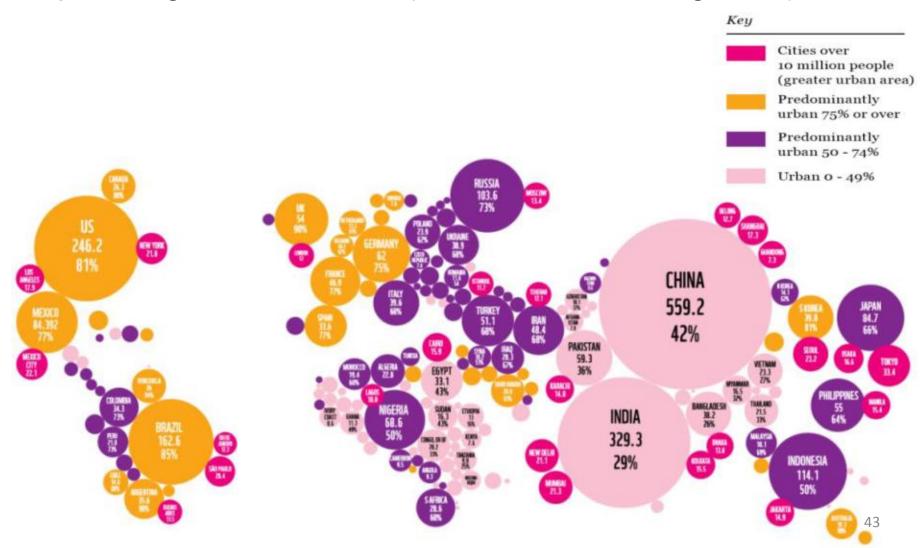
## Society

World population trend (UN-2014 World Urbanization Prospects)



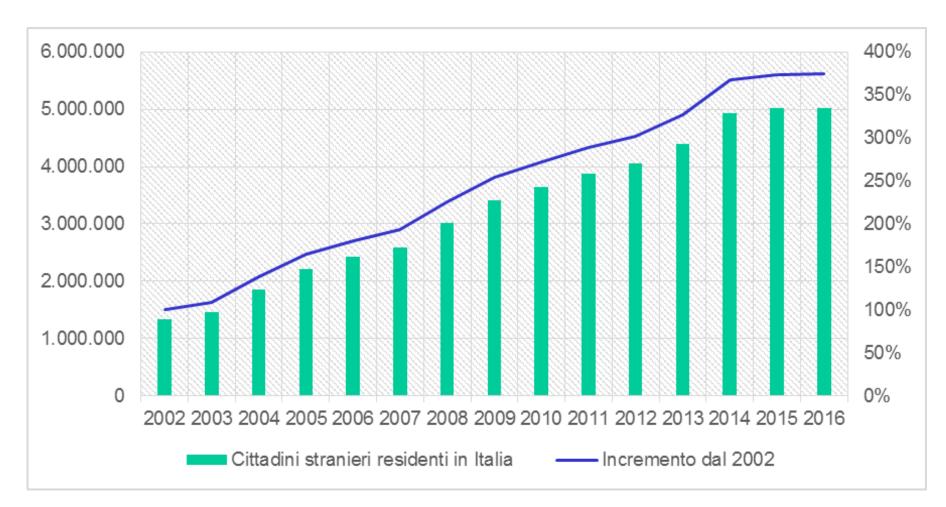
## Society

People living in urban areas (WWF - Planet Living 2012)



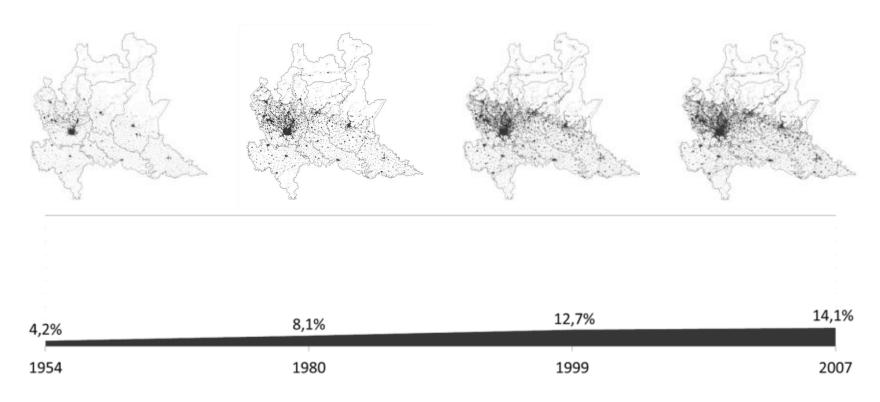
# Society

## Foreigner citizens in Italy (2002-2016) - ISTAT



## **Environment**

## Urban areas increase (1954-2007)



## Environment

## Agricultural lands loss (1954-2007)

	1 Urbanizzato					2 Aree agricole				
	1954	2007	Δ ha	Δ%	Δ% anno	1954	2007	Δ ha	Δ%	Δ % anno
VA	11.199	34.759	+23.560	+210,4%	+4,0%	44.263	18.239	-2 <mark>6.024</mark>	-58,8%	-1,10%
МВ	6.531	21.578	+15.046	+230,4%	+4,3%	31.015	14.788	-16. <mark>227</mark>	-52,3%	-1,00%
со	5.596	20.506	+14.910	+266,4%	+5,0%	39.147	19.408	-19 <mark>.739</mark>	-50,4%	-1,00%
LC	3.302	12.174	+8.871	+268,6%	+5,1%	24.879	12.930	-11.9 <mark>49</mark>	-48,0%	-0,90%
MI	20.121	62.632	+42.511	+211,3%	+4,0%	127.731	81.870	-45.861	-35,9%	-0,70%
BG	8.258	38.273	+30.015	+363,5%	+6,9%	115.380	77.975	-37.405	-32,4%	-0,60%
so	1.964	7.780	+5.817	+296,2%	+5,6%	33.544	24.639	-8.90 <mark>5</mark>	-26,5%	-0,50%
BS	12.769	53.994	+41.226	+322,9%	+6,1%	221.032	167.307	-53.725	-24,3%	-0,50%
PV	10.796	26.776	+15.980	+148,0%	+2,8%	244.596	219.612	-24.984	-10,2 <mark>%</mark>	-0,20%
MN	9.682	29.068	+19.385	+200,2%	+3,8%	210.782	192.166	-18. <mark>616</mark>	-8,8 <mark>%</mark>	-0,20%
LO	3.004	9.818	+6.814	+226,8%	+4,3%	68.073	62.720	-5.35 <mark>3</mark>	-7,9 <mark>%</mark>	-0,10%
CR	6.894	18.693	+11.799	+171,1%	+3,2%	161.437	151.377	-10.06 <mark>0</mark>	-6,2 <mark>%</mark>	-0,10%
					<u> </u>					
LOMBARDIA	100.117	336.050	+235.933	+235,7%	+4,4%	1.321.877	1.043.030	-278.847	-21,10%	-0,40%

In Lombardy region we lost 5,400 ha per year of agricultural lands, around 15 ha per day

## Resilient cities



## What's 100 Resilient Cities?



100 Resilient Cities - Pioneered by the Rockefeller Foundation (100RC) is dedicated to helping cities around the world become more resilient to the physical, social and economic challenges that are a growing part of the 21st century.

Cities in the 100RC network are provided with the resources necessary to develop a roadmap to resilience

100RC is a no-profit funded by the Rockefeller Philantropy Advisors (RPA)

## What's 100 Resilient Cities?



A Resilient city is capable to live and grow rapidly, innovating and adapting its shape and patterns of life and organization, in response to new challenges. In particular during critical or unforseen situations or even emergency.

Resilient is a city that organize themselves to do so by activating their capacity planning and government, involving the local community (citizens and their representatives, the business sector and scientific research).

# Challenges



**ABOUT US** 

NEWS

**OUR CITIES** 

OUR PARTNERS CITY RESILIENCE Q

#### Selected Cities

Explore the member cities in the 100 Resilient Cities network.

ALL REGIONS \*









#### ALL CHALLENGES \*

LANDSLIDE

**OVERPOPULATION** 

OVERTAXED/ UNDER DEVELOPED/UNRELIABLE TRANSPORTATION SYSTEM

POLITICAL INSTABILITY

POLLUTION OR ENVIRONMENTAL DEGRADATION

POOR AIR QUALITY/POLLUTION

POOR HEALTH INFRASTRUCTURE

POOR TRANSPORTATION SYSTEM

PRONOUNCED POVERTY

RAINFALL FLOODING

RAPID GROWTH

REFUGEES

RESOURCE SCARCITY

RIOT OR CIVIL UNREST

RISING SEA LEVEL AND COASTAL EROSION

SOCIAL INEQUITY

TERRORISM

TROPICAL STORMS

TSUNAMI

**VOLCANIC ACTIVITY** 

WATER MANAGEMENT ISSUES

**WILDFIRES** 

# Challenges

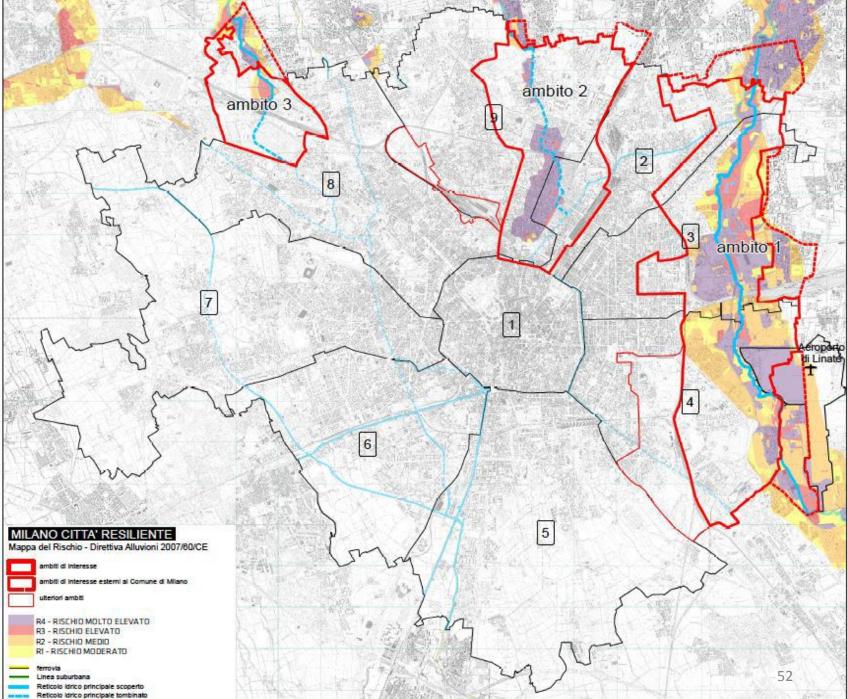


- HEAT WAVE
  - LACK OF AFFORDABLE HOUSING
  - RAINFALL FLOODING
  - RESOURCE SCARCITY
  - RIOT OR CIVIL UNREST

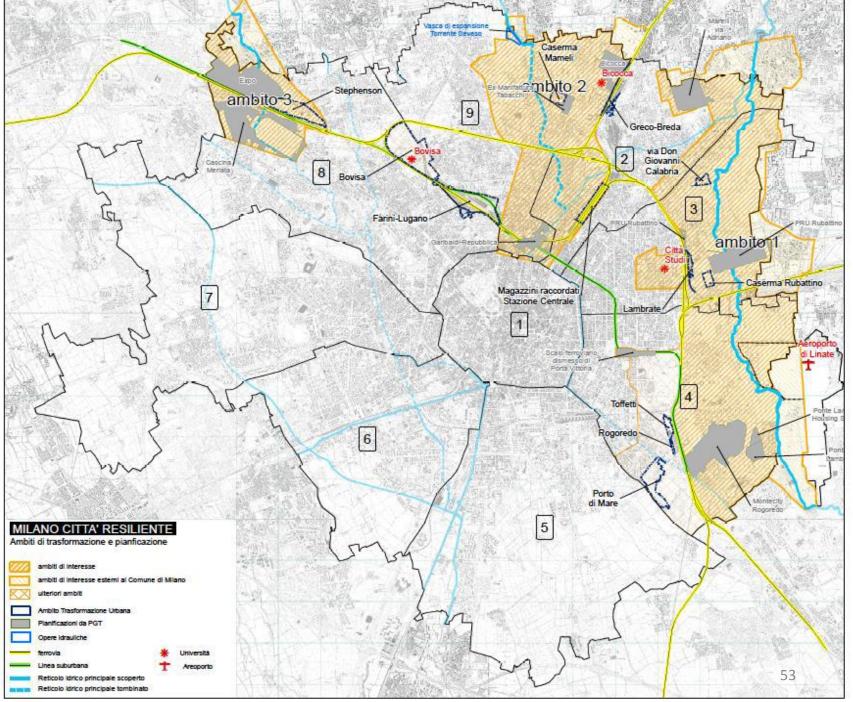
The need to handle emergencies arising from the hydrogeological and climate change: flooding, heat waves or peaks of cold.

Milan will have a particular attention to the hardships faced by the elderly and children who live in the suburbs.

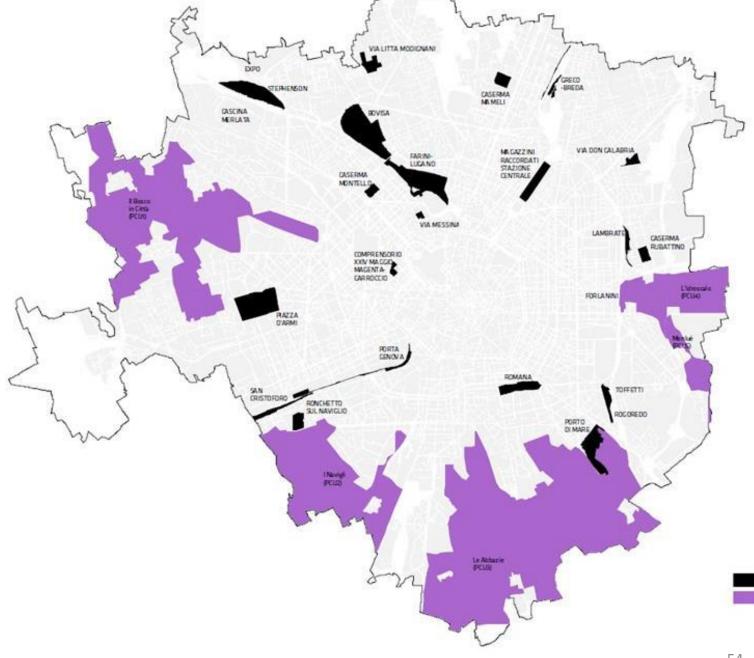










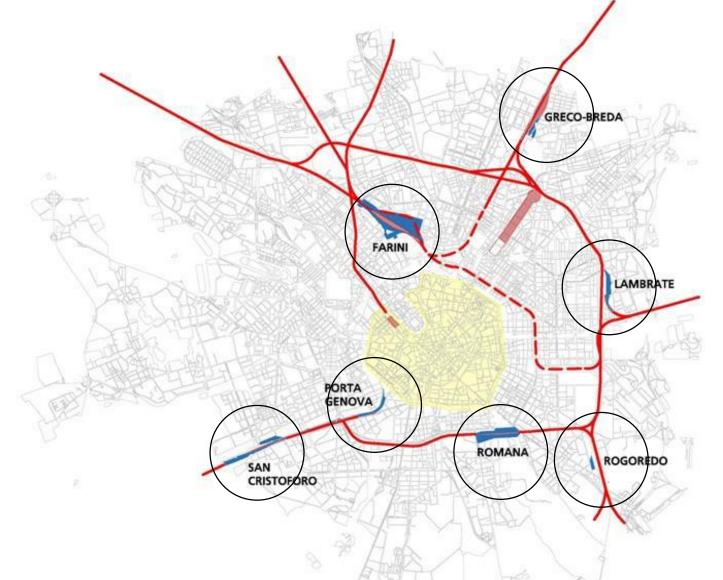






The question of **urban quality** in the suburbs with particular reference to the districts of **social housing**.





### **Railway Abandoned Station Milan**

The areas for disposal or already more instrumental brownfield areas including in the areas of transformation have a total area of about 1,200,000 square meters.

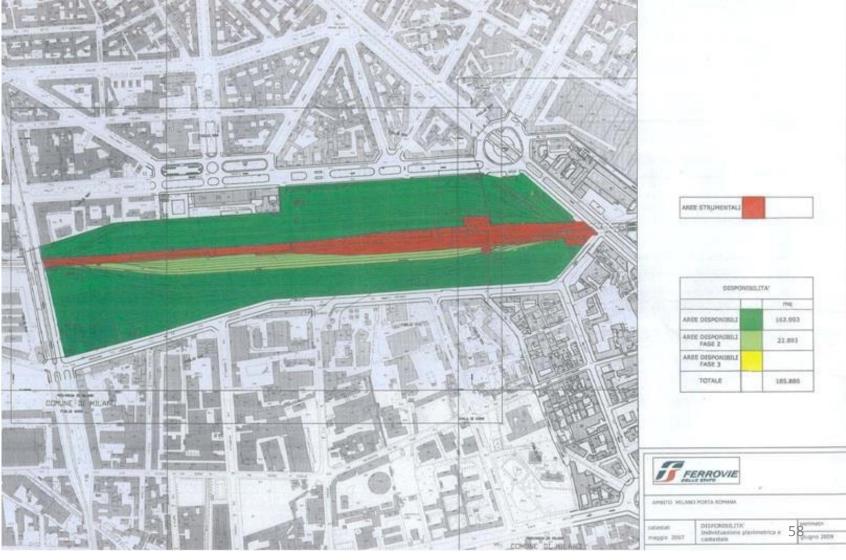
56







#### **SCALO ROMANA: DISMISSIONI**



# **OPPORTUNITIES**

#### **ROMANA**

PGT ALLEGATO 3 AMBITI DI TRA SFORMAZIONE URBANA Piano di Governo del Territorio







## Two challenges strongly intertwined:

the demand for quality in the urban suburbs can be answered in those interventions that are also helpful to reduce the risks and effects of hydrogeological and climate change faced by the elderly and children who live in the suburbs.



## Vision & Action



#### **Urban Development, Green and Mobility**

#### DG

# Territorial Development

- PGT Plan of Government of the territory
- Building Code Regulations
- Shared Project Areas

#### DG

Mobility, Transport and Environment

- PUMS Urban Mobility Sustainable Plan
- Shared Gardens project
- Programs to prevent raising of the water

# DG Life Quality

- Green Area Regulation
- Shared Gardens Project

# DG Public Works and Landscape

Abaco of the Urban Design

#### Monitoring and management of emergencies caused by extreme weather

DG
Urban Security

• Emergency plan and intervention on the flooding of the Lambro / Seveso / Olona

DG

Social Policy

• Care plans Hot / Cold

DC

**Economic Development** 

• Programs of financial compensation

#### Maintenance, upgrading and development of social housing estates

DG

Housing

Zone Agreement

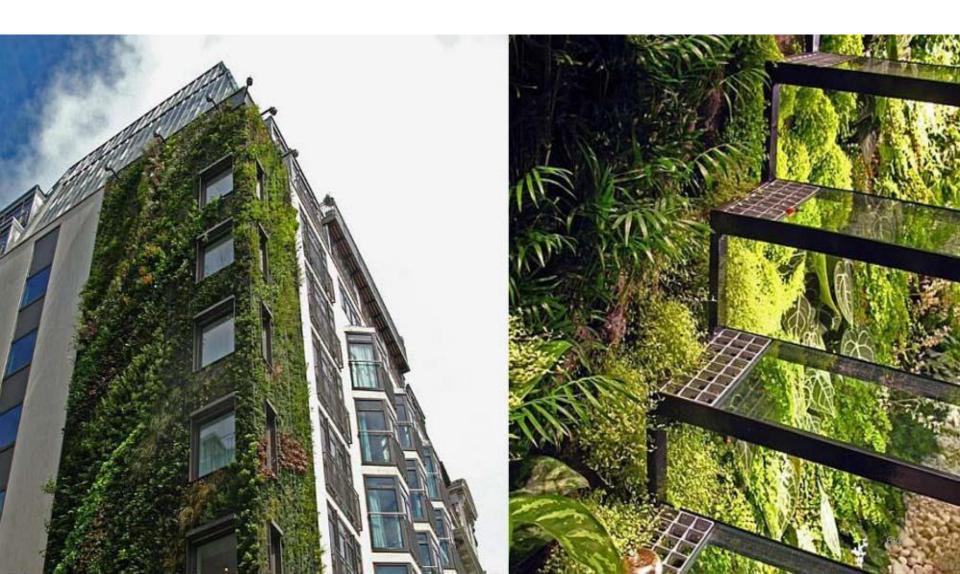
DG

**Urban Development** 

Integrated programs of action for the new quarters of Social housing

#### **GREEN**

The spread of green areas (areas, roofs, walls) or micro redevelopment of public spaces conscious presence of green that improve not only the quality of urban life, including the local microclimate, thus mitigating the negative effects of the summer heat peaks





Interventions for urban and hydraulic protection of buildings and public spaces, that increasing the green areas and the permeability of the soil, multiplying the capacity of local water retention and drainage of water, during extreme weather events or flooding due to floods and raising the water

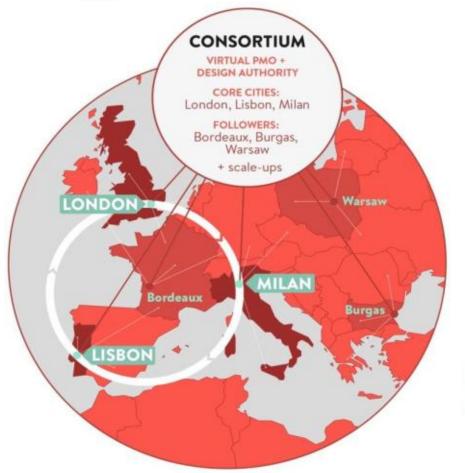
# **Sharing Cities**





## Sharing Cities – The consortium and timing

H2020 SCC-01-2015



3 LEAD CITIES

**3 FOLLOWERS** 

**20-35 SCALE UP CITIES** 

**6 TRANSVERSAL PARTNERS** 

20+ DEVELOPMENT PARTNERS

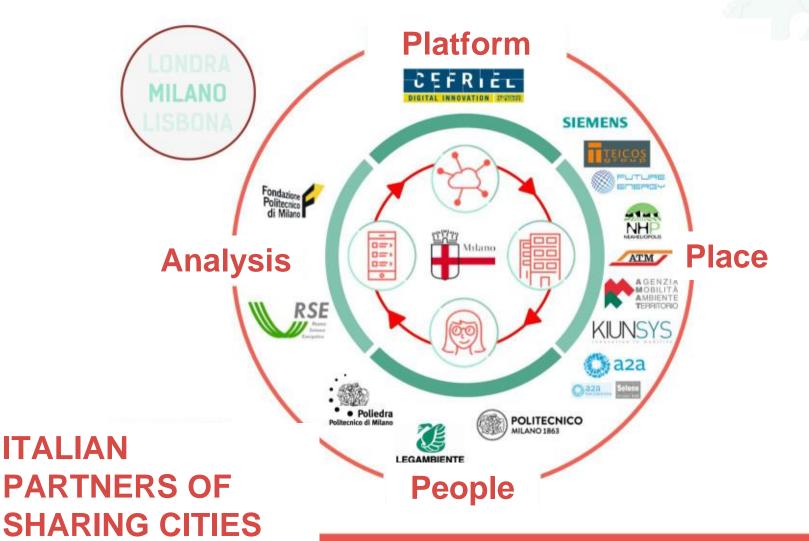
Implementation Monitoring

2016-2018

2019-2020



## Project partners





## Project areas



#### London

 8.5m residents + 1.1m daily visitors + 16.8m tourists

#### Greenwich

- · Peninsula brownfield
- · 23,000 council housing
- 46,000 private housing
- 25% CO<sub>2</sub> from municipal buildings
- 12 low capacity charging points
- · autonomous vehicle test
- · 23,000 street lights





#### Lisbon

 0.6m residents + 0.4m daily visitors + 10m tourists

#### Downtown

- 540 ev public charging points from 4 providers
- MOBiE single platform to manage ev charging points
- Transpolis public transport platform
- · 64,000 street lights
- · 163 sets of open data







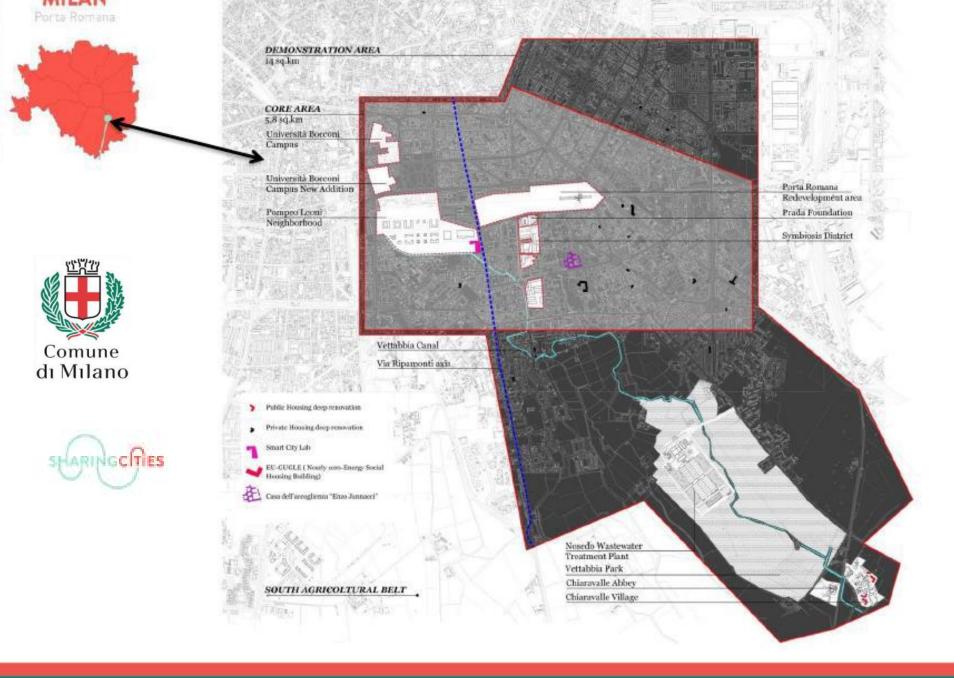
#### Milan

- 3m residents + 0.8m daily visitors + 1.9m tourists
- 70% live in multi-owner buildings rated G or F
- 6,500 GUIDAMI car sharing members
- ION ev test

#### Porta Romana

- · Rail Station brownfield
- 100,000m<sup>2</sup> industrial retrofit
- · Smart City Lab
- · Heat recovery unit



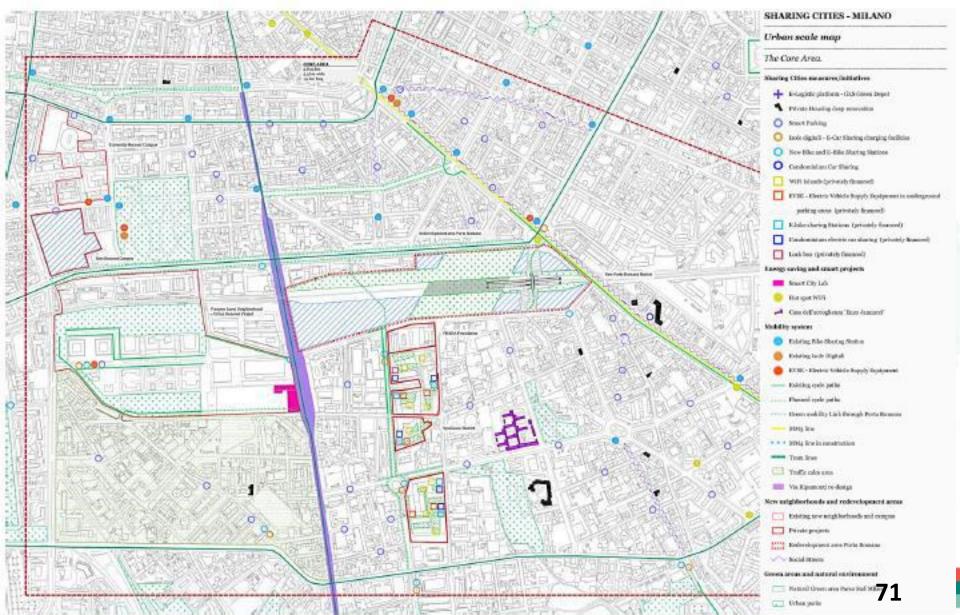














#### **Innovative solutions for:**

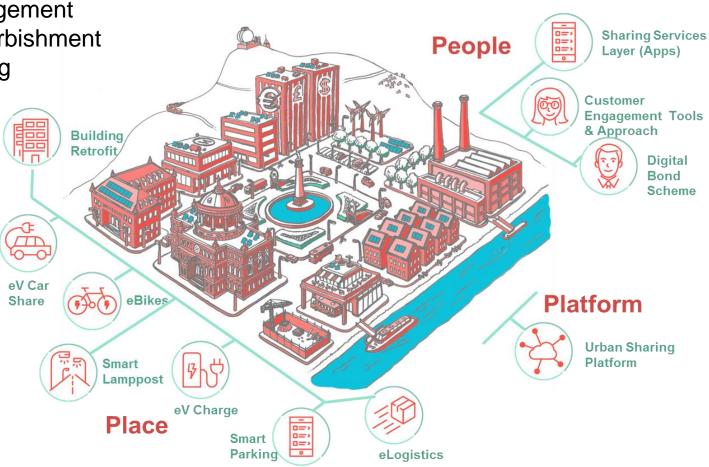
electric mobility

citizen engagement

building refurbishment

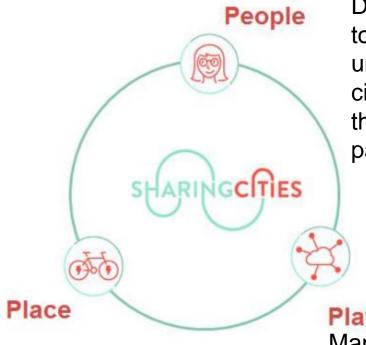
public lighting

**ICT** 





#### People – Place – Platform



Develop new approaches and tools to improve the public's understanding of how smart cities should operate. Promote the citizens' active participation.

#### **Platform**

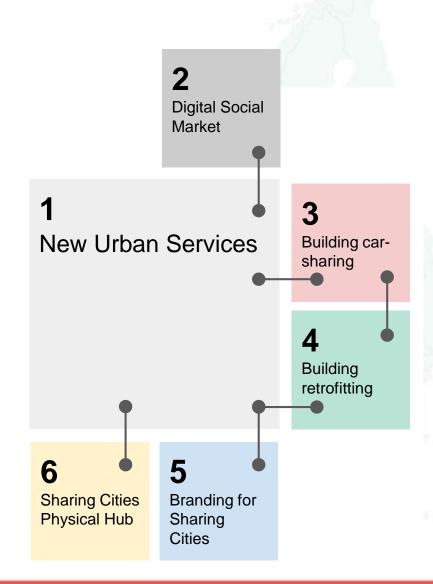
Manages data from a wide range of sources, including sensors, as well as traditional statistics. It is built on common principles, open technologies and standards.



### People – Co-design



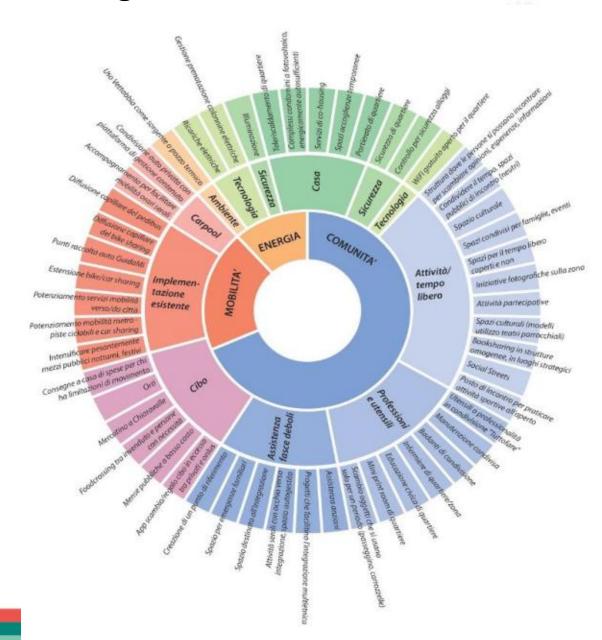
- workshop
- mock-up
- hackathon
- crowdfunding



### People – Co-design – New Urban services



6 workshops for envisioning new urban services





#### People – Digital Social Market







**Energy management** 

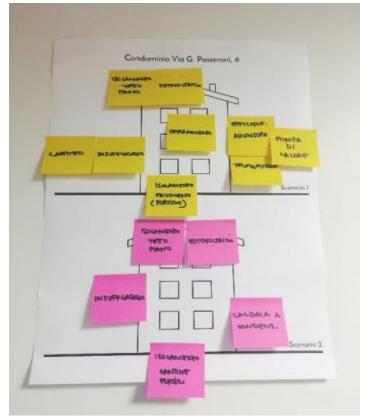
**Smart Lampposts** 

Mobility





#### People – Co-design – Building retrofit



5/6 private buildings to be refurbished (21.000 sqm)

Codesign process for engaging people in massive refurbishment

1/2 public buildings to be refurbished (5.000 sqm)



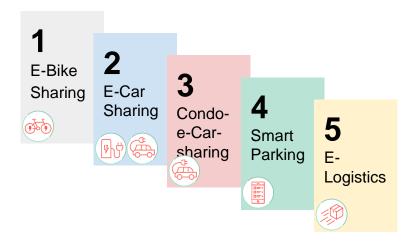
9 meetings / round tables - 20 buildings involved 3 groups, 3 meetings for each group

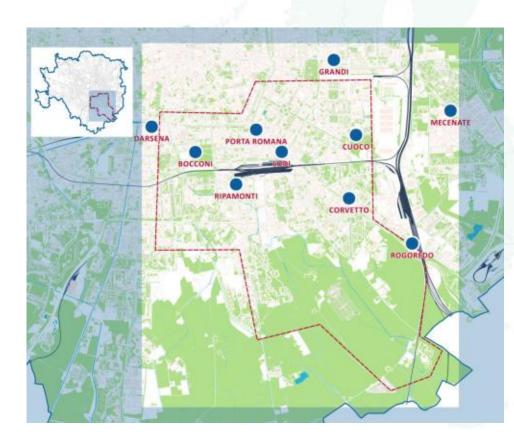
1 extra-meeting in each building for engaging 50%+1 inhabitants



**General Goal**: Low carbon mobility

**How**: 10 Mobility areas







#### Place – Mobility – e-bike sharing

# **1**eBike Sharing

- Enhancement of Bike sharing service with the set-up of new stations and 150 e-bikes
- Reservation system & algorithm for forecasting availability of bikes for relocation strategies







### Place – Mobility – e-car sharing

- Enhancement of Car sharing service with the set-up of 10 eV charging stations
- Algorithm for relocation of electric cars







### Place – Mobility – condo e-car sharing

**3** eCar-sharing condominiale

#### **Service**

2 eV for condominium car sharing

- Selection of condominium through surveys and data analysis
- Selection of e-car sharing provider through public call



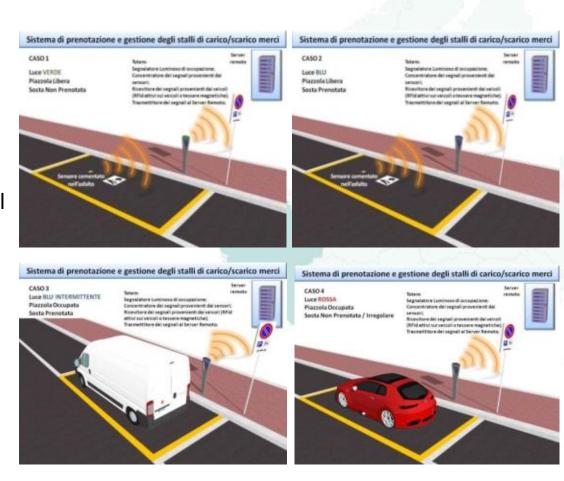




#### Place – Mobility – smart parking



- Public Transport accessibility protection: avoid illegal parking next to the Public Transport stops
- Pedestrian crossing protection from illegal parking: avoid illegal parking next to the pedestrian crossing or crossroads
- Parking control for disabled people
- Parking control for load/unload logistics operations
- E-car sharing management





### Place – Mobility – e-logistics

- E-logistics service with 9 e-vans and 2ebikes
- Optimization of logistics EV management
- Possible integration with e-bike sharing
- Implementation of Mobile Depot service to be evaluated









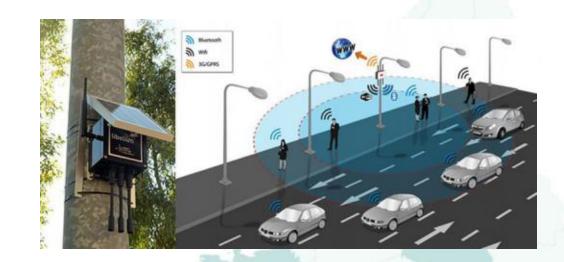






#### Place – Smart Lampposts

- WiFi antennas
- Environmental monitoring
  - Air quality
  - Temperature
  - Humidity
  - Atmospheric pressure
  - Noise
- Push to talk
- Monitor traffic flows and speeds of vehicles and flows of pedestrian
- Discouraging double parked cars system: avoid double parking along the street for traffic fluidization





#### Sharing Cities in a nutshield

- Ambitious (for both the wide range of interventions and the approach)
- Districts as test area of the smart city
- High level of replication (in the same in city and in other ones)





# Open Agri



## Milan: an agricultural town

Milan	Population	Area	Agricultural Area
Local District	1.316.000 inhabitants	182 sqm	27 sqm (15% about)
Metropolitan district	3.869.000 inhabitants	1.575 sqm	652 sqm (41% about)

The **food farming sector** is a key point in the national debate not only for the economical importance of this productive area (**+ 40% in 7 years** according to a recent studio from Nomisma), but also for the environmental and cultural implications linked to **the trend to get back to cultivate the terrains**, and to more respect for the environment and lansdcape

## Milan: an innovative town

According to the data from the register of innovative startups from the Italian Chamber of Commerce (October 2016)

Milan start-up landscape is the most flourishing of Italy with around 935 innovative startups (14,69% of national total)

In Italy there are 6763 start ups (+ 7% than in year 2016)

In Lombardy region there are 1382 innovative startups (21,72 of national total)





\*Souce: Infocamere, National Report, Italian Chamber of Commerce

### Innovation in food farming's system

CONSORZIOD

distretto agricolo milanese

- 2011: Foundation of DAM consortium
- Since 2012: Guidelines and Public Announcements for farmer's markets, ethical purchasing groups (community supported agriculture) and shared gardens and vegetable gardens
- Dal 2012: the start of a Plan to recover the old, historical and abandoned rural farmsteads (16 farmsteads)
- 2013: Milano Metropoli rurale («Milan as a rural Metropolis») – an Agreement signed among the Provincia di Milano, Regione Lombardia and Consorzio DAM for a shared strategy on a urban-rural development on metropolitan scale www.agricity.it

### Innovation in food farming's system

- Since 2013: Alimenta2Talent: a program to support innovative startups in the food farming sector and in the sector of «scienze della vita» (sciences for life)
- 2015: Pubblication of the Food Policy Guidelines 2015-2020 (by Milano City Council) and of the Milan Urban Food Policy Pact joined by 90 cities worlwide
- 2016: OpenAgri: New Skills for new Jobs in Periurban Agriculture (Urban Innovative Actions, DG Regio)
- 2016 Food City







### **Urban Innovative Action (UIA)**

- UIA is a new program from the European Commission
- Subventioned through FESR 2014-2020
- Supporting innovative ideas to face relevant urban EU challenges
- Total budget : 372 Mil €
- 378 proposals
- 27 finalist projects
- 18 selected projects
- 4 cities in Italy: Milan, Turin, Bologna and Pozzuoli (near Naples)

### **UIA: themes and requirements**

- Innovative solutions, that are also creative and long lasting and forsee the expertise of the different stakeholders
- Strong local partnerships among urban authorities; a good mix of complementary partners involved
- Potential to *trasfer* the innovative solutions proposed



## **Open Agri**

Open Agri is the project presented by Comune di Milano (as a lead partner) with the goal to match the food farming sector with economic innovation, technology, and social field

Total project budget:

6.245.000

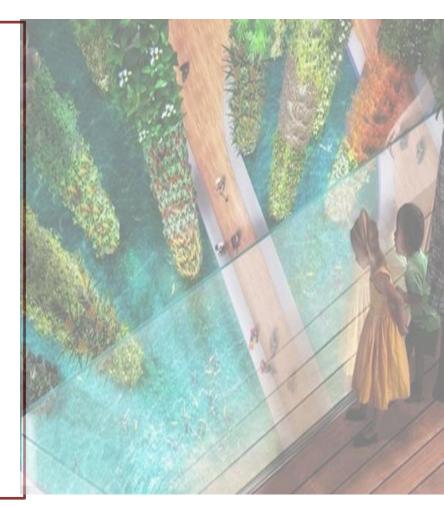
cofin FESR: 4.996.000 (80%)

Municipality of Milan budget:

3.040.000

cofin FESR: 2.432.000 (80%)

November 2016  $\rightarrow$  October 2019



## Open Agri - partners

#### PARTNERS SELECTED THROUGH A PUBLIC CALL

- Camera di Commercio, Industria, Agricoltura e Artigianato (CCIAA)
- Fondazione Politecnico di Milano (FPM)
- Fondazione Parco Tecnologico Padano (PTP)
- Università degli Studi di Milano (UniMi)
- Politecnico di Milano (POLIMI)
- Avanzi s.r.l.
- Cineca
- FUTURE FOOD INSTITUTE Trust (FFI)
- ImpattoZero Srl
- La Strada Società Cooperativa Sociale
- Associazione Sunugal
- Poliedra
- IFOA Istituto Formazione Operatori Aziendali
- Mare s.r.l. impresa sociale
- FOOD PARTNERS SRL

### A WIDE NETWORK OF STAKEHOLDERS:

- associations of enterprises linked to the local CCIAA (Confartigianato, Confcommercio, etc...)
- Corsorzio DAM
- Fondazione Sviluppo Ca' Granda
- Fondazione Sodalitas
- Fondazione Cariplo

## **Open Agri - goals**

OpenAgri will create a new agricultural center, a point of excellence within the Porto di Mare area, a "urban fringe» between the Parco Agricolo Sud Milano and the Mazzini neighbourhood, so to be able to match the improvement of the food farming system — from production to waste management — and the creation of SME and innovative startups, promoting social inclusion and culture

## Open Agri – main outputs

Investment

Rural farmstead Nosedo (2000 mq + 5000 mq surroundings); already included in the Milan's plan for recovering rural farmsteads of Comune di Milano.

Skill, training and startup business

OPEN INNOVATION HUB: development of an innovative model in the periurban agriculture filed through the envolvment of all the stakeholders; involvment of SME and STARTUPs with accelleration programs and feasible innovative proejectualities; experimentation of innovative tools for the transfer and certification of non formal competences (Openbadge)

Research and development

ANALYSYS OF CRITICAL SITUATIONS (environmental, social, economical) and identification of the needs and competences that are useful to restart the peri-urban agriculture in a susteinable way

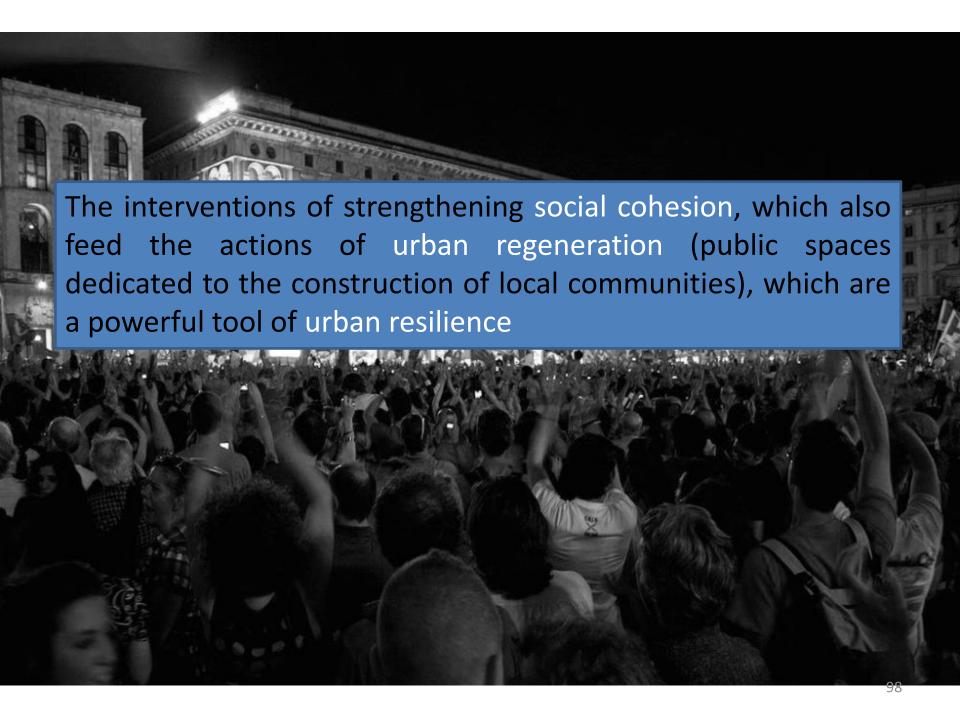
**Pilots** 

#### **EXPERIMENTATION OF NEW TECNOLOGIES linked to**

- agricultural production (implementing a cultivation based on aquaponic system;
- Transformation and processing of food (Officucina)
- Consumption and distribution (new logistic solutions for the last mile transportation)
- Waste management, thinking about circular economy

Social lab

NEW SYNERGIES among the existing territorial networks and the Open Innovation Hub in order to include and integrate the most fragile categories: a community's agriculture, and education aimed to improve the knowlwdge on agriculture







# Investigation of current climate change impacts and vulnerability

### Methodology

- Identification of observed climate change impacts based on the results of scientific papers and reports that deal with the climate change impacts under examination in the project area (municipality, region or country).
- Identification of the adaptation measures/actions set and foreseen with respect to the impacts under examination, in order to structure the "climate change vulnerability assessment".

#### Sources:

- (i) existing regional and/or national climate change vulnerability and adaptation plans.
- (ii) other policies that may have not been developed for the purpose of adaptation to climate change, but are indirectly contributing to the reduction of vulnerability and subsequently, to adaptation.
- Identification of other non-climate related pressures (such as economic crisis, immigration, environmental pollution) that may exacerbate climate change vulnerability and reduce adaptive capacity.





## Municipalities' profiles

Each climate-change impact under examination is described for each one of the partner municipalities:

- Municipality of Reggio Emilia (Italy)
- Municipality of Lakatamia & Strovolos (Cyprus)
- Municipality of Peristeri (Greece)





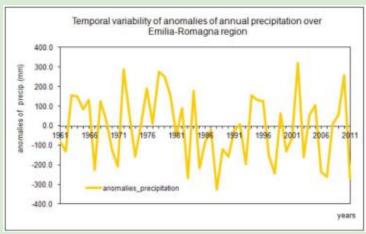












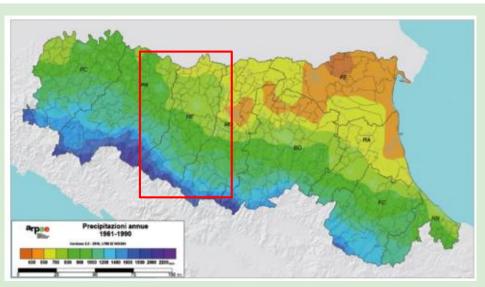
### In general

As regards the precipitation over Emilia-Romagna, negative anomalies had characterized the last two decades (figure a), while over long period (1961-2011) a slightly negative trend of annual precipitation had been noted (figure b). Seasonally, a slightly negative trend had been recorded in winter, spring and summer precipitation while a positive trend had been obtained during autumn. As regards the extremes of precipitation, Pavan et al.,(2008) founded negative trends in the number of wet days during winter and spring and positive trend for the number of days with intense precipitation during summer season.

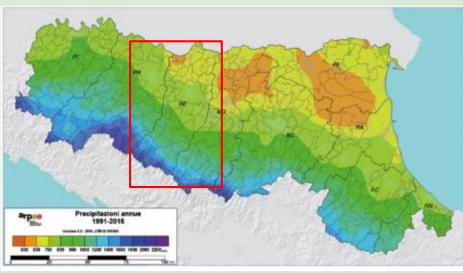








Average values of annual precipitation in Emilia-Romagna in the thirty years of reference 1961-1990.

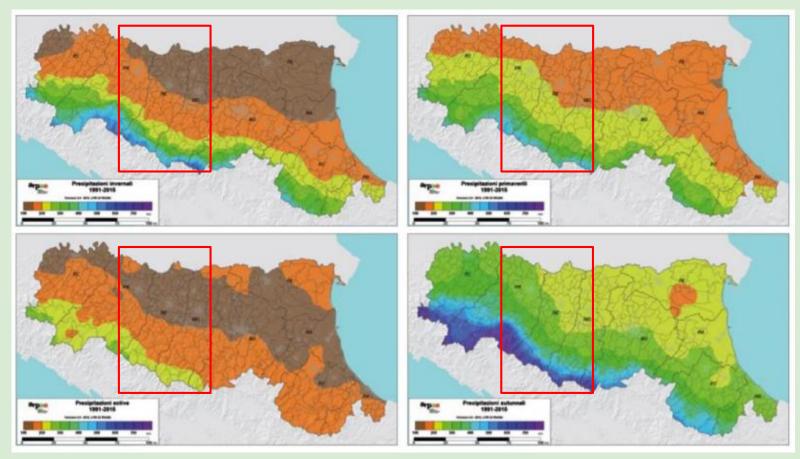


Average values of annual precipitation in Emilia-Romagna in the recent period 1991- 2015.







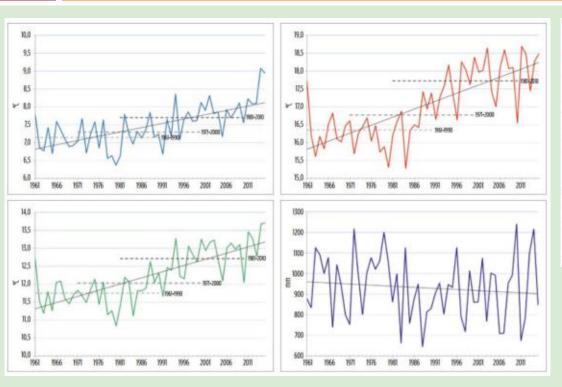












1971-2000	Minimum temperature (°C)	Maximum temperature (°C)	Rainfall
Winter	0,4	7,6	310
Spring	6,2	16,4	229
Summer	15,2	27,0	188
Autumn	10,5	20,1	197

2021-2050	Minimum temp variation (°C)	Maximum temp variation (°C)	Rainfall Variation (%)
Winter	+1,7 ↑	+1,4 ↑	-2 ↓
Spring	+1,3 ↑	+2,1 ↑	-11 ↓
Summer	+1,8 ↑	+2,5 ↑	-7 ↓
Autumn	+1,7 ↑	+1,8 ↑	+19 ↑

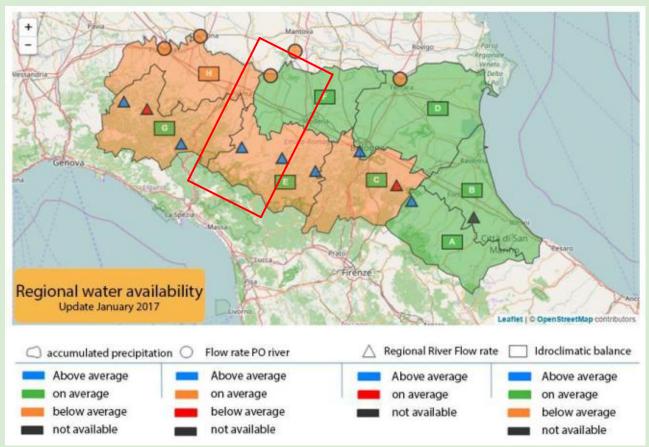
Seasonal average values of temperature and precipitation in the thirty years 1971-2000 Emilia-Romagna. Below the changes expected in the future (2021-2050) \*.

Historical trends of temperature ( $^{\circ}$  C) minimum, maximum, average, and Annual precipitation (mm) between 1961 and 2015.









There are four main rivers of the province of Reggio Emilia:

- the river Po (about 20 km),
- the river Enza (about 85 km),
- the river Secchia (170 km)
- the river Crostolo (55 km)

#### Natural lakes:

Lake Gruma in the

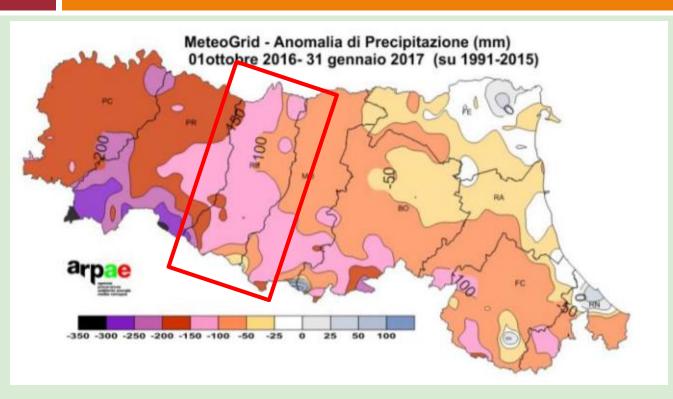
For the management of the Civil Protection emergencies and for the assessment of the water hazard, the region is divided into right minimises by the letters A to H, made taking into account the climatological and hydrological homogeneity

Campegine,

Environmental (climate-change) profile of the partner municipalities e.lakes of Cerre

(one main and two





Precipitation anomaly in October 2016 - January 2017 compared to the trend from 1990 to 2015

Temperatures: Minimum considerably lower than normal, Maxims lower than normal on the mountains

Precipitation: much lower than the climatic expectations, on average by 75%, rains virtually absent over much of central and western areas, from Piacenza to Modena.



OF
Environmental (climate-change) profile of the partner municipality and in surplus only in areas





Irrigation Volumes ( present climate and different climate scenario with different irrigation types, crop uses, etc.. at 2033-2050 (Mm3/anno)

- a) current / recent media;
- b) future scenario:
- b0. Future climate / surface irrigation / crop use current / current coefficients;
- b1. Future climate / surface irrigation / current crop use / coeff. Partly varied;
- b2. Future climate / optimal irrigation / crop use current / coeff. partially changed;
- b3. Future climate / surface irrigation / crop intended use / varied coefficients;
- b4. Future climate / optimal irrigation / crop intended use / coeff. partly varied.



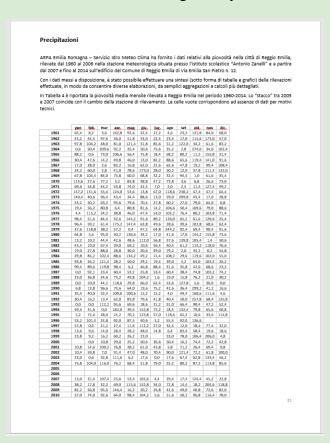


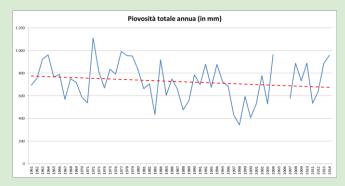


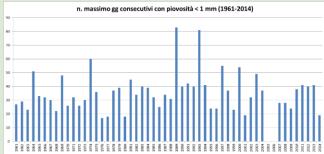


CLIMATE CHANGE IMPACTS REPORT TECNICO

### The climate change impacts on Reggio Emilia – technical reports







ARPA Emilia Romagna - Hydro Weather Climate Service has provided data relating to rainfall in the city of Reggio Emilia, recorded from 1960 to 2006





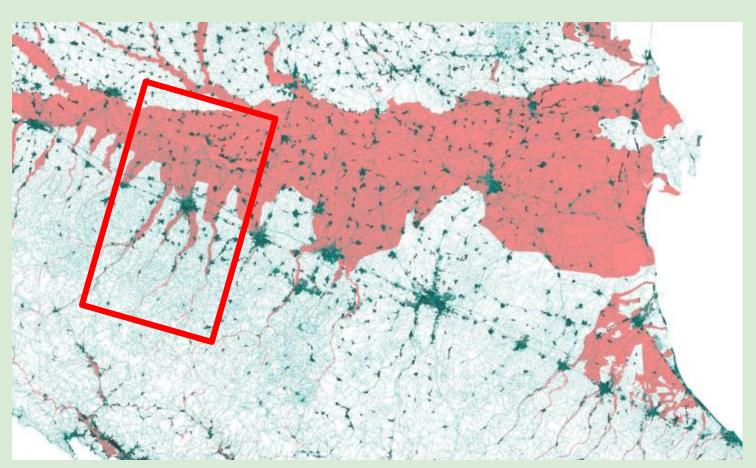












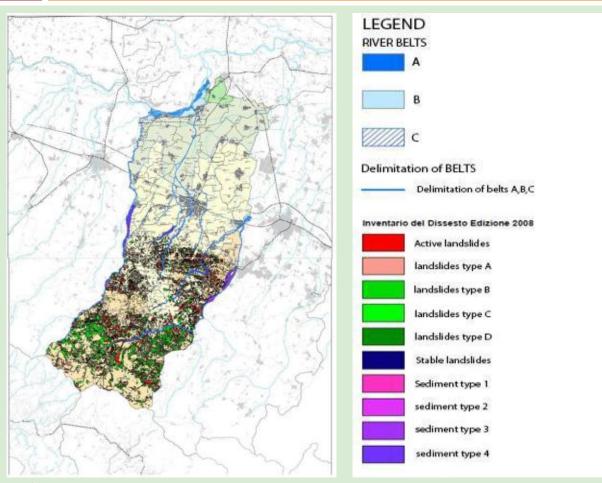
Map of flood risk of the Emilia Romagna Region.

Forecast for events of 100 years of return period. (IUAV elaboration)









Knowledge framework of the PTCP (Spatial Plan for provincial coordination) of Reggio Emilia:

Map of flood and hydrogeological risks









The main rules inside of the MUNICIPAL PLAN (PSC)

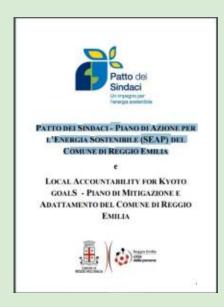
The municipal plan (PSC) provides for each new transformation area, the environmental parameters to be met including:

- The planting, in both industrial and residential areas, trees and shrubs.
- -In the same residential areas is provided a permeation rate of up to 60% of the land surface of the intervention;
- Within each expansion sector, both residential and productive, it is an area expected to be sold to the City to be allocated to public spaces (especially green public) and a private green area with ecological value.









The main directions of the **SEAP PLAN** include:

LINE OF ACTION 2. A city greener and more efficient

Projects expected by 2013 (2010-2013)

16. Make some new green areas in the area of the Rhone Park in Fontanile dell'Ariolo and create an urban forest

Projects planned by 2020

17. We will allocate new areas for public parks and forests over the next 10 years, an area of 3,000,000 square meters and circ for a total of about 150,000 new trees









### The CIVIL PROTECTION PLAN

The **Civil protection plan** defines the operational structure able to deal with the first emergency situations:

- Organize a municipal operating structure, formed by municipal employees, volunteers, private enterprises, to ensure first responders;
- Enable emergency aid to the population; provide adequate information to citizens on the degree of exposure to risk and to enable appropriate early warning systems;
- Ensuring the supervision Depending on which of the geological risk or other risk situations; ensure availability finalized on a priority basis upon receipt of the alert notices;
- Identify safe sites to be used to estimate recovery for the exposed population, activating, if necessary, preventive evacuations.

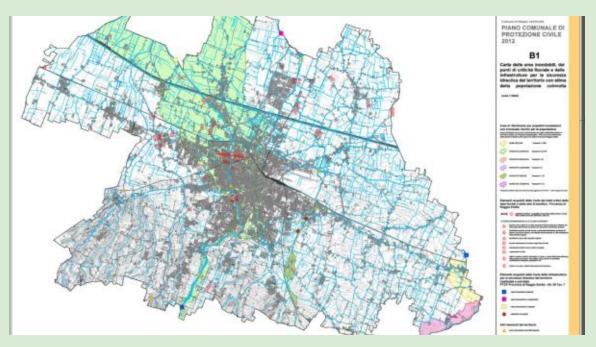








### The CIVIL PROTECTION PLAN



The Civil Protection Plan contains also a map of the floodable areas and critical issues related to infrastructure

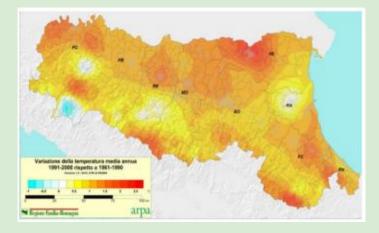


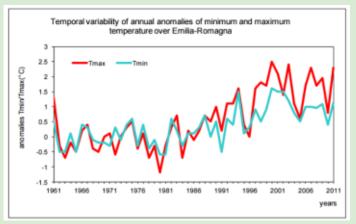




### In general

During the last century the frequency of extreme events in Europe has significantly changed. An increase in the frequency of extreme events associated to higher temperature and a decrease of the frequency of events associated with lower temperature have been observed. Analysing in details the annual minimum and maximum temperature over Emilia Romagna region, positive trend has been detected over the period 1961-2011, more intense in maximum  $(0.5^{\circ}C/\text{decade})$  than in the minimum (0.3°C/decade) temperature. As could be noted in figures the temporal variability of minimum and maximum temperature over the region presents an intensification of the anomalies especially after 1990. Similar signal of trend has been detected at seasonal level, with anomalies more intense during summer: 0.65°C/decade for maximum temperature and 0.4°C/decade for minimum temperature. The analysis of extreme temperature revealed an increase in 10th and 90th percentile associated with a decrease in winter frost days and an increase in summer heat waves, over the period 1958-2000 (Tomozeiu et al., 2006).

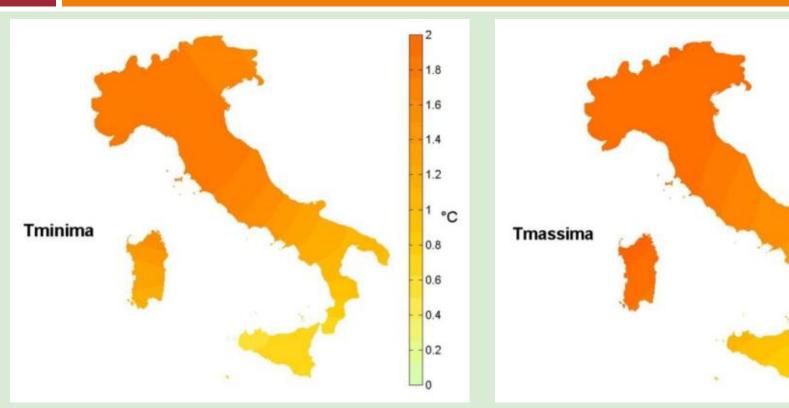


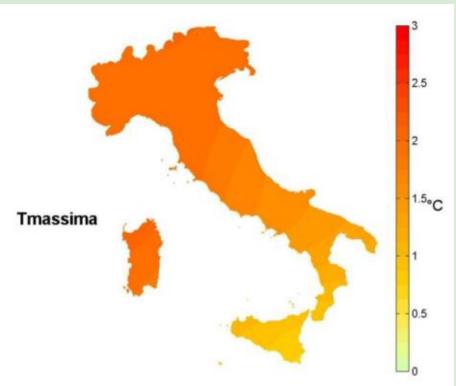










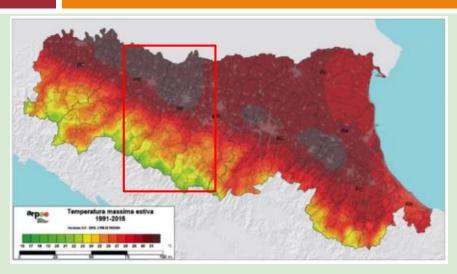


Anomalies of the minimum and maximum temperature annual 2015 compared to the normal value 1961-1990.

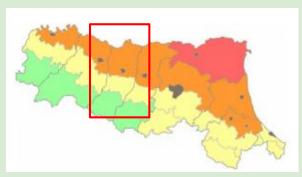




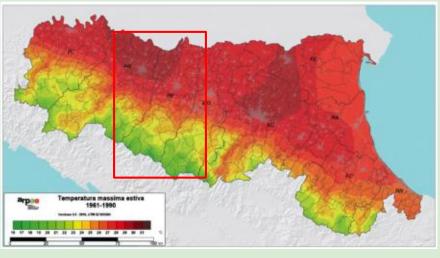




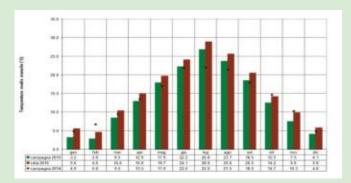
AVERAGE VALUES OF MAXIMUN SUMMER TEMPERATURES IN THE THIRTY YEARS OF REFERENCE 1991 - 2015



FORECASTS
CONCERNING THE
BIOCLIMATIC
DISCOMFORT
DURIGN SUMMER



AVERAGE VALUES OF MAXIMUN SUMMER TEMPERATURES IN THE THIRTY YEARS OF REFERENCE 1961 - 1990



MEAN MONTHLY
TEMPERATURES
RECORDED IN
REGGIO EMILIA 2015

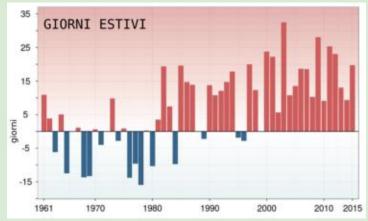


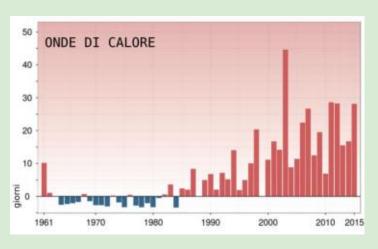




The Urban Heat Island (UHI) effect is a well-known phenomenon defined as the difference of temperature between an urban area and the rural one. The impact of urban structures have been studied for decades, and it is still subject of interest, since the urban world's population keeps increasing. Cities have deep impacts on climate on different spatial scales: from microscale (building and urban canyon) to mesoscale (city and surrounding areas) to macroscale (regional and global). These impacts include the UHI, air quality, air pollution and CO2 emissions. At the same time, the urban environment may affect health, energy consumption and water supply

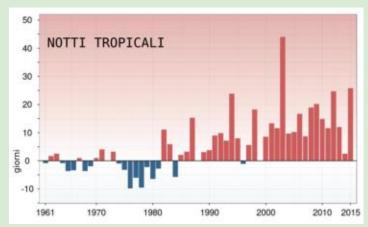
Series of average annual anomalies in the number of summer days in Italy compared to the normal value 1961-1990.





Series of average annual anomalies in the number of days with heat waves (WSDI) in Italy compared to the normal value 1961-1990

Series of average annual anomalies in the number of tropical nights in Italy compared to the normal value 1961-1990.



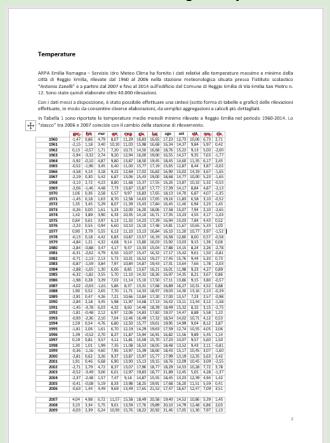


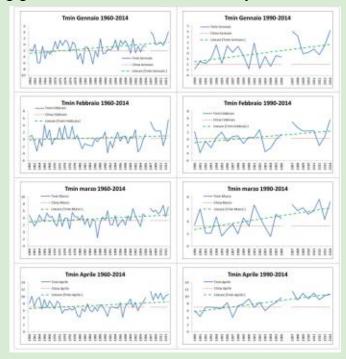






### The climate change impacts on Reggio Emilia – technical reports





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### **CLIMATE PLAN**

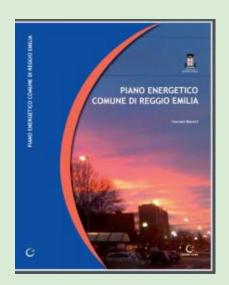
The climate plan of Reggio Emilia provides a line of action towards improving the microclimate of urban centers and local areas. These adaptation strategies are aimed at:

- increase forest and lowland forest areas for the function of absorption of CO2 and improvement of bio-local micro-climatic conditions;
- increase the urban green spaces in the cities within the regulation of urban and architectural transformations in line with targets for the reduction of the "heat island phenomenon" (urban heat Island - UHI).









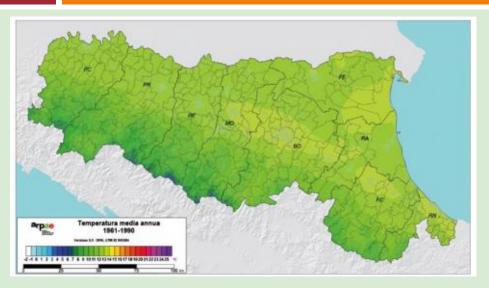
### The main directions of the **Municipal Energy Plan** include:

- promote the use of cogeneration plant solutions (possible extension district heating network, creating new local area networks);
- promote the use of plant systems characterized by high efficiencies;
- promote the adoption of plant systems powered by renewable sources, installations in particular photovoltaic and solar thermal, thanks to the incentives affecting the industry;
- promote the development of high / very high energy efficiency buildings through voluntary mechanisms that may provide the support to those already in place, on a mandatory basis already provided for by national legislation;
- assess and report on other systems in the near future might find spreading at the level of service utilities or directional / commercial structures (e.g.: fuel cells, micro-generators, wind turbines with vertical axis);

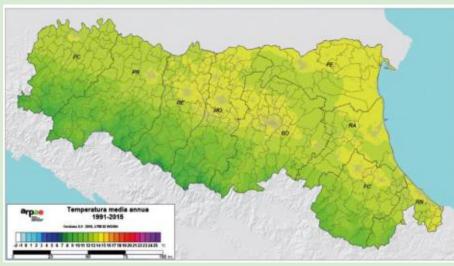








Average temperatures in the Emilia-Romagna in the thirty years of 1961-1990 reference. The average overall temperature was equal to 11.7 °C.



Average temperatures in the Emilia-Romagna in the quarter-century from 1991 to 2015. The overall average is 12.8 ° C

+1.1 ° C compared to reference 1961-1990







Energy demand	1990 (GWh)	1995 (GWb)	2000 (GWb)	2001 (GWb)	2002 (GWb)	2003	2004 (GWb)	2005 (GWh)	2006 (GWb)	2007 (GWb)	2008 (GWb)	2009 (GWb)	2010 (GWb)	2011 (GWb)	2012 (GWb)	2015 (GWb)	2020 (GWh)
Civil sector	1492	1585	1716	1843	2075	2049	2034	2087	2142	2121	2138	2154	2170	2272	2313	2436	2646
Industrial sector	1354	1510	1780	1843	2010	1967	1983	2067	2154	2165	2214	2264	2315	2404	2465	2649	2966
Transportation industry	1192	1270	1568	1669	1686	1722	1743	1823	1907	1923	1974	2025	2076	2119	2170	2326	2593
Agricultural sector	142	134	182	191	199	203	205	214	223	225	230	236	241	251	258	279	315
	(GWh)	(GWh)	(GWh)	(GWb)	(GWh)	(GWh)	(GWh)	(GWb)	(GWb)	(GWh)	(CWh)	(GWh)	(GWh)	(GWh)	(GWb)	(GWh)	(GWh)
Totale	4208	4501	5237	5551	5757	5944	5959	6175	6400	6397	6509	6621	6734	6985	7140	7614	8426

### Energy balance Municipality of Reggio Emilia (top - down procedure

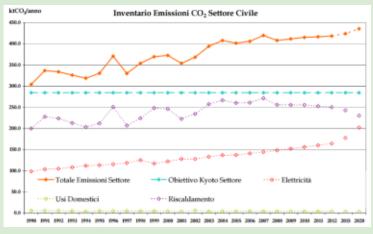
GHG emissions	[CO <sub>2</sub> ] 1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2015	2020
	[laCO <sub>2</sub> ]	[laCO <sub>2</sub> ]	[krCO <sub>2</sub> ]	[kaCO <sub>2</sub> ]	[krCO <sub>2</sub> ]	[laCO <sub>2</sub> ]	[ktCO <sub>2</sub> ]	[ktCO <sub>2</sub> ]	[krCO <sub>2</sub> ]	[ktCO <sub>2</sub> ]	[laCO <sub>2</sub> ]	[ktCO <sub>2</sub> ]	[keCO <sub>2</sub> ]	[ktCO <sub>2</sub> ]	[krCO <sub>2</sub> ]	[ktCO <sub>2</sub> ]	(keCO <sub>2</sub> )
Civil sector	270	273	296	319	329	305	304	314	324	323	327	332	336	335	338	348	363
Industrial sector	244	257	287	309	319	301	300	310	320	319	323	327	332	344	350	367	395
Transportation industry	297	311	388	418	431	431	430	444	458	456	462	469	475	501	512	545	601
Agricultural sector	30	29	37	40	41	35	35	36	38	37	38	38	39	41	41	43	46
-	[kiCO <sub>2</sub> ]	[laCO <sub>2</sub> ]	[kiCO <sub>2</sub> ]	$[ktCO_2]$	[krCO <sub>2</sub> ]	[keCO <sub>2</sub> ]	[laCO <sub>2</sub> ]	[keCO <sub>2</sub> ]	[ktCO <sub>2</sub> ]	[ktCO <sub>3</sub> ]	[krCO <sub>2</sub> ]	[fatCO <sub>2</sub> ]	[ktCO <sub>2</sub> ]	[keCO <sub>2</sub> ]	[keCO <sub>2</sub> ]	[ktCO <sub>2</sub> ]	[krOO <sub>3</sub> ]
Totale	1084	988	1162	1252	1292	1382	1380	1424	1470	1464	1484	1504	1525	1564	1595	1690	1853

Inventory GHG emissions Municipality of Reggio Emilia (top - down procedure)



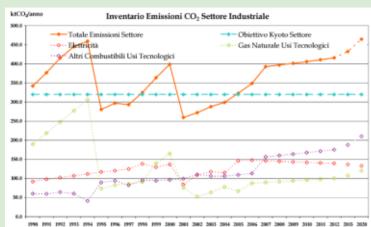




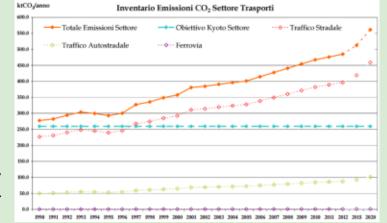


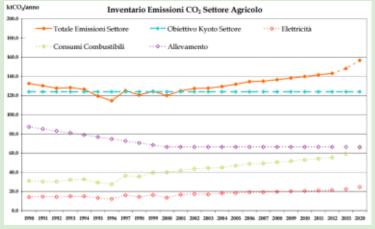
Emissions inventory civil sector





Emissions inventory
Agricultural sector





Emissions inventory transport sector







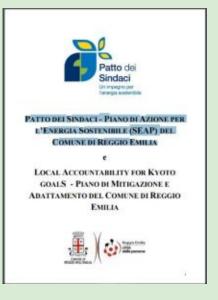
The energy balance of the civil sector, developed and presented in this chapter has highlighted some important aspects that can be summarized as follows:

- \_ The thermal energy requirements for winter heating of the civil users (residential and tertiary) are met almost entirely by natural gas powered systems; in particular, almost 71% of the users served from power stations fueled by natural gas, while 27% of them are directly connected to the district heating network;
- \_ The electricity needs show a constant trend of growth associated, inter alia, to the diffusion of for summer air conditioning systems;
- \_ In recent years there has been the creation of a considerable number of new housing (population growth), which need a greater amount of energy to meet the demands









### The main directions of the **SEAP PLAN** include:

- To promote on the whole territory the development of renewable energies
- Create synergies with all local stakeholders of the territory to increase production and use of photovoltaic energy and micro-cogeneration
- 1. New energies zero CO2
- Strengthen public transport and the use of bicycles to reduce traffic
- Create of interchange points between the various types of efficient transport
- 4. A city that moves better

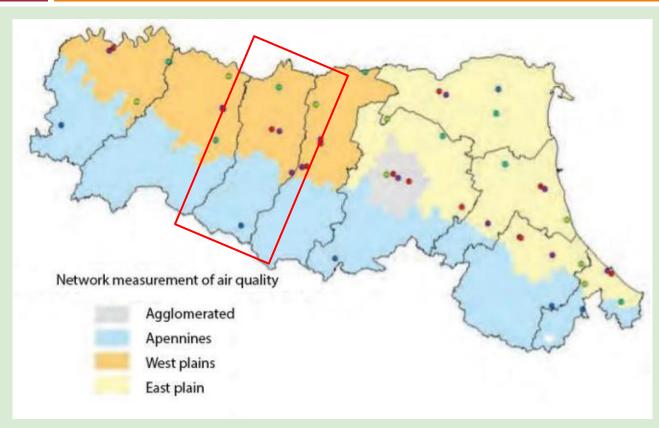
- Focus on energy efficiency of new and old buildings, containing urbanization in existing areas
- Create new sites for public parks and forests, involving in this project also local associations
- A city greener and more efficient
- To promote a more sustainable and efficient commercial and operating system from the point of view of energy in companies and local private exercises
- 5. low-carbon economy

- Improve maintenance and energy efficiency of water and power networks
- Adopt new measures for the treatment of municipal waste, focusing on a strengthening of the collection on the territory
- · Closing the incinerator Cavazzoli
- The networks and smart services
- Promote studies and research to investigate the effects of change climate of the city of Reggio Emilia
- Make adaptation to dimate change one of the key strategies to be considered in decision-making tools of the City
- Adapting to changing climate

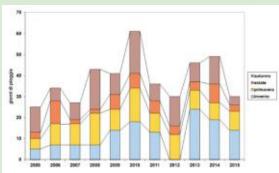




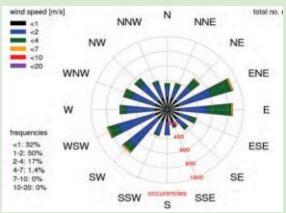




Network for measuring air quality and regional zoning.



Number of days with precipitation > 5 mm / day recorded in Reggio Emilia.



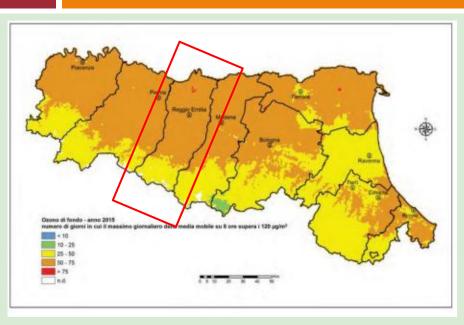
Wind rose (intensity and direction) of the province of Reggio Emilia - 2015.



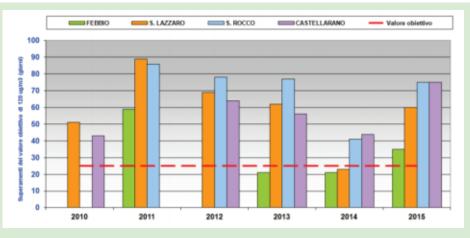




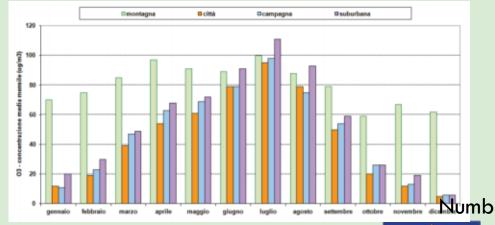
mode

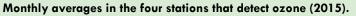


Days exceeding the O3 Daily volume in the region.



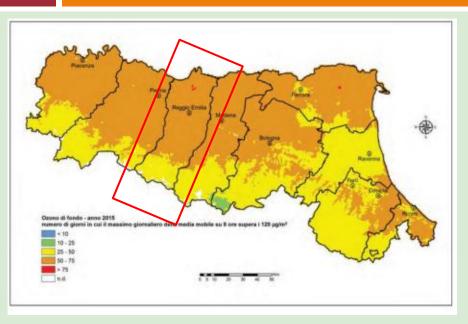
Number of days exceeding the target value for human health.





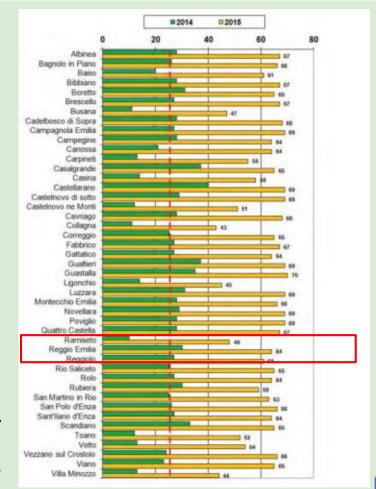






Days exceeding the O3 Daily volume in the region.

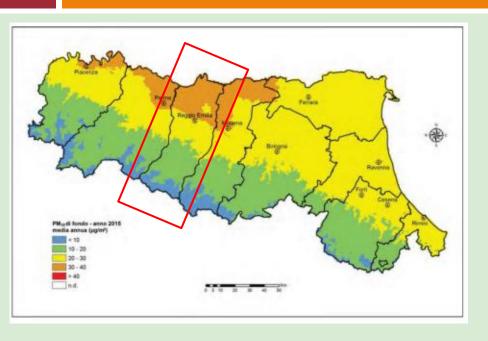
Number of days of annual O3 exceeding estimated for each of the municipality the province of Reggio Emilia through the modeling process

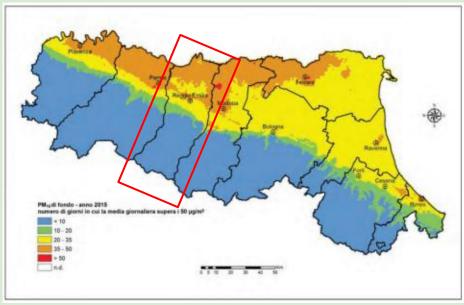












Annual average PM10 cross the region

Days exceeding the PM10 daily volume at ground level in the region









Historical trend of the annual average concentration of PM10 detected by the ground stations for urban traffic (Viale Timavo)

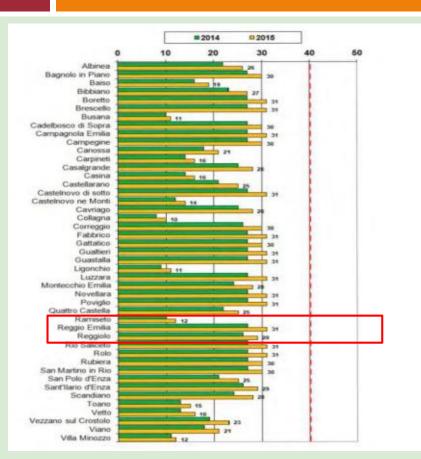


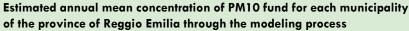
Trend of annual average concentrations of nitrogen dioxide in the stations of bottom and in the traffic station.

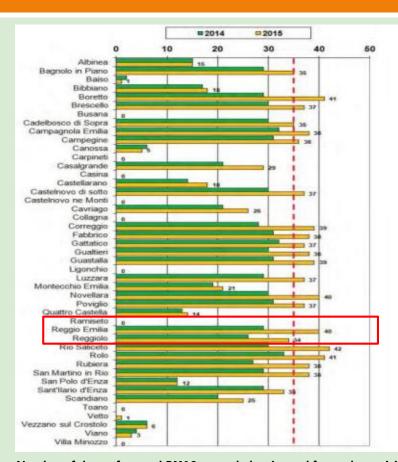












Number of days of annual PM10 exceeded estimated for each municipality of the province of Reggio Emilia through the modeling process (background values).





# Cyprus







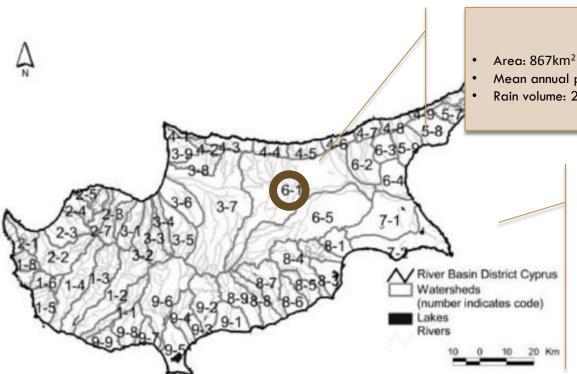
### In general

Water resources of Cyprus are limited due to its semi-arid climate. Freshwater availability depends almost entirely on rainfall that is highly variable with frequent prolonged periods of drought. As a result, water demand frequently exceeds the amount of freshwater available. Although water availability has substantially increased through the exploitation of non-freshwater resources (desalinated and recycled water) and the decrease in water consumption, the pressure on water resources remains obvious. Another significant pressure posed on the water resources of Cyprus is the water demand for the tourism sector (4% of the total water demand), which intensifies the competition for water between the water users, given its substantial contribution to the economy of Cyprus.





### Water supply sources-Surface water bodies



### **Watershed of Pediaios**

- Mean annual precipitation: 316mm
- Rain volume:  $2.74E+08 \text{ m}^3/\text{yr}$

### River water bodies

- Rivers that originate in the Troodos area
- All the river water bodies have large rain volume with non-continuous flow
- River length: Between 0.8 60.8km

### Lakes

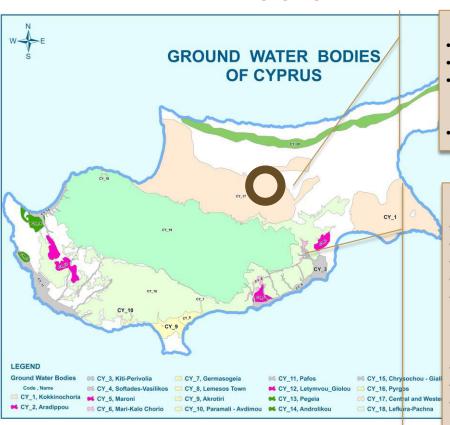
Lake Magli: It is a small artificial lake (covering an area of 37 hectares with a perimeter of 760 m, where part of the river Pediaios empties into).

Figure 3 River basin district Cyprus with its watersheds and rivers





### Water supply sources-Groundwater bodies



### Groundwater body of Central and Western Mesaoria

- The biggest aquifer in Cyprus
- One of the most complicated hydrogeological systems
- Due to its complexity and the lack of data (a large part of this water body does not belong to the Republic of Cyprus), it is not possible to have exact measurements about the water supply and demand balance.
- Mean precipitation: 280mm

### Groundwater body status based on the §5 of the Water Framework Directive 2000/60/EC

- Quantitative status: Bad
- Qualitative status: Good
- Salinization: NO
- Nitrates: YES
- High concentrations in
  - 1. Cl<sup>-</sup> and SO<sup>2-</sup><sub>4</sub> due to the chemical composition of the rocks
  - 2. NO-3 due to the extensive use of fertilizers
  - 3. NH<sup>+</sup><sub>4</sub> due to livestock breeding
- Drinking water use: YES
- Status characterization: Bad
- Overpumping





### icosia

inhabitants).

VBN is to operate the water sq.Km area and water mains of water reservoirs, and the receipt, millions CM. of water annually. mers the WBN is supplying with consumption per inhabitant for 5.320 CM of water on average from the Water Development and it is conveyed in 12 water e total capacity of the reservoirs of water for 36 hours to the nsumers mainly by the gravity with high altitude a water tower height has been constructed.

### quality and in sufficient quantity vater supply sources-Major water works

### MAJOR WATER WORKS

**KERYNE** 

Akrotiri Irrigation Area

I in the supply system.

• Tersefanou-Lefkosia Pipeline: 2nd phase of Souther Conv

Southern Conveyor Project is the largest water development project undertaken Objective  $\rightarrow$  collect and store surplus water flowing to the sea and convey it to

domestic water supply and irrigation.

Construction period → 1984 until 1994

Cost → 163 million Cypriot pounds

Description  $\rightarrow$ 

Phase I: construction of Kouris dam on Kouris river, the main conveyor, a 110 Kr reservoir, the telemetry system and Kokkinokhoria, Athienou, Troulloi and Avdello area of about 9 767 hectares.

Phase II: "Diarizos diversion, conveying water from Diarizos river through a 14,5 Chapotami scheme, Limassol and Tersefanou water treatment plants, Tersefanou-Ni pipeline, water supply to villages west of Limassol and the Akrotiri, Parekklisia, Ma irrigation schemes on a total area of about 4159 hectares. The Limassol and Terset water supply to villages west of Limassol, the Akrotiri, Parekklisia and Kiti irrigation Tersefanou-Nicosia conveyor and the Chapotami scheme have been completed."

Photos and Data of the Major Water Works can be found by clicking

Objective  $\rightarrow$  it serves the needs of the free area of Famagusta and part of the needs of Larnaca and Nicosia.

Dhekelia Desalination Plant

Description 

Desalination plants introduced in April 1997 with the operation of Dhekelia Desalination Plant. It has a nominal capacity of 40.000m<sup>3</sup> of water per day.





Environmental (clin

. Nominal daily capacity: 40 000 m3/day . Nominal yearly capacity: 14 600

### Climate-change impacts

### Change in river flow

Relationship between precipitation and inflow for each of the dams in the Cypriot partner municipalities was studied based on historical records

The inflow was affected by the precipitation following a similar pattern for each dam

### Change in groundwater levels

The decrease in effective rainfall and the consecutive years of drought in conjunction with the intense agricultural development that took place during the second half of the previous century in Cyprus led to the depletion of surface water stored in reservoirs and the exploitation of aquifers (direct climate change effect), especially for agriculture as the irrigation period elongated. Furthermore, cuts in water supply by the Government imposed in periods of drought or high water pricing have often led private water consumers to illegally abstract water from boreholes (indirect climate change effect), which resulted in further deterioration of groundwater quantitative status.





### Adaptation measures-Measures to increase freshwater supply

- 1. Increase storage capacity: As there are no rivers with perennial flow in Cyprus, ground-water was the main source of water until 1970 for both drinkingand irrigation purposes. This resulted in the depletion of aquifersand thus the Government decided to invest in the construction ofdams to increase freshwater availability and storage capacity.
- 2. Inter-basin water transfer: Although a large number of dams has been constructed inCyprus, not all areas were located in a distance that would enableconnection to them, while the construction of dams at low altitudes where the majority of the main urban centres of Cyprus arelocated, was not feasible. As a result, these areas relied exclusivelyon groundwater resources for satisfying their needs for drinkingand irrigation water, which led to significant reductions in ground-water reserves. The Government then decided to undertake a series of projects for the interconnection of rivers, reservoirs and aquifersand the transfer of water from areas with adequate water reservesto areas with limited water reserves. Inter-basin water transferallows for considerable flexibility in water management and allo-cation.
- 3. Rainwater harvesting: Subsidies are provided to farmers in the framework of the Rural Development Programme for the implementation of on-farm RWH practices with the installation of small-scale waterreservoirs on farmland. A study on the investigation of the potential use of rainwaterin Cyprus, concluded that as far as households are concerned, economic incentives could be provided for the installation/maintenance of RWH infrastructure (including treatmentsystems) in conjunction with the imposition of fees based on theamount of rainwater run-off to the streets (instead of the currentfee which is based on the household surface), in order to provide motivation for rainwater reuse.





### Adaptation measures

### Measures for the exploitation of non-freshwater resources

- 1. **Desalination:** As the exploitation of freshwater resources and other watermanagement measures did not meet water demand in Cyprus, theGovernment decided to augment drinking water supply with thecommissioning of desalination plants. This had a two-fold bene-fit, as apart from the increase in drinking water supply, freshwaterreplaced by desalinated water may be used for irrigation in agricul-ture, thus resulting in an increase in irrigation water supply as well.
- 2. Greywater reuse: A programme of subsidies in place for reducingpotable water consumption, which foresees inter alia the provision of economic support for the installation of greywater treatmentsystems in order to use treated greywater for toilet flushing andwater gardening in households, as well as in schools, military campsand other public buildings.





### Adaptation measures-Measures to decrease water demand

- 1. Replacement of water distribution networks: Continuous efforts are being made forthe replacement of the water supply networks and for the detection of the defective equipment. In particular, the water supplyboards in the urban areas are investing in the replacement and improvement of their networks as well as in advanced monitor-ing systems, which are contributing in the timely identification of leakages and replacement of defective pipes. However, a large part of the urban water distribution network is more than 40 years oldand requires replacement.
- 2. Use of water supply meters: The installation of individual water sup-ply metres to the domestic sector in Cyprus is almost universal, while for irrigation purposes, it is restricted mainly in areas sup-plied with water from the Governmental Water Projects (GWP) or from boreholes in certain groundwater bodies that are under spe-cial water saving measures.
- 3. Control of groundwater exploitation: The Law on the Inte-grated Water Management 79(I)/2010 sets new requirements forgranting permissions regarding borehole drilling and pumping. Furthermore, the Law foresees the installation and monitoring of water metres in boreholes in order to control the limits setfor water pumping, according to Article 11 of the WFD. It is expected that the installation of water metres will eliminate violations.
- **4. Land consolidation:** Reduction in the fragmentation of agricultural holdings, the oppor-tunity for scale economies in irrigation works and the achievement of significant water savings.





# Water availability and droughts strovolos

### Adaptation measures-Measures to decrease water demand

- 5. Water pricing: Up to date, the price of the water service in Cyprus is cal-culated based exclusively on the recovery of the financial costswhile the environmental resource costs are not taken into accountfor With respect to the tariff structure, theauthorized drinking water providers in Cyprus sell the water theybuy on wholesale from the Water Development Department (WDD)to the final consumers, by applying different tariff systems.
- 6. Provision of subsidies for water savings: The Government of Cyprus provides subsidies in order to reducepotable water consumption mainly in households. The water-saving subsidies are for (i) the drilling of a borehole for wateringgardens, car wash, etc., (ii) the connection of boreholes with toiletcisterns, (iii) the installation of a hot water recirculator and, (iv)the installation of a greywater treatment system for the irrigation of gardens.



### Adaptation measures-Measures for the management of droughts

- 1. **Water import:** To address the impacts of severe drought on drinking wateravailability in Cyprus during the summer of 2008, 3.3 Mm3of waterwas emergently shipped to the island from Greece. The year thatfollowed, an additional amount of water of 2 Mm3was imported from Greece.
- 2. Water rationing: Mandatory water use restrictions are applied when water avail-ability is limited in order to reduce total water consumption orto restrict particular water uses. In Cyprus, waterallocation mechanisms under drought conditions (water rationing)have been established to provide priority to maintaining domesticand municipal water supplies. The second priority is to maintainsupplies to perennial crops and greenhouses at 80% of the recom-mended application levels. Seasonal vegetable crops constitute thethird priority. The water cuts in irrigation from the South ConveyorSystem during the period 2000–2010 ranged from 10% to 90% withthe exception of 2004 where the water cuts were equal to zero.
- 3. **Drought management plan:** The Government of Cyprus has elaborated a Drought Man-agement Plan (DMP) in order to prepare for, and effectively respond to droughts. The DMP of Cyprus structuresupon the EC guidelines on drought management and is closely linked with the National Water Policy, which is based on the criteria and objectives of the WFD.





### **Conclusions**

- 1. Overall it can be said that although there is a substantial num-ber of measures in place that are considered to address climate change impacts on water resources and the adaptive capacity of the water sector has considerably been increased, the overall vulnerability remains high, as water demand is still not satisfied incertain areas and/or for certain uses, in times of drought.
- 2. Furthermore, there should be a shift towards a more balanced and integrated approach on water management in Cyprus, according to which demand-side measures are further enhanced, while any adverse impacts from the implementation of the measures are min-imized to the degree possible.
- 3. If water availability is still not met, supply-side measures such as the exploitation of wastewater, greywater and rainwater could be employed or further promoted. In particular, the contribution of reclaimed water in irrigation water supply maybe further increased while it could also be used in urban applications. The use of greywater may be further promoted in households and in large buildings as well, whereas rainwater could also be recycled in similar applications, thus reducing the need for desalination water.
- 4. The national policy on drought is considered of outmost importance for increasing the preparedness of the country to face droughts, and therefore it is crucial that it is supported by the necessary resources to successfully accomplish its aims.





### Climate change impacts

While no single storm or flood can be attributed directly to global warming, changing climate conditions are at least partly responsible for past trends.

Pediaios area has significant potential for flood risk. The flood mechanisms for the case of PDSKP C01 p. Pediaios is the natural overflow and flow blockage due to the failure of the section of the bed of the stream and the lack of cross-section of bridges and culverts.

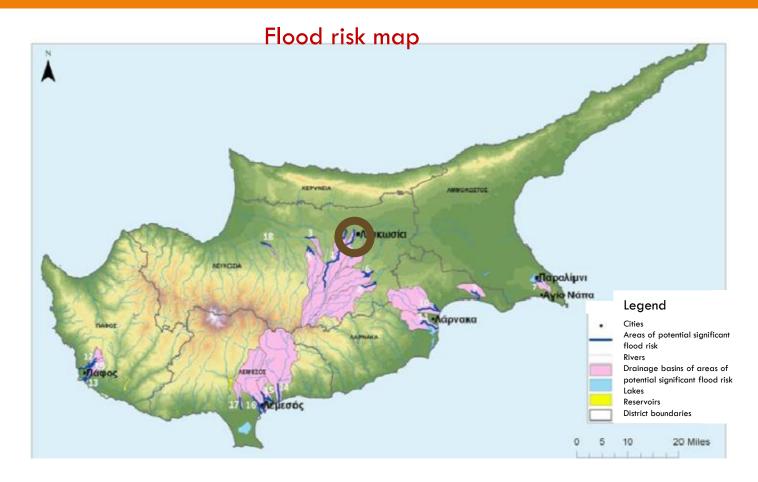
In specific, floods occur at low watercourses where the available height is very small (especially near the the park of Nicosia, where in several cases the side streets are close to the river bed). In addition the dense coverage of the reed in the area increases flood potential. It has to be noted that the park of Nicosia, as well as the provision of open spaces help towards the decrease of flood potential in Pediaios area. Furthermore, Tamassos dam, Magli lake, as well as the many recharge mounds contribute to flood potential decrease.

Structures related to Pediaios area and are located in Strovolos municipality present bedsores when the level of water rises over the roadway.

Based on the abovementioned, it appears that in relatively few segments of the overall 25km of Pediaios river, the level of protection provided by the return period is less than 20 years.

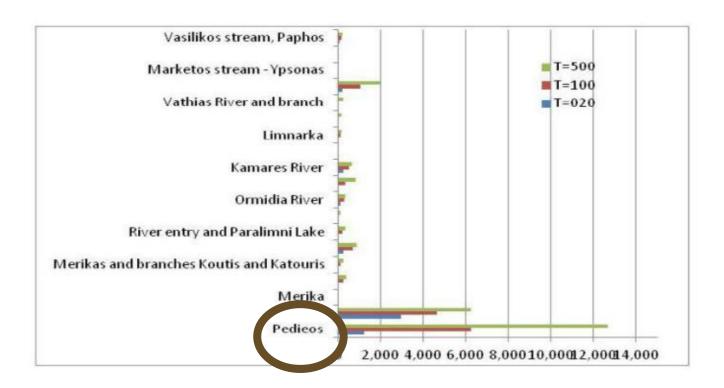












Estimated number of people affected by flooding at present building density (T= return period)





### Adaptation measures

The last two decades, a separate drainage system is being developed In Cyprus in order to collect stormwater. So far, the drainage network in the majority of the big urban centres of Cyprus has been completed except for Nicosia. However, certain flood protection measures have been taken, namely:

- 1. **Tamassos dam:** This dam was not designed as a flood prevention work but as a recharge. Nevertheless, it has a role in flood protection. It was constructed and operated in 2002, with a total storage volume of 2.80 hm3 water.
- 2. Lake Magli: It is a small artificial lake (covering an area of 37 hectares with a perimeter of 760 m, where part of the river Pediaios empties into). The lake is a management standard flood runoff in urban facilities covering aesthetical and halting-flood-runoff needs. It serves the enrichment of groundwater, as well as the local Irrigation uses for the service which was constructed.
- 3. Warning mechanism for exceptional weather and flooding in Nicosia / Strovolos Municipalities and Lakatamia (proposed-raising awareness): Development of an alert mechanism about the flood potential for the Municipal Authorities of Nicosia/Strovolos/Lakatamia (combination of thunderstorms and high Tamassou reservoir level). In addition, design and development of a mobilization mechanism for removing residents and forbidding access to Pediaios Park and the riparian areas of Nicosia.



