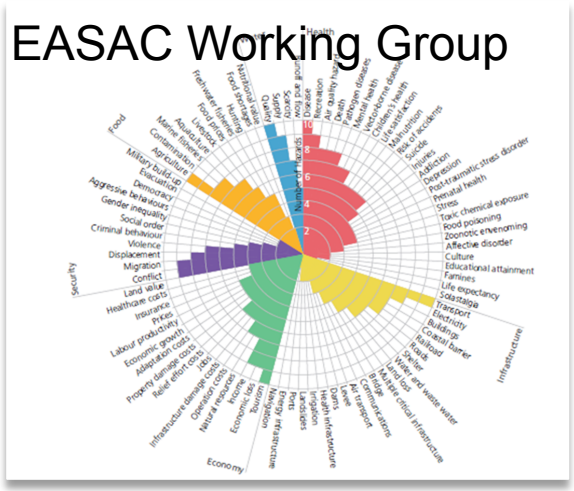
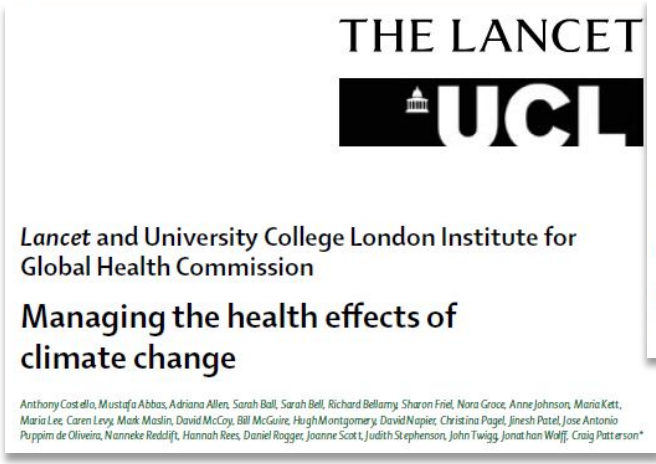
Session 14
Resilient and productive neighbourhoods

CONSTRUCTION OF HEALTH RESILIENCE OF LOCAL COMMUNITIES: THE CONTRIBUTION OF IoT TECHNOLOGIES

Prof. Rosalba D'Onofrio; rosalba.donofrio@unicam.it
Prof. Elio Trusiani; elio.trusiani@unicam.it
Prof. Roberta Cocci Grifoni; roberta.coccigrifoni@unicam.it

University of Camerino, Italy

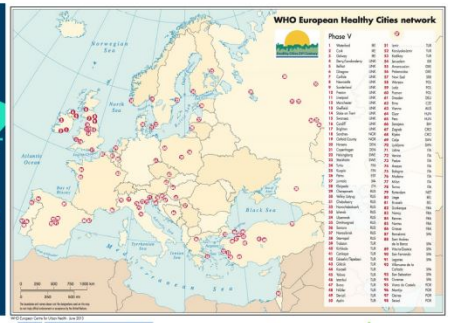


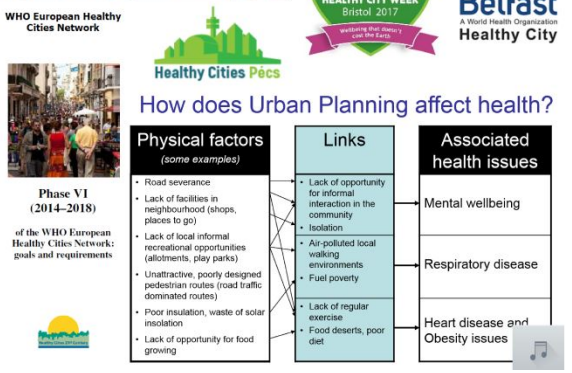


BACKGROUND

Climate change is affecting the health and well-being of people living in European cities with effects such as: poor air and water quality, the urban heat island, food safety, the spread of infectious diseases, and injuries and deaths due to extreme weather events (WHO Europe, 2017).

These effects are felt hardest by the weakest segments of the population (children and elderly people) and aggravate chronic health conditions such as





"The density of cities can increase vulnerability to the local manifestations of extreme weather and climate change in several ways: reducing green space and mature trees that have a cooling effect on ambient air, for example; creating barriers for natural air and water flow; and producing large quantities of biological waste that can contaminate floodwaters.

THE LOCATION, QUALITY, AND UPKEEP OF LOCAL INFRASTRUCTURE – water supply, sanitation and drainage, roads and related structures such as culverts and bridges – **CAN ALL PLAY AN IMPORTANT ROLE IN MODIFYING HEALTH AND OTHER IMPACTS OF CLIMATE CHANGE.** Ultimately, the level of vulnerability of these modulating systems will be important in the

Climate change and human health in cities

Coordinating Lead Authors: Martha Barata (Rio de Janeiro), Eva Ligeti (Toronto)
Lead Authors: Gregorio De Simone (Rio de Janeiro), Thea Dickinson (Toronto), Darby Jack (New York City), Jennifer Penney (Toronto), Mizanur Rahman (Dhaka), Rae Zimmerman (New York City)

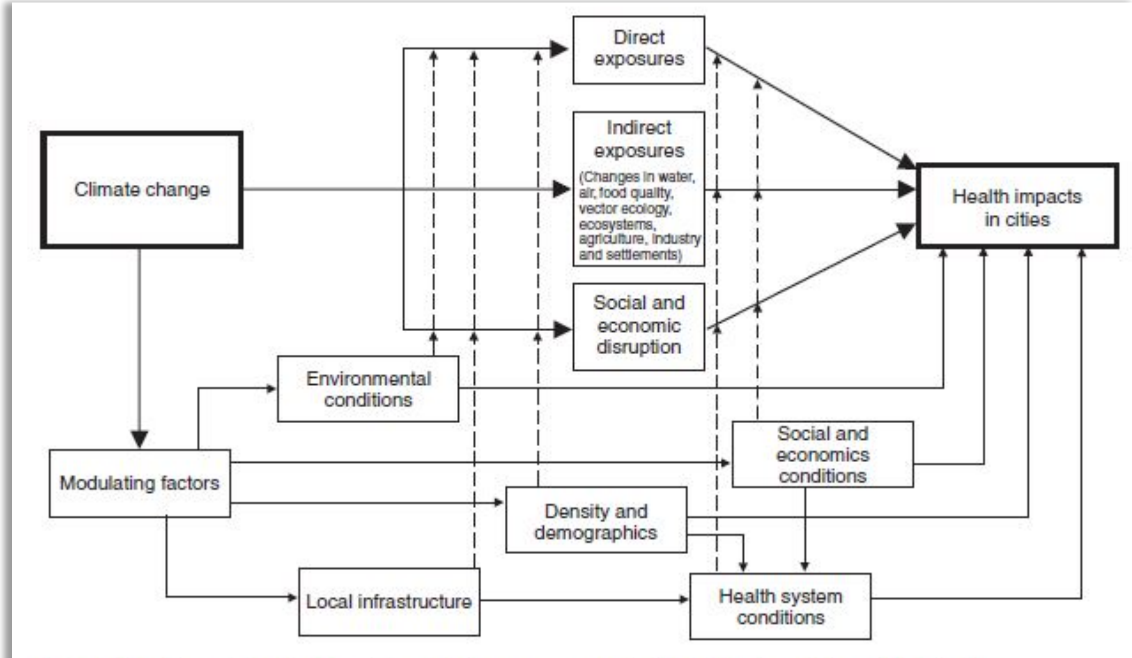


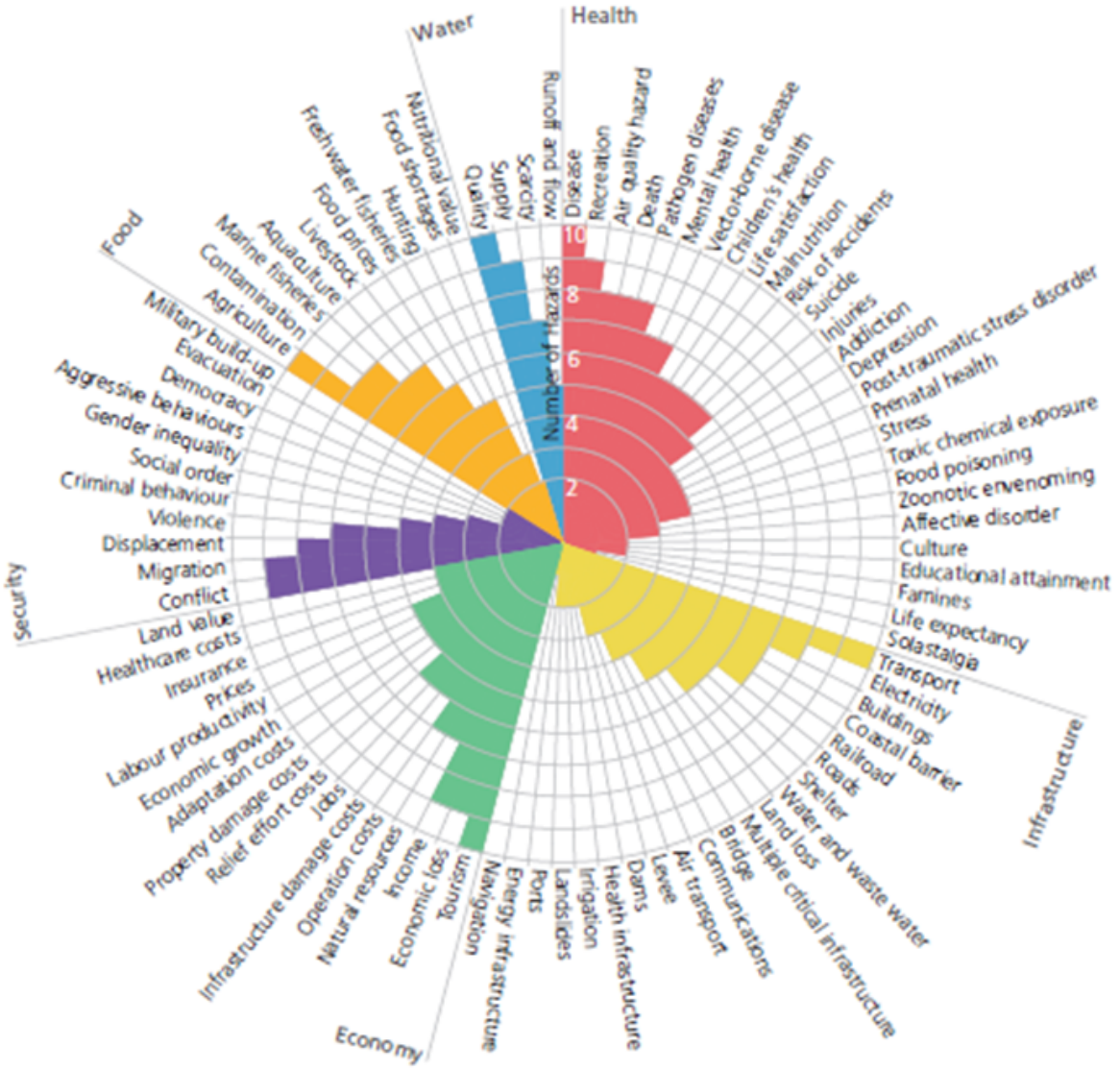
Figure 7.1: *Three main mechanisms of how climatic processes may affect health in cities and its modulating factors.*

Source: Adapted from Confalonieri et al., (2007).

Table 7.1: *Climate change-related drivers and outcomes for urban health.*

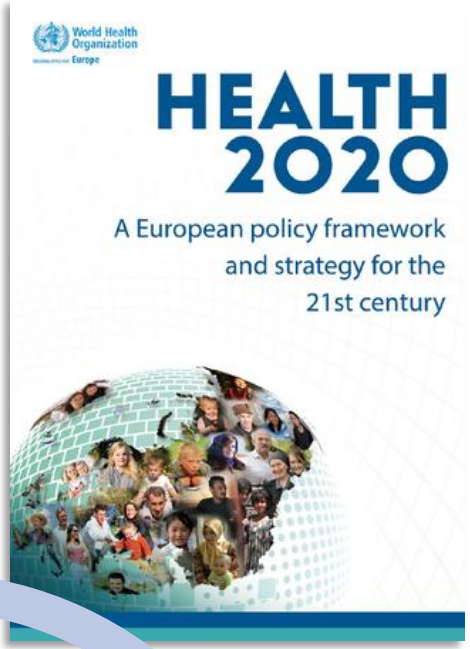
Drivers	Health endpoint	Impact on cities	Degree of uncertainty	Key references
Temperature extremes	Mortality via heat exhaustion. Elderly most vulnerable	Pronounced (via urban heat islands)	Low (extensive evidence exists)	Kovats and Hajat, 2008; Bell *et al.*, 2008
Wind, storms, and floods	Mortality via physical trauma, drowning	Pronounced (population density in vulnerable areas)	Low (extensive evidence exists)	Guha-Sapir *et al.*, 2004; Ahern *et al.*, 2005
Drought	Malnutrition	Ambiguous	Medium (adaptive capacity is poorly understood)	Confalonieri *et al.*, 2007
Water quality	Diarrheal disease	Pronounced (flush contaminants, may overwhelm city water systems)	High (limited research)	Hunter, 2003; Kistemann *et al.*, 2002
Air quality	Respiratory illness	Pronounced (population density, pollution sources)	High (limited research, likely to vary greatly across cities)	Kinney, 2008; Holloway *et al.*, 2008; Steiner *et al.*, 2006
Aeroallergens	Allergies, asthma	Ambiguous	High (limited research, likely to vary greatly across cities)	USEPA, 2008
Vector-borne diseases	Malaria, dengue, others	Diminished – few vectors thrive in urban environments	High (scholarship on urban effects)	Lindsay and Birley, 1996

- The recent publication of the **European Academies Science Advisory Council**, called **"The imperative of climate action to protect human health in Europe" (EASAC, 2019)** (Fig.1) and is coming to the forefront of public opinion with articles in newspapers around the world, not least the recent TIME Report "2050 The Fight for Earth".
- The **EASAC Working Group has worked on mitigation and adaptation measures** in European cities to address climate change and the health benefits of their inhabitants.
- . From all these experiences, it emerges for



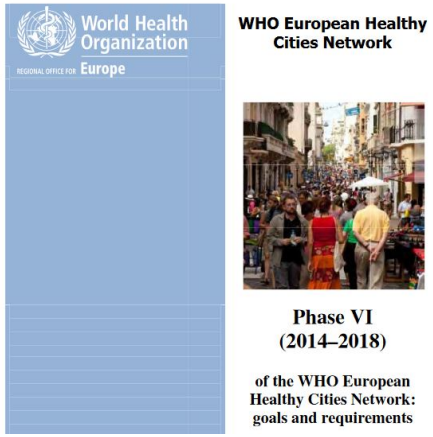
OUR POINT OF VIEW

Between all disciplines involved about these themes, tough URBAN PLANNING AND DESIGN are called to respond to the needs of health in cities, in delivering health improvements through reshaping the urban fabric of cities, in the creation of new healthy urban environments, in the sustainable organization of mobility, land use, and green areas.



"Healthy as the Pulse of the New Urban Agenda" (WHO 2016) introduced the **idea of urban health resilience** as the need to promote resilient urban policies to reduce the risk of climate change with respect to human health.

The Fifth and Sixth Ministerial Conferences on Environment and Health from 2010 and 2017



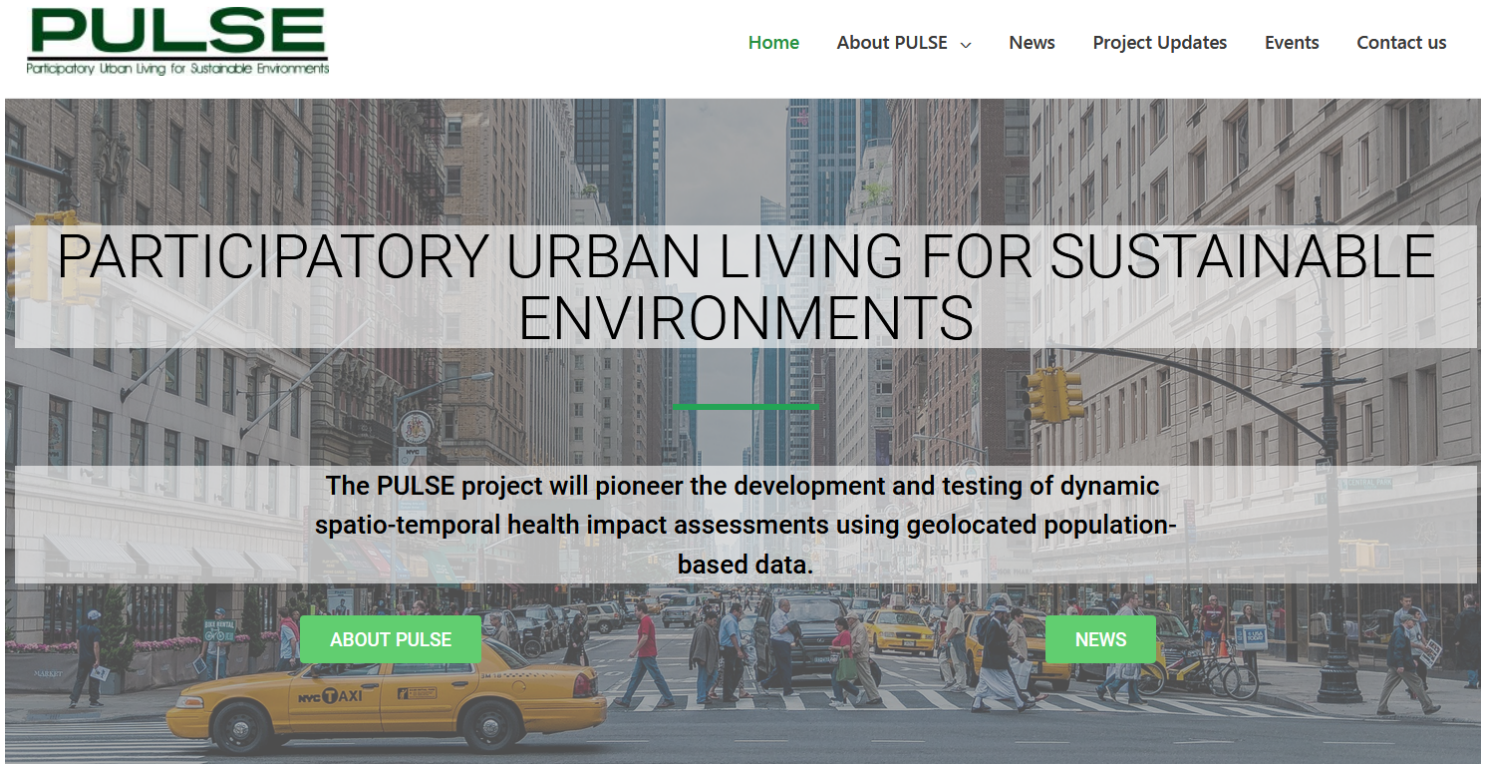
- The need for relevant investigation tools and integrated analysis is therefore indispensable.
- The knowledge we need must combine quantitative and qualitative data to measure/assess the effects of climate change and measures to increase the resilience of cities, actively involving communities.

About Urban Planner…

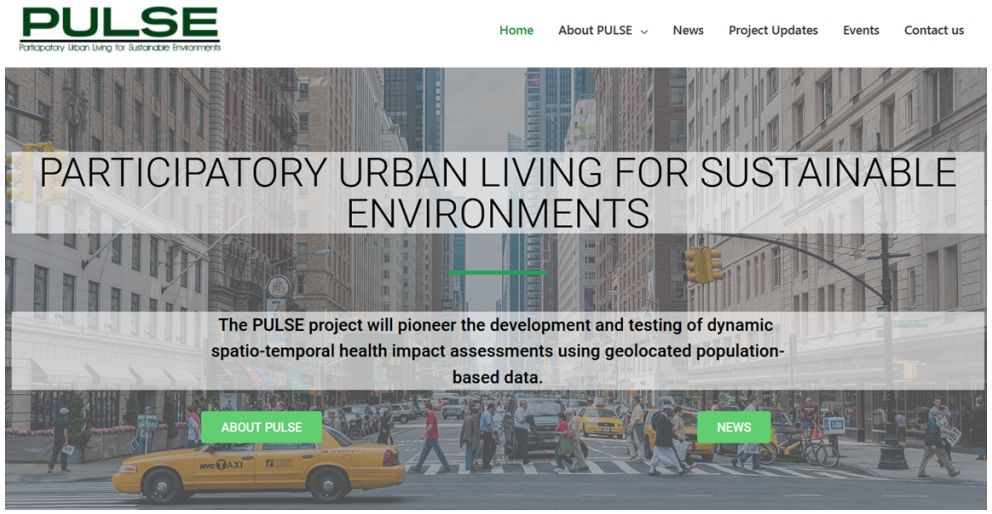
- Renewed relationship between urban planning and health
- Renewal of analysis and project knowledge tools about the city
- From the project to the process to the prefigurative scenarios, predictive and adaptive design solutions changing the meaning and the time horizon of the urban planning project and above all the actors: the communities as co-projects of the living space.
- Renewal of the term and meaning of INTEGRATION

ONGOING EXPERIENCES

Some cities are trying to use new technologies to investigate and improve the quality of urban health



- **PULSE (Participatory urban living for sustainable environments; http://www.project-pulse.eu/)** is, for example, a research and innovation action funded under the EC Framework Programme H2020 which aims to initiate a collaborative dialogue between five global cities:
  - Paris, Barcelona, Birmingham, New York and Singapore to transform public health **from a reactive to a predictive system**, through the

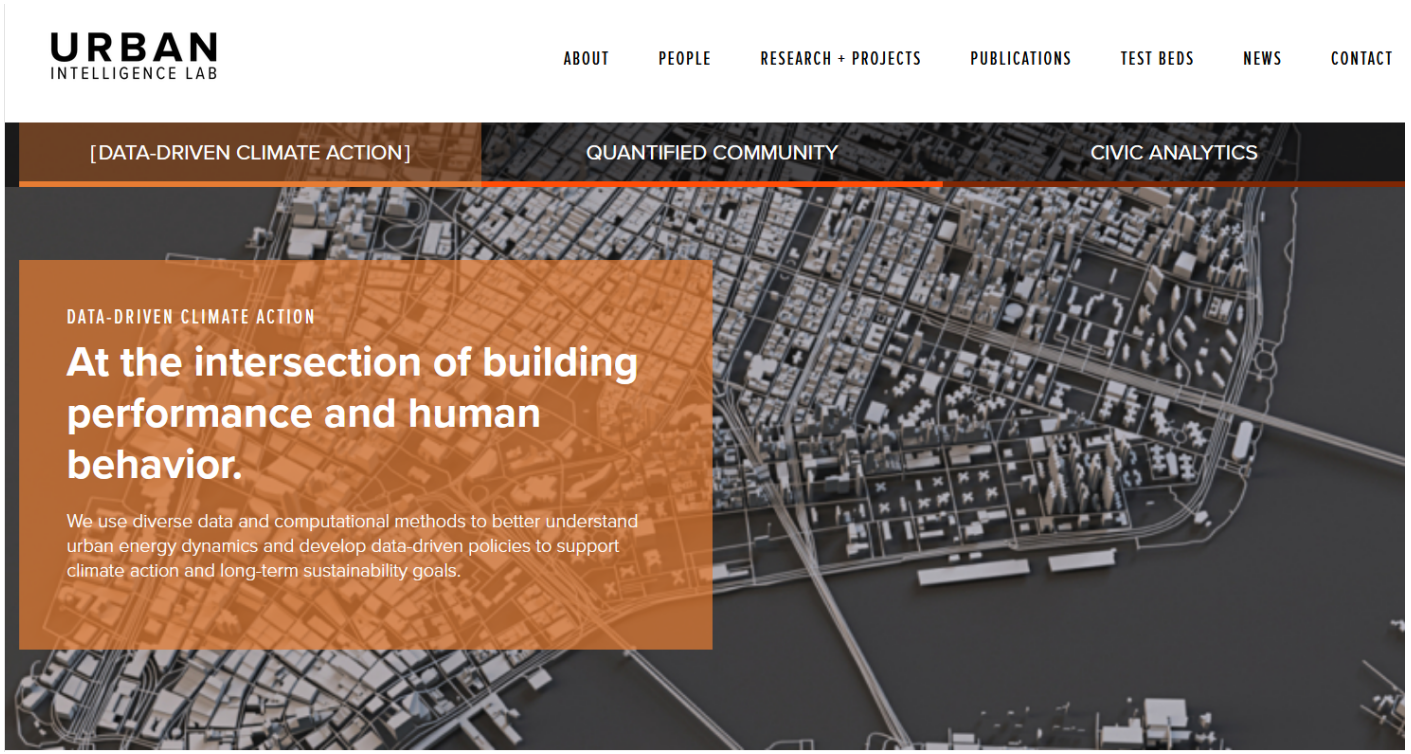


inactivity and metabolic disease of type2diabetes.

The objective of the research is to build extensible models and technologies to predict, mitigate and manage these health problems through the use of GIS technology and real-time data mapping tools within the physical space of the city; this will allow, for example, to analyze data on air pollution in certain places with respect to the occurrence of respiratory diseases.

The data collection system and the information management dashboard allow the integration of different sources: from apps, to Fitbits, to sensors.

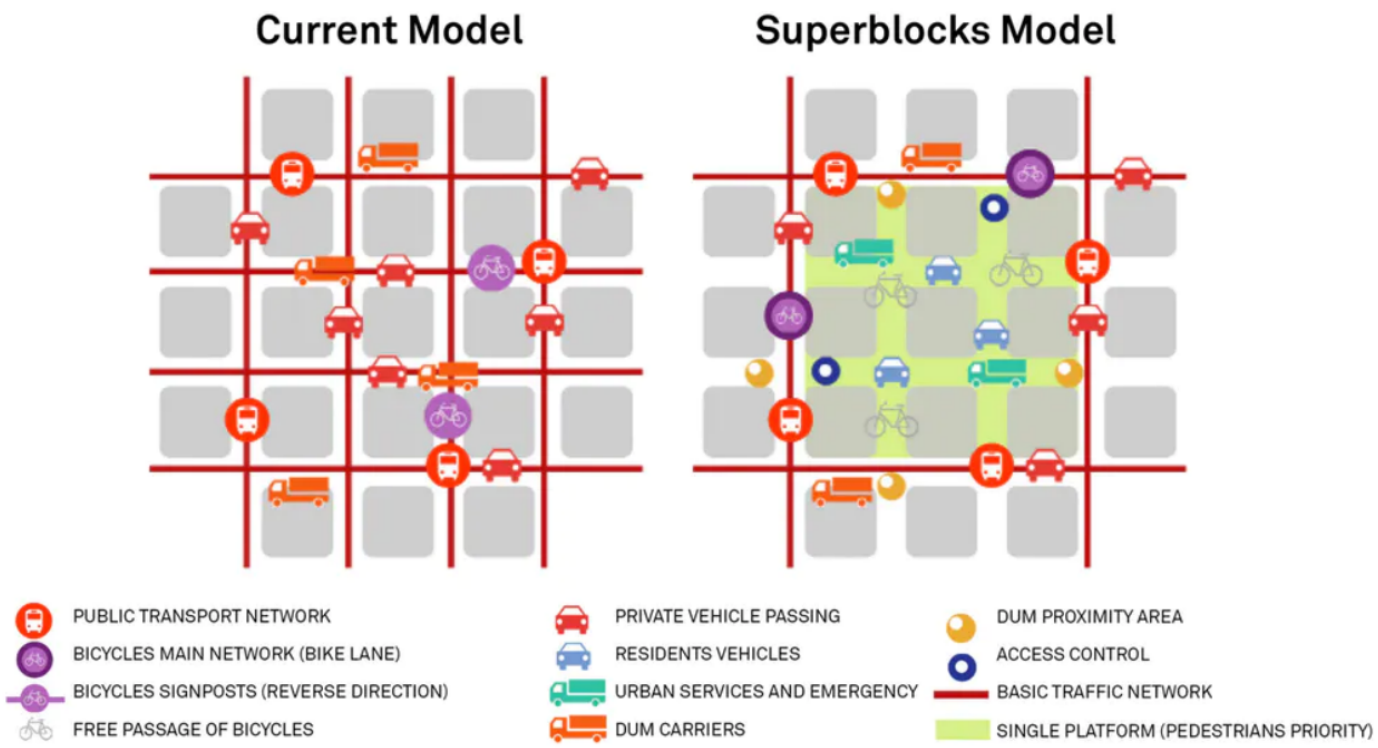
The design of low-cost, reproducible and interoperable sensor platforms used in these experiences presents a number of technical challenges: from the right selection of locations whereto apply them, to mitigate the impacts of external elements, to legal and privacy issues. All these variables can make the deployment of sensors in urban spaces very complex and in this case the comparison and contribution of the local community is extremely important.

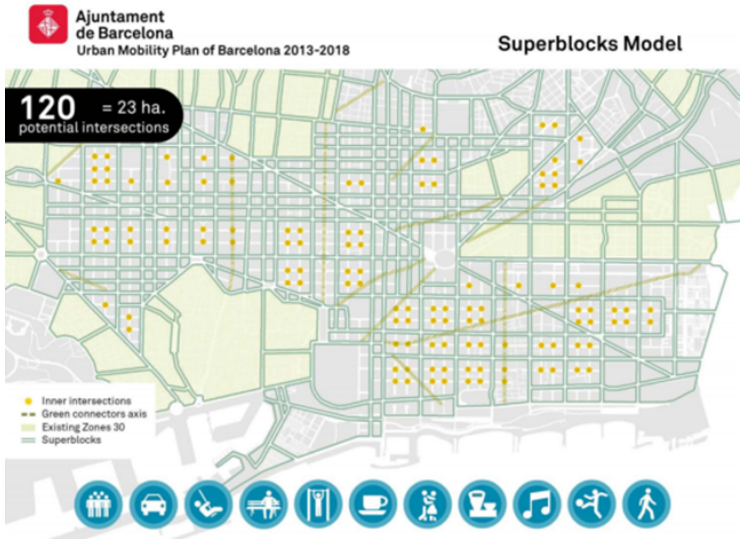


- Another ongoing experiment within the Center for Urban Science and Progress (CUSP) of the NYU, called "Quantified Community" (QC), uses a system of collecting, measuring and analyzing data on environmental conditions and human behavior of the inhabitants of some neighborhoods of New York, to better understand and how the built environment affects the individual and social well-being (Kontokosta, 2016a).

An urban detection platform, the QC Urban QoL Sensor, has been developed: an inexpensive and reliable "array" of sensors to measure and

SUPERBLOCKS MODEL





Modello Superblocks: Barcelona's car-free "superblocks" could save hundreds of lives.

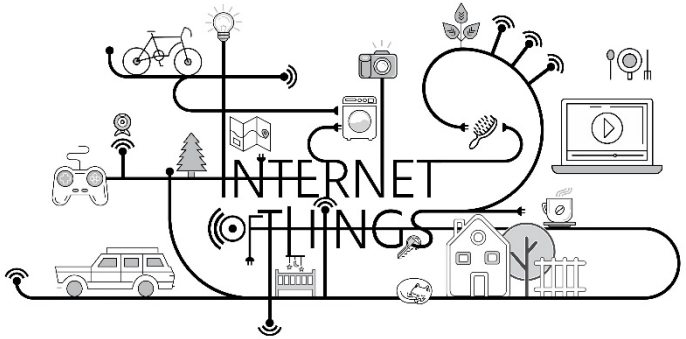
PROPOSAL

The University Research **CCHURE (Climate change and urban health resilience)** funded in 2018 by the University of Camerino represents an attempt to contribute to developing the field of research described above. The proposal, currently in its initial phase, is applied to the Monticelli Ascoli Piceno district.

Climate Change and Urban Health Resilience aims to define a transdisciplinary methodology :

- to evaluate the effects that climate change produces on urban health;
- to direct policies for adaptation/mitigation through the contribution of many scientific disciplines;

  (URBAN PLANNING, ARCHITECTURE, MEDICAL SCIENCE, COMPUTER SCIENCE, SOCIAL SCIE L SCIENCE),
- interaction w palities and loca
- the involvem al communities w w IoT (Internet of Things) te s and mobile cro



CCUHRE PROPOSES TO:

1) Build a **methodology to investigate** the relationships between the impacts of climate change and the health/well-being of inhabitants on the urban scale of the neighborhood, which contributes to selecting actions and combinations of actions for mitigation and adaptation with citizens' active role.

2) Build a **methodology for public administration to select scenarios for adaptation to/mitigation of the effects of climate change,** through the use of real-time analytics and data feedback mechanisms and non-instrumental interaction with local communities.

a) Climate and Health Profile (CHP)

to construct the neighbourhood CHP, reference will be made to qualitative/quantitative indicators that assess the effects of climate change on the health andwell-being of the population.
These indicators will be selected based on existing public health data, as products of international research, and with the contribution

a) Climate Health Lab (CHL):
construction of a platform of sensors and automation technologies (Urban Internet of Things, IoT), which will provide real-time information/ measurement of the physical/environmental conditions of the neighborhood and its inhabitants.
This platform will be implemented with citizen contribution through the use of mobile crowdsensing techniques, which will allow smart-

b) Climate and Health Actions (CHA)

the selection of actions and combinations of actions for adaptation and mitigation, already present in international best practices, with reference to the "fundamental themes" of urban design — land use, mobility, housing, open spaces, and meeting spaces, the natural environment — and some themes of technological design — temporariness and flexibility, etc.

With the CHL, it will be possible to:

- analyse and assess the difference between subjective and objective measurements of quality-of-life indicators to understand how the perception of different environmental conditions varies across the neighbourhood;

- verify and compare, with the help of researchers, technicians, and citizens, the "health" performance of the scenarios identified and their

CCUHRE RESEARCH UNITS

The research involves different disciplines of the University of Camerino and Italian and International research groups which hold consolidated experience in the field of urban regeneration, climate change, and urban health (Columbia University in New York, University of Adelaide in Australia, University of Turin, La Sapienza University, University of Belgrade, University of Maranhão- UEMA-Brazil, Middlesex University).

Also, the research has the support of public administrations involved in the project: the City of Ascoli Piceno, the local health agency ASUR-Area Vasta 5 (Ascoli Piceno-San Benedetto del Tronto).

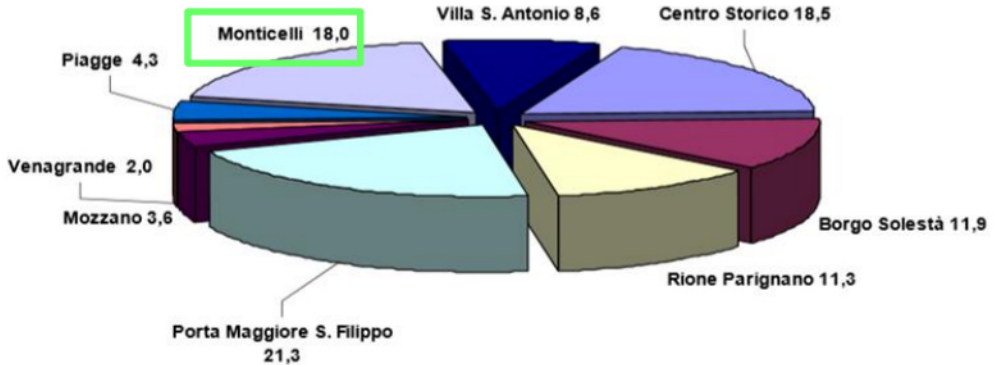
The work is organized in five Work Packages.

WP #	Title of the WP	UNIT(S) involved	Main Goal *(in short)*	Activities in each WP
1	COORDINATION AND MANAGEMENT	UO1 with the contribution of UO2; UO3; UO4; UO5	Coordination and monitoring of the research and project activities, financial aspects and risk management	1. Technical coordination 2. Financial coordination 3. Monitoring and administrative controls 4.Call and Coordination of meetings and workshop
2	DEVELOPMENT OF A METHODOLOGY TO ASSESS THE NEEDS OF HEALTH IN NEIGHBOURHOODS AND THE SELECTION OF ACTIONS TO MITIGATE AND ADAPT TO CLIMATE CHANGE	UO2 and UO4 with the contribution of UO1; UO2; UO5	To identify impacts of climate change on human health and well-being and the related adaptation and mitigation strategies considering urban planning and design for small and medium European towns.	1.Identification of content for the Climate and health profile (CHP) 2.Selection of best practices in health-based actions (CHA) for mitigation and adaptation 3.Selections of means of effective interaction with the local population
3	CONSTRUCTION OF HEALTH RESILIENCE OF LOCAL COMMUNITIES WITH THE CONTRIBUTION OF IoT TECHNOLOGIES	UO3 with the contribution of UO1; UO2; UO4; UO5	Building a virtual assessment platform for the neighborhood for assessment with citizen contribution: the impacts of climate change on health that determine the Health climate profile, the adaptation and mitigation actions, and to select scenarios of adaptation and mitigation.	1.CHL Domain: data attributes and relationships 2.CHL Functionalities as cloud-based services 3.CHL Interface: as a web- based application 4.App: allowing smart-phone users to interact with CHL and supporting the recruitment phase 3.5 Protocol to select citizens focus groups
4	USE CASES ADAPTATION, INTEGRATION AND EXPERIMENTATION	UO5 with the contribution of UO1-UO2- UO3-UO4	Showing the feasibility of CCUHRE innovations by testing the selected adaptation and mitigation scenarios, to support the decision-making process	4.1. Activation of the software platform "Climate and Health Lab (CHL) and formation of the Monticelli Focus Groups 2.Climate and Health Profile (CHP) for Monticelli 3.Climate and Health Actions (CHA) for Monticelli 4.Design prefiguring of scenarios for mitigation and adaptation (design laboratory) 5.Use of CHL to assess the scenarios 6.Selection of scenarios through comparison and projection in time
5	DISSEMINATION AND EXPLOITATION ACTIVITIES	U01 and U03 with the contribution of UO2; UO4; UO5	Spreading of results among towns, public and private entities, etc, thereby leading to new ideas for further research at the national and European levels.	1. Project identity 2. Links to the websites of the institutions and research entities involved to provide public information about the project; 3.Publications and presentations 4. Exploitation activities

CCHURE_ Team:
Professors: Rosalba D'Onofrio, Elio Trusiani, Michele Talia, Maria Federica Ottone, Roberto Ruggero, Roberta Cocci Grifoni, Enrica Petrucci, Iolanda Grappasonni, Giuseppe Costa, Piera Di Martino, Leonardo Mostarda, Marta Magagnini, Franco Raimondi, Francesca Giofrè, Zoran Djukanovic, Luca Bradini, Mariana Pierantozzi, Gerardo Doti, George Zillante, Lina M. Calandra, Andrew Rundle ; **Researchers**: Chiara Camaioni, Tatiana Guarnier, Diletta R. Cacciagrano, Ingrid Gomes Braga; **PhD students**: Ilaria Odoguardi, Fabio Pagnotta, Gianmarco Mazzante, Graziano F. Marchesani; **Advisor Public bodies**: Maurizio Piccioni, Remo Appignanesi, Benedetta R. Ruggeri

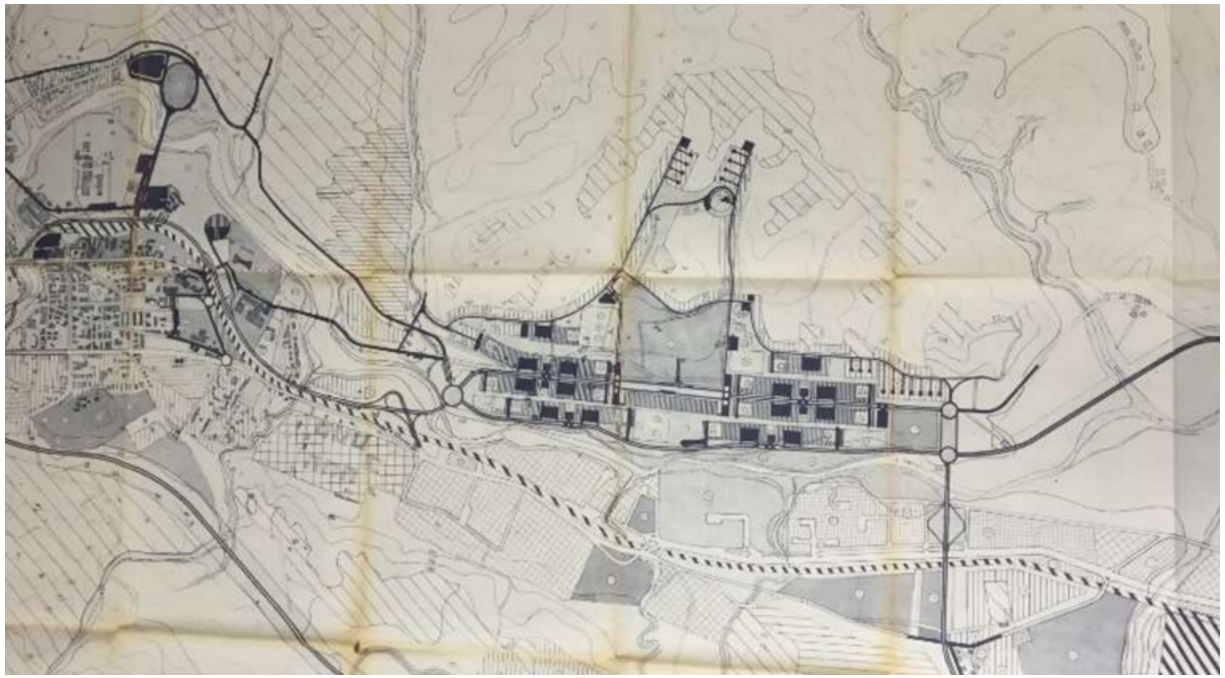
CENTRO STORICO

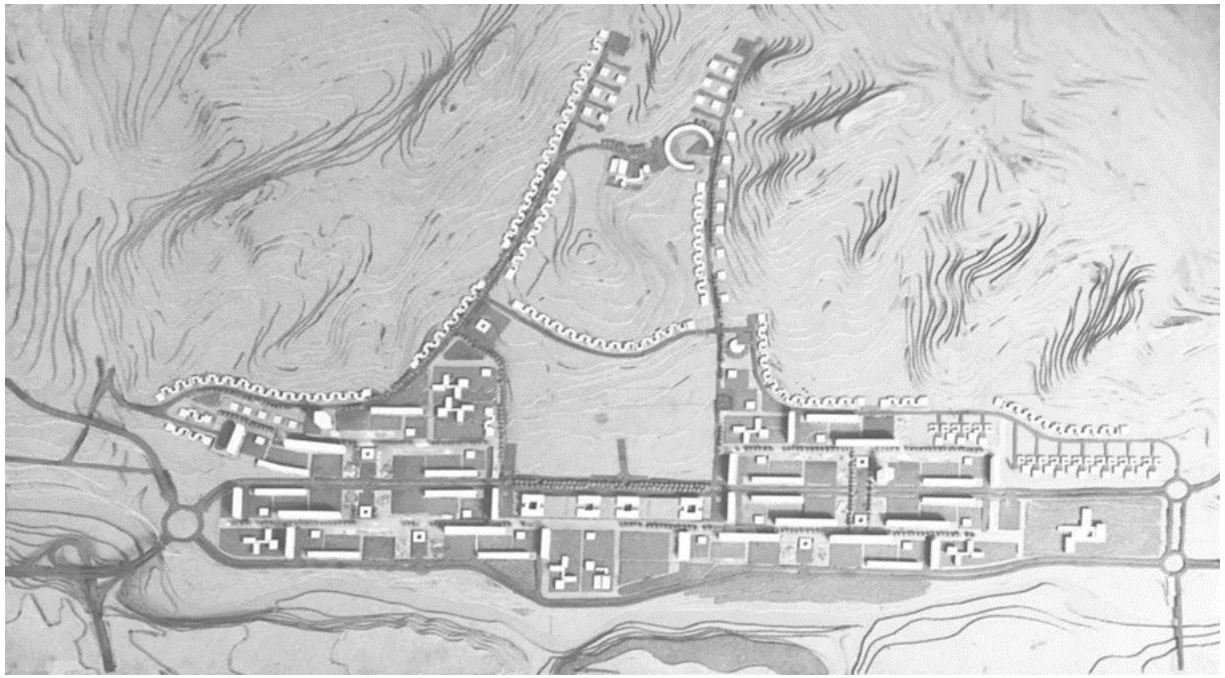
QUARTIERE MONTICELLI



% resident population 2011

	v.a.
Centro Storico	9.361
Borgo Solestà	6.203
Rione Parignano	5.716
Porta Maggiore S. Filippo	10.792
Mozzano	1.849
Venagrande	1.018
Piagge	2.201
Monticelli	9.115
Villa S. Antonio	4.345
Totale	50.600





PRG 1968, LEONARDO
BENEVOLO AND GIOVANNI ZANI

MONTICELLI DISTRICT

PRG 1968 PLANNED BY BENEVOLO AND ZANI expresses the idea of a linear development along a central axis, in the West-East direction they start a new zone……
Monticelli District

Benevolo's operational strategy is achieved in a complete way:

- public urbanization of soils;
- expansion of the residential city by autonomous districts;
- expressive research of rationalism movement
- increase of infrastructure: the rapid crossing of the

Until the ‘70s, Monticelli is still an agricultural area then was identified by the new Plan as an area of natural expansion of the city.
The largest residential volumes had to be concentrated in the area of new construction with a view to settling 21,000 inhabitants compared to the 75,000 envisaged throughout the municipal territory for the year 1975.
This prediction was overestimated as also the data related to the nucleus of Monticelli.

BUILDING TYPOLOGIES


The multistorey line buildings


Towers

The old rural buildings

FEATURES AND USE OF THE SPACES

Areas along the Tronto river

Parking areas

Urban green park

Spaces adjacent to buildings

OUTDOOR

SP

Monticelli is a district of public housing, characterized by situations of building degradation, insufficient social aggregation centers and public and private services, scarcity of equipped green areas, in a context of poor social cohesion…

The district is also crossed by an equipped infrastructure, used as a crossing road and traveled by high-speed vehicles; this infrastructure causes a

RESTO DEL CARLINO, 8 GIU

WORK-PLAN

1ST STEP COMPLETED

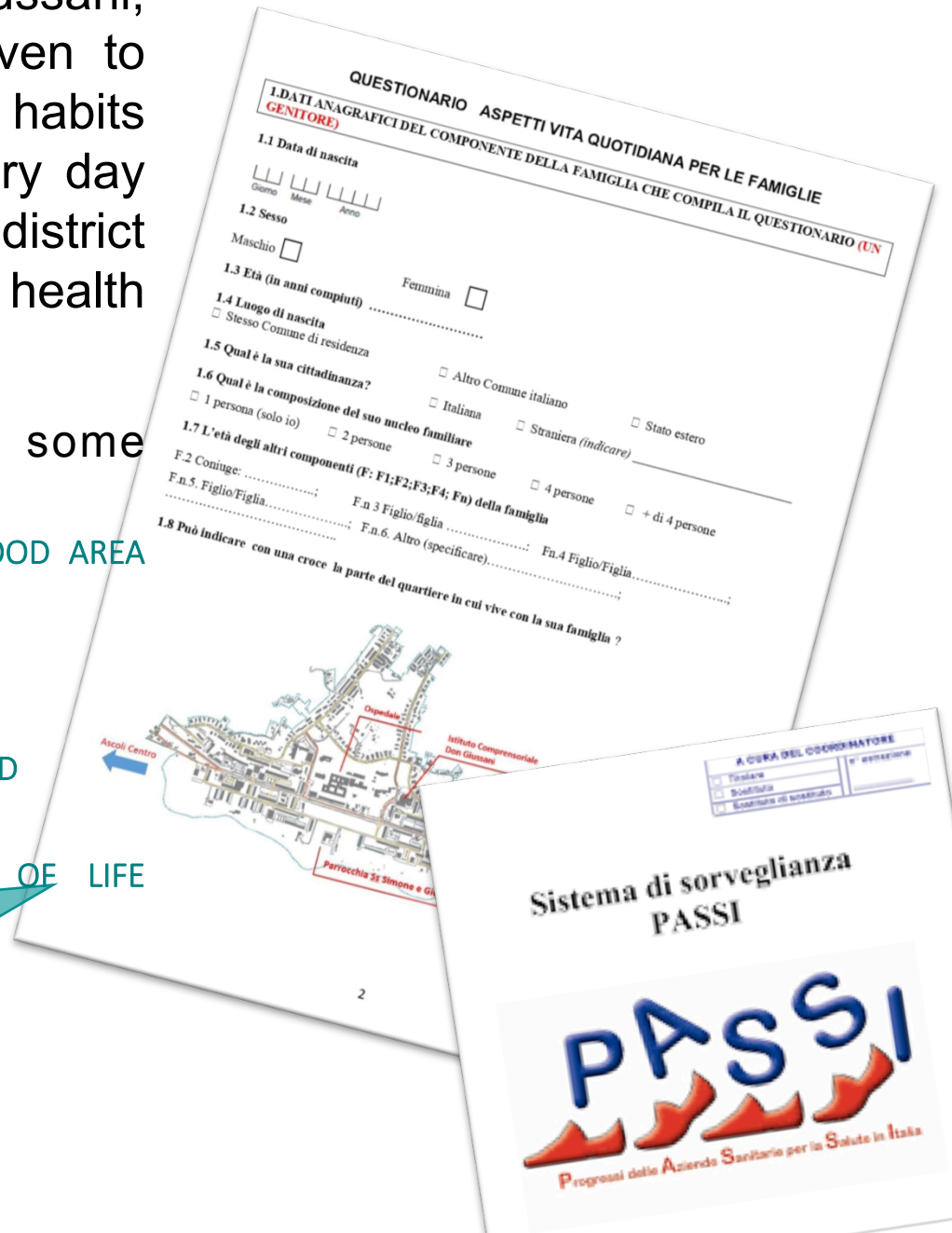
- Urban survey
- Presentation of the research to community
- Distribution/ dissemination of the questionnaire to families

With the collaboration of the secondary school Don Giussani, 600 questionnaires were given to families to learn about the habits and problems they face every day in the life of the Monticelli district and which can affect their health and quality of life .

The investigation deepens some themes, such as:

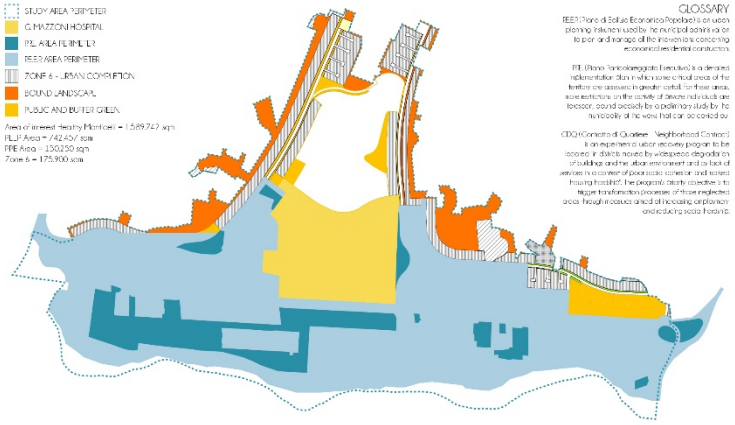
- THE CHARACTERS OF THE NEIGHBORHOOD AREA WHERE THE FAMILY LIVES
- NEIGHBORHOOD SECURITY
- ACCESSIBILITY TO SERVICES
- SOCIAL COHESION IN THE NEIGHBORHOOD
- DAILY TRAVEL
- THE CHARACTERISTICS AND QUALITY OF LIFE INDOOR
- LIFE CUTTED OFF

THE SURVEY WILL PROVIDE ELEMENTS THAT WILL ALLOW US TO OUTLINE AN OVERALL PICTURE OF THE QUALITY OF LIFE OF INDIVIDUALS AND FAMILIES.

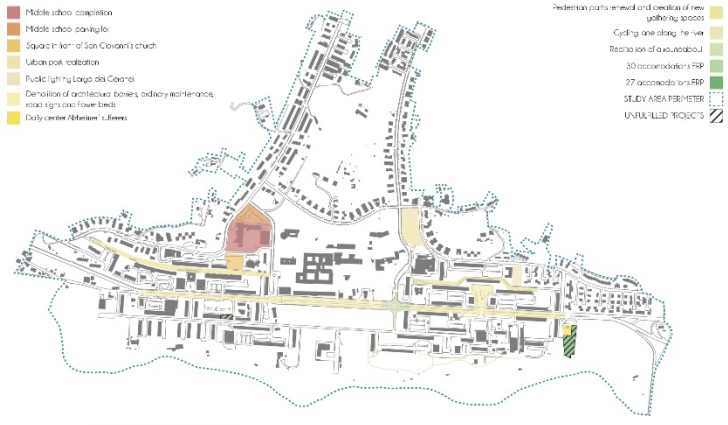


RBAN SURVEY

CDQ'S PRIVATE INTERVENTIONS

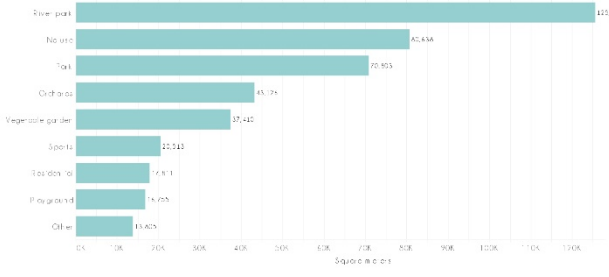


DESIGNATED USES FOR MONTICELLI QUARTER



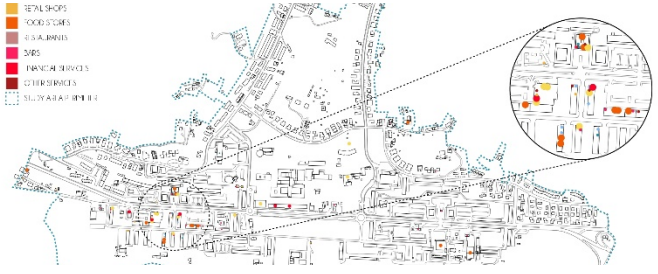
CDQ'S PUBLIC INTERVENTIONS

DISTRIBUTION AND QUALITY OF OPEN SPACES

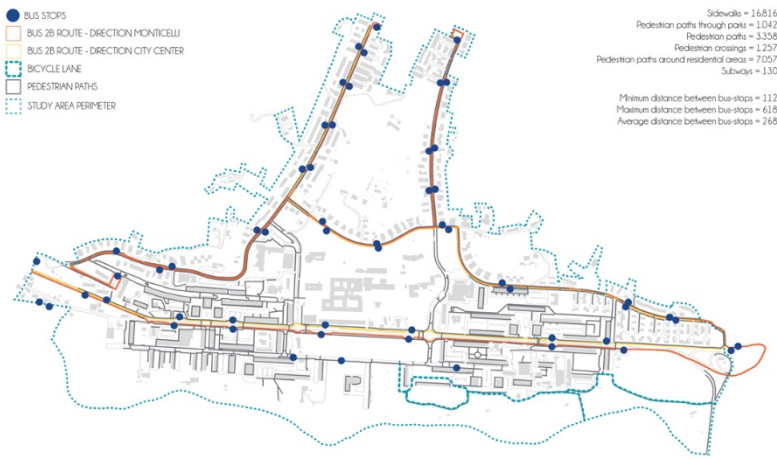


DISTRIBUTION OF SERVICES AND ACTIVITIES

REPORT OF PRIMARY SERVICES



MOBILITY



REPORT OF THE NEIGHBORHOOD MOBILITY

WORK-PLAN

1ST STEP COMPLETED

- Urban survey
- Presentation of the research to community
- Distribution/ dissemination of the questionnaire to families

WORK IN PROGRESS

- Distribution/dissemination of the PASSI questionnaire
- Elaboration of the results obtained from the first questionnaire addressed to families and first deductions
- Selection of quality of life indicators
- Identification of best practices with the support of international experiments

- Construction of the neighborhood profile based on the results obtained
- Comparison on the selection of quality of life and Best Practices indicators
- Identificat… methods of involvement of the district (participation and communication activities) FOCUS
- communication strategy, programming and web links,
- Definition of 2nd step

In summary, the most important issues are:

- traffic
- air pollution
- noise
- low street lighting/insecurity
- road pavement conditions

Elaboration of the results obtained from the first questionnaire addressed to families and first deductions

a) Climate Health Lab (CHL):

construction of a platform of sensors and automation technologies (Urban Internet of Things, IoT), which will provide real-time information/ measurement of the physical/environmental conditions of the neighborhood and its inhabitants.

This platform will be implemented with citizen contribution through the use of mobile crowdsensing techniques, which will allow smart-phone users to interact with IoT devices.

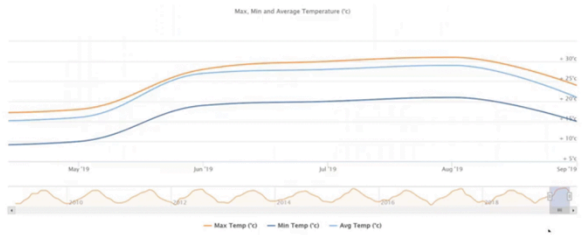
START TIME

NOW

END TIME

Monitoring Level

Vegetation information + Building and material information + Orographic information + Climatic scenario



Climatic scenario from historical weather data set

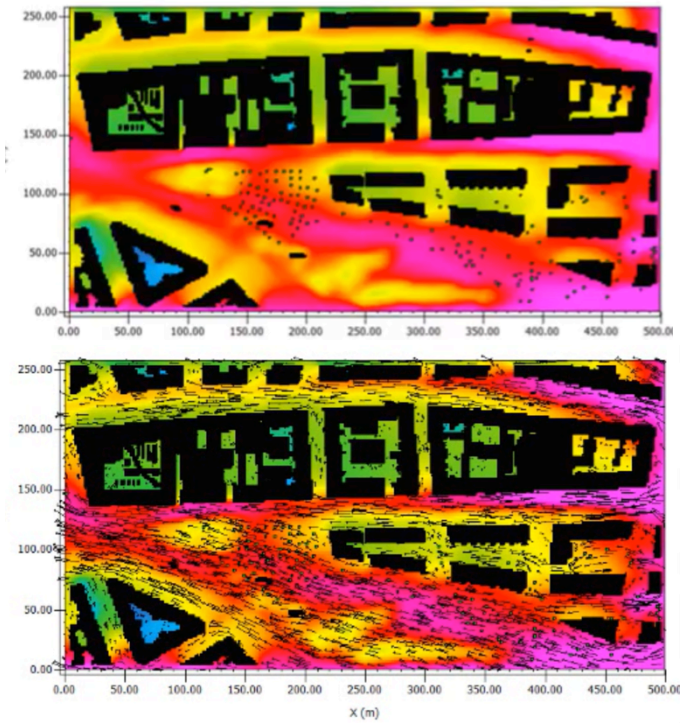
Urban diagnosis

Beacon sensors + Mobile application

Human input

Temperatures sensors + Humidity sensors + Air quality sensors

Urban input



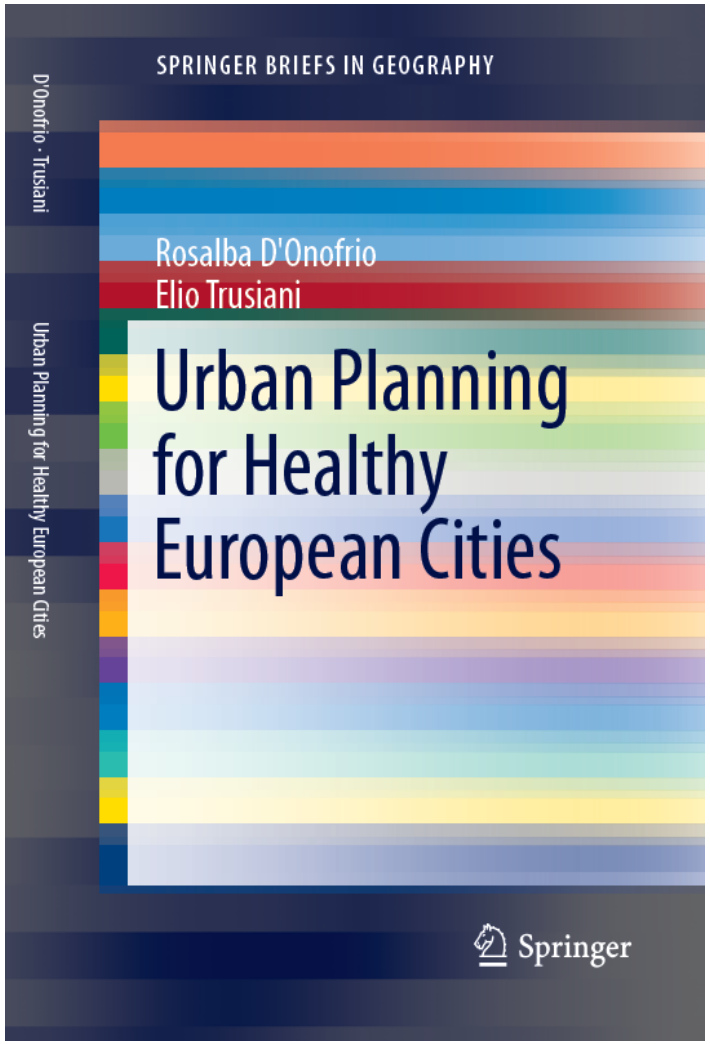
From weather data to simulation data

Urban design

Urban planning collects climate analysis and participatory urban action plans

Prognostic level

numerical simulation to foresee the urban climate evolution and adaptation strategies



Thank!

Scuola di Ateneo
Architettura e Design "Eduardo Vittoria"
Università di Camerino