

teaching exchange on

Resilience and Climate Change

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Politecnico di Torino

Interuniversity Department of Regional and Urban Studies and Planning

Responsible Risk Resilience Centre - R3C

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The 2018 CitiesIPCC Research and Action Agenda outlined that currently **cities face global challenges**, as unsustainable development patterns, rapid and unplanned urbanisation, effects of climate change. To provide a broad answer to climate change and socio-economic uncertainties, cities worldwide have already started to develop specific mitigation and/or adaptation policies and tools, responding to the need for a **green transition in tackling global threats and focusing on resilience**. The EU Green Transition can be framed within the resilience-oriented policies and tools since their main objectives aim to overcome climate change and environmental degradation, fostering climate neutrality by 2050, boosting the economy through green technology, creating sustainable industry and transport, and cutting pollution. At the same time, resilience-based policies and tool can welcome adaptation and mitigation to reduce the adverse effects of climate change on societies.

expected learning outcomes

- Develop knowledge on resilience
- Expand awareness on policies and tools that support a just green transition in tackling global threats
- Investigate urban resilience practices with case studies from cities worldwide

- Conduct a preliminary measurement of territorial vulnerabilities in Albania
- Analyse the current and future urban trends at the local level
- Forecast future resilient scenarios for just green transition



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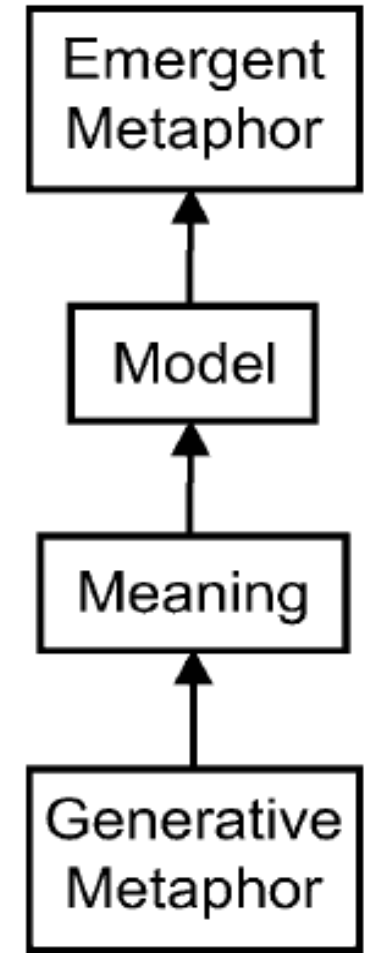
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R3C - Politecnico di Torino
Presentation

The fundamental of resilience in global challenges science

- The term resilience stems from the **Latin word “resilio”** which means to spring back, rebound, shrink, retreat, and give up. It is a composite word formed by the **prefix “re-”**, usually defining the reiteration of action and sometimes used to reiterate a concept, and the **verb “salio”** meaning to jump, to bounce, but also to flow
- Extensive use of resilience in its different disciplinary meaning
- Umbrella concept (Brown, 2015) because of its great attractiveness to solve urban challenges
- Generative and emergent metaphor (Pickett et al. 2004), a semantic utopia which should help to design a multidisciplinary knowledge networks to innovate planning and practices



1**Engineering Resilience****2****Ecological Resilience****3****Socio-Ecological Resilience
Evolutionary Resilience**

Applying the Resilience Perspective to Planning: Critical Thoughts from Theory and Practice

Edited by Simin Davoudi & Libby Porter (Planning Theory & Practice, 2012)

*“There are some promising parallels between evolutionary resilience and the interpretive approach to planning [...] because both **promote the understanding of places not as units of analysis or neutral containers**, but as complex, interconnected socio-spatial systems with extensive and unpredictable feedback processes which operate at multiple scales and timeframes”*

*As the world is “a becoming”, resilience is not the “return to normalcy”, but instead “a **continually changing process**”*

Urban resilience refers to the ability of an urban system - and all its constituent socio-ecological and socio-technical networks across temporal and spatial scales - to maintain or rapidly return to desired functions in the face of a disturbance, to adapt to change, and to quickly transform systems that limit current or future adaptive capacity

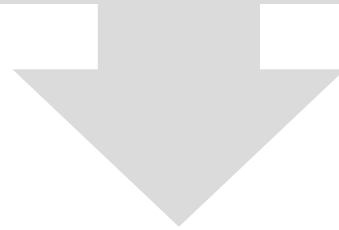
[Merrow et al., 2016: 39](#)

Spatial resilience is the ability of a territorial system to improve its adaptive capacity intending to evolve all its material and immaterial components toward a new territorial system's organization after an unexpected shocks and disturbances.

[Brunetta & Caldarice, 2020: 1](#)

a paradigm shift

Spatial planning is a **complex construct**, a **recursive process** deploying different **forms of rationality** at successive stages by **various actors** in changing roles



Resilience should become the paradigm to select value goals and the needed action during the planning process

Resilience as the engine of innovation in the planning process

Urban resilience, climate change, and just green transition in international policies

Landslides
Floods
Urban heat island
Storms
Volcanic activity
Earthquakes
Droughts
Wildfires

|
CLIMATE CHANGE

+

Rapid Growing of Cities

Soil Sealing

|

SOIL

VULNERABILITY



RESILIENCE IS THE SOLUTION?

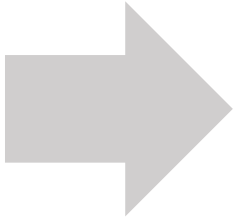
UN, 2009



the international policy momentum

2012: UN RIO+20: THE FUTURE WE WANT

*11 paragraphs on resilience
to ecosystems, climate change, cities*

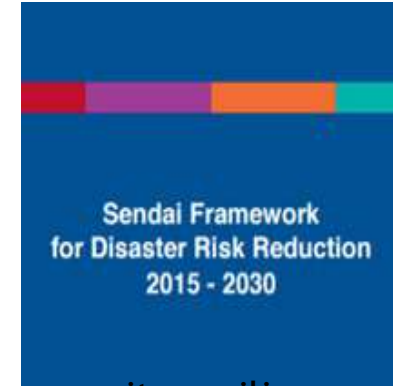


Transforming our World: the 2030 Agenda for Sustainable Development" or Agenda 2030
Sustainable Development Goals



Resilience used coupling mitigation and adaptation to be implemented in cities

Paris Agreement



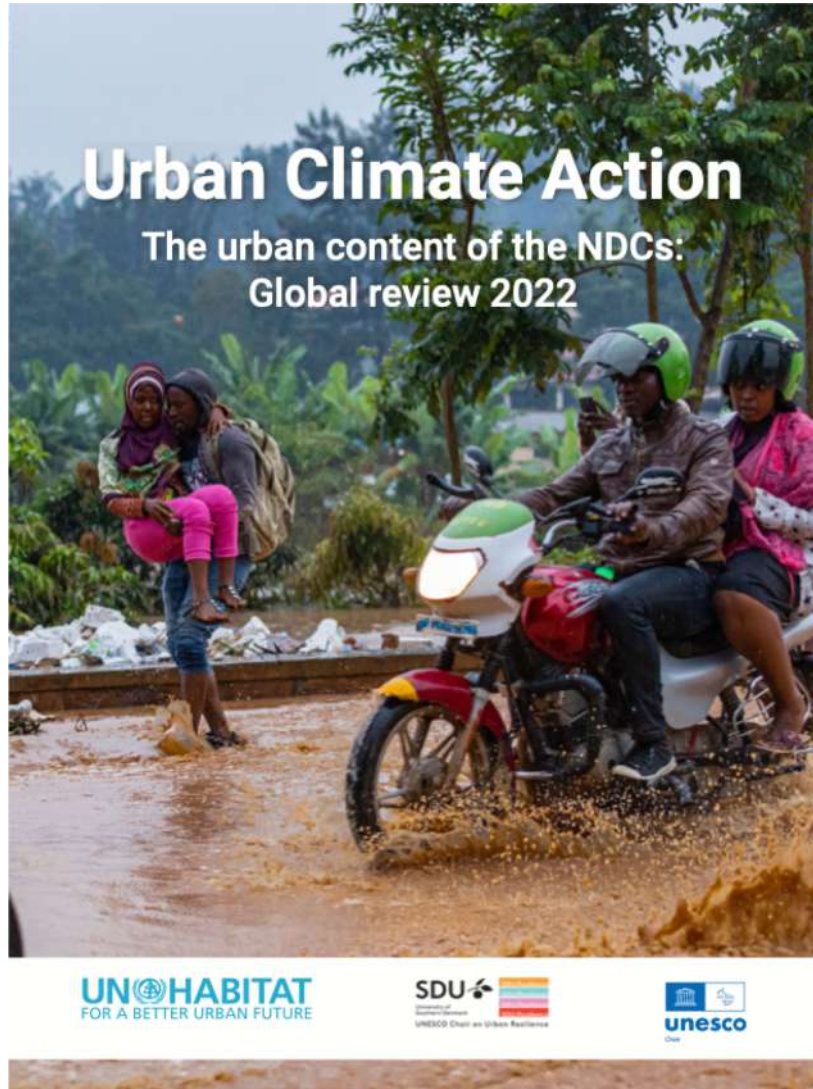
Strong focus on city resilience related to natural disaster and hazards

Sendai Framework



United Nations Conference on Housing and Sustainable Urban Development

New Urban Agenda - 21st Century



ACKNOWLEDGEMENTS

Coordinator:
Bernhard Barth¹

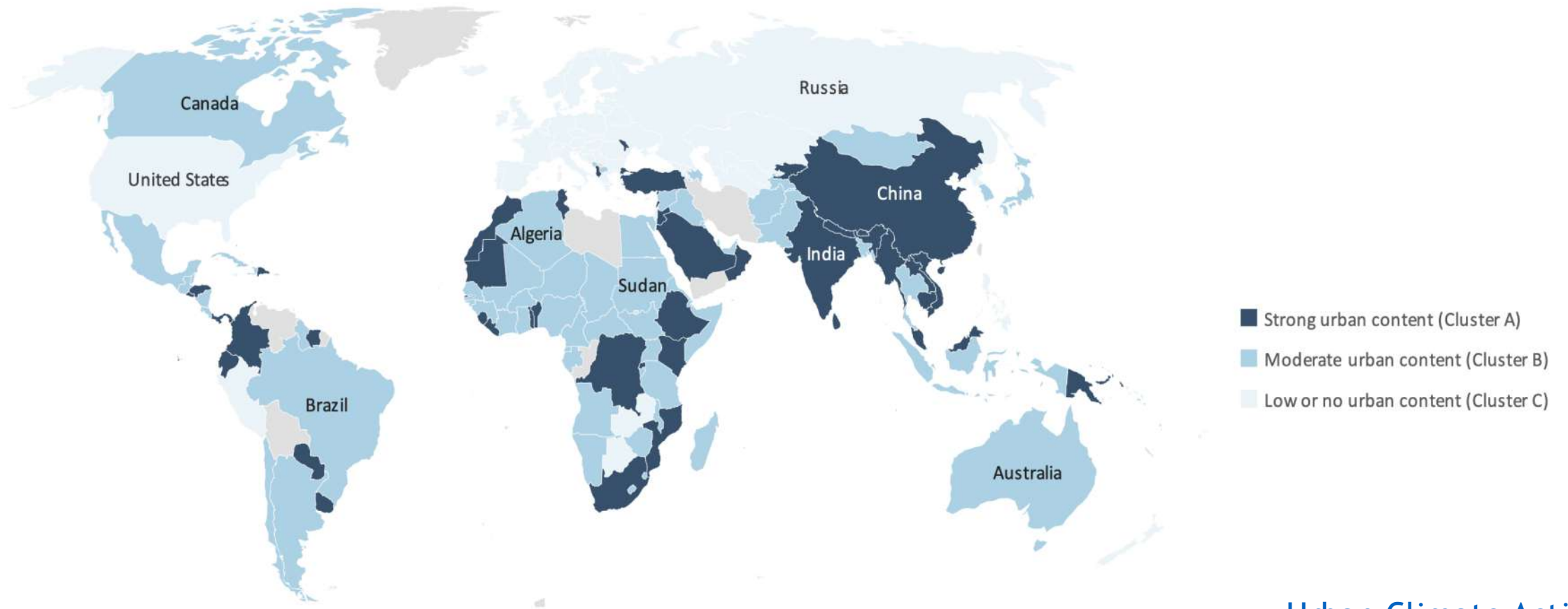
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Map 1: Map of Urban Content, Cluster A, B and C.

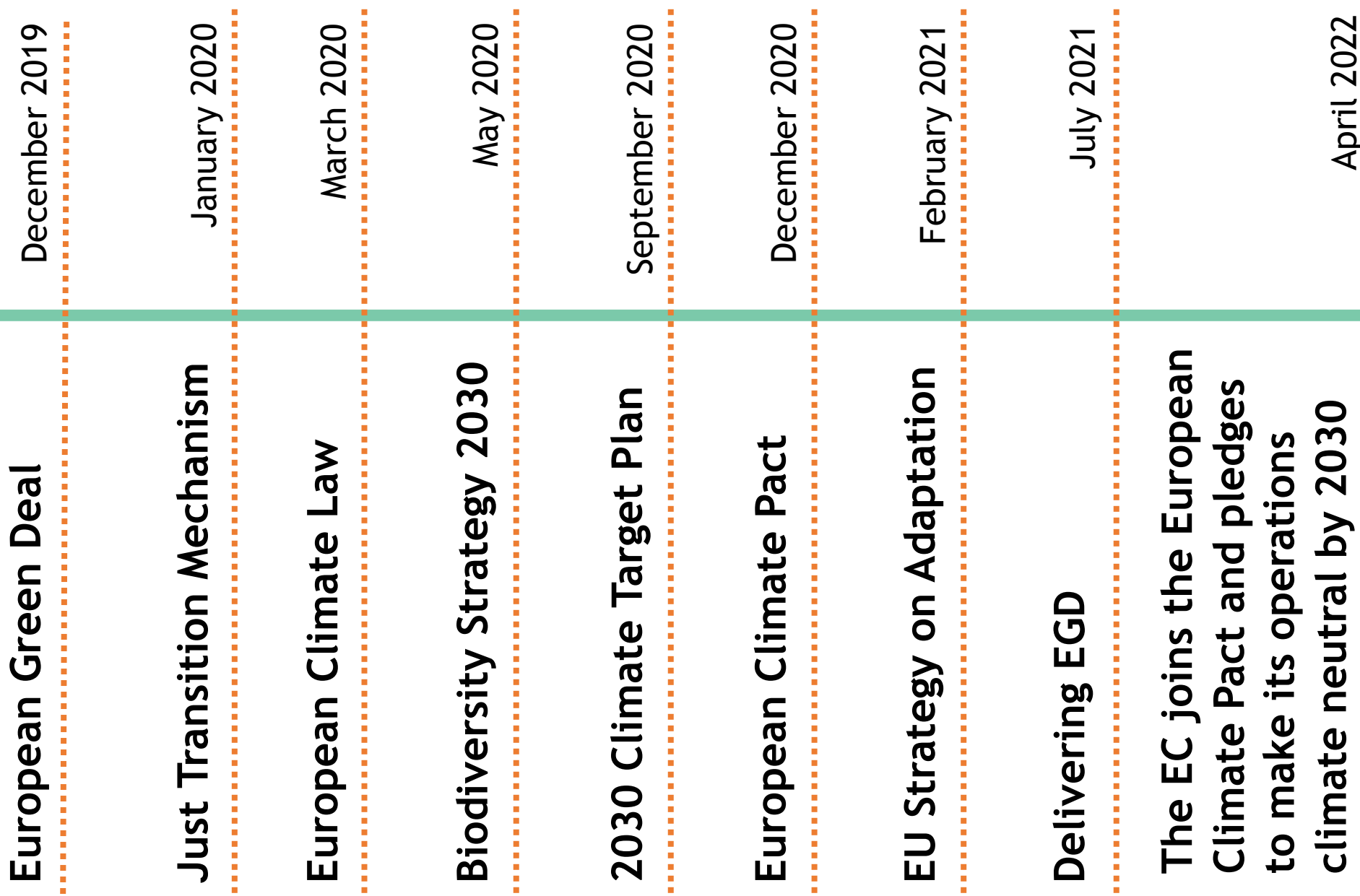


NDCs submitted in October 2021

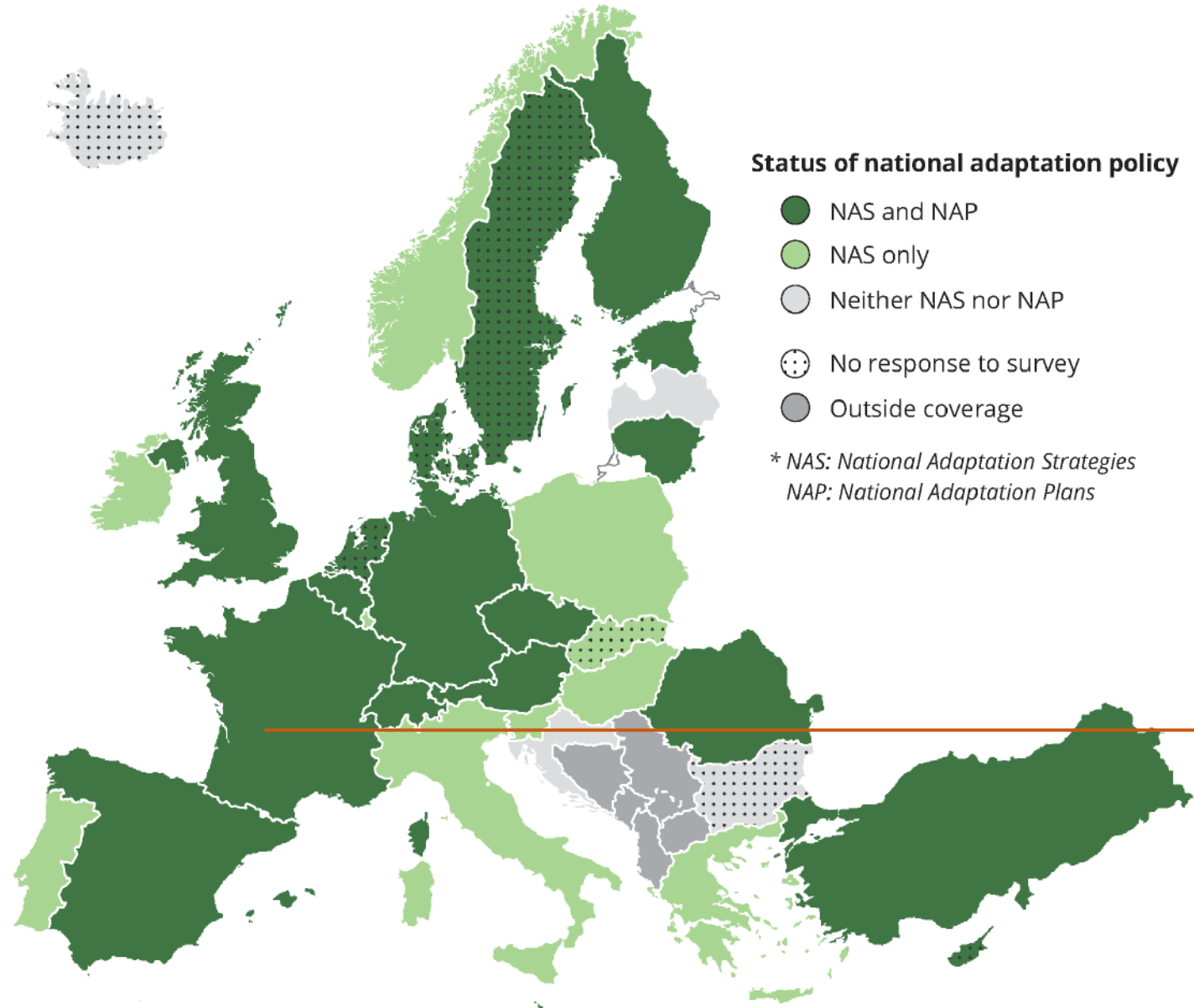
Albania has developed and implemented a large number of adaptation related policies, strategies, plans, programmes, project and actions. Among others, the country has identified priority adaptation actions in the **National Strategy on Development and Integration 2015-2020**, the **Third National Communication**, the **National Climate Change Policy** and the **NSCC** and its **National Adaptation Plan**, the **Adaptation Plan for Tirana**, the **national tourism strategy 2019- 2023**, the **national forest policy 2019-2030**, the **integrated cross-sectoral plan of Tirana-Durres area** and the **Green Climate Fund Country Programme** that was developed in a participatory manner based on the previous documents. These documents identify a very large number of adaptation actions.

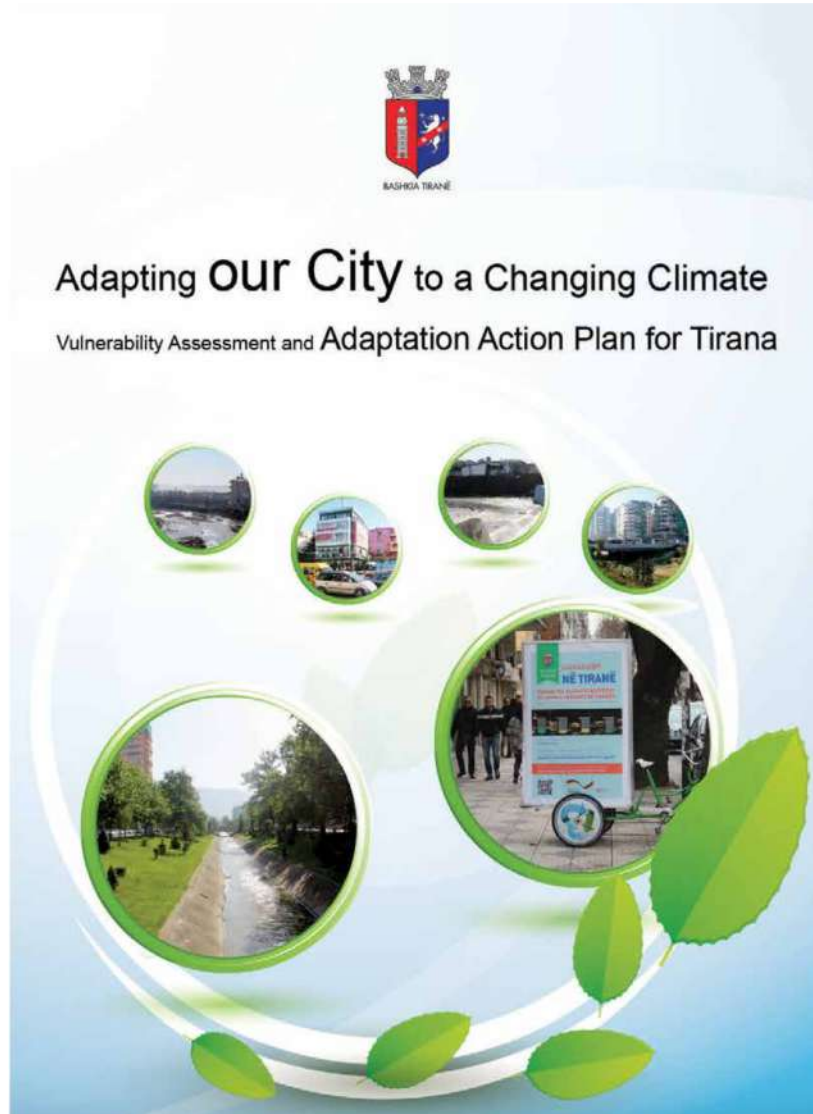
Adaptation measures				Co-benefit potential		Ease of implementation			Priority level
				Develop-ment	Mitigation	Institutional	Technical	Financial	
Weights				0.8	0.2	0.3	0.3	0.4	
Strengthening the enabling environment	Policy and governance	Strengthen the institutional framework (e.g. coordination)	Institutional and organisational strengthening of governmental structures in providing interconnection between planning authorities and other inter-sectoral bodies that play a role in adapting against climate changes.	High	Low	Low	Medium	Medium	High
			Development of territorial climate change adaptation plans for the whole coast (an integrated coastal zone adaptation plan), specific regions (the 4 that were prioritized) or cities	High	Low	Low	Medium	Medium	High
			Development of sectoral climate change adaptation plans for the 3 main sectors prioritized and the supporting sectors (water, energy and agriculture/forestry/fisheries)	High	Medium	Medium	Medium	Medium	Very high
			Development of risk management plans	High	Low	Medium	Medium	Medium	Very high
			Mainstreaming climate change adaptation into national cross-sectoral development planning legislation, budget, regulations, procedures and tools	High	Low	Low	Medium	High	Very high
			Mainstreaming climate change adaptation into spatial/territorial development planning legislation, regulations, procedures and tools, including building	High	Low	Medium	Medium	Medium	Very high

In line with the Paris Agreement’s adaptation objectives, these actions will **enhance adaptive capacity, strengthen resilience and reduce vulnerability to climate change**, with a view to contributing to sustainable development and ensuring an adequate adaptation response in the context of the temperature goal



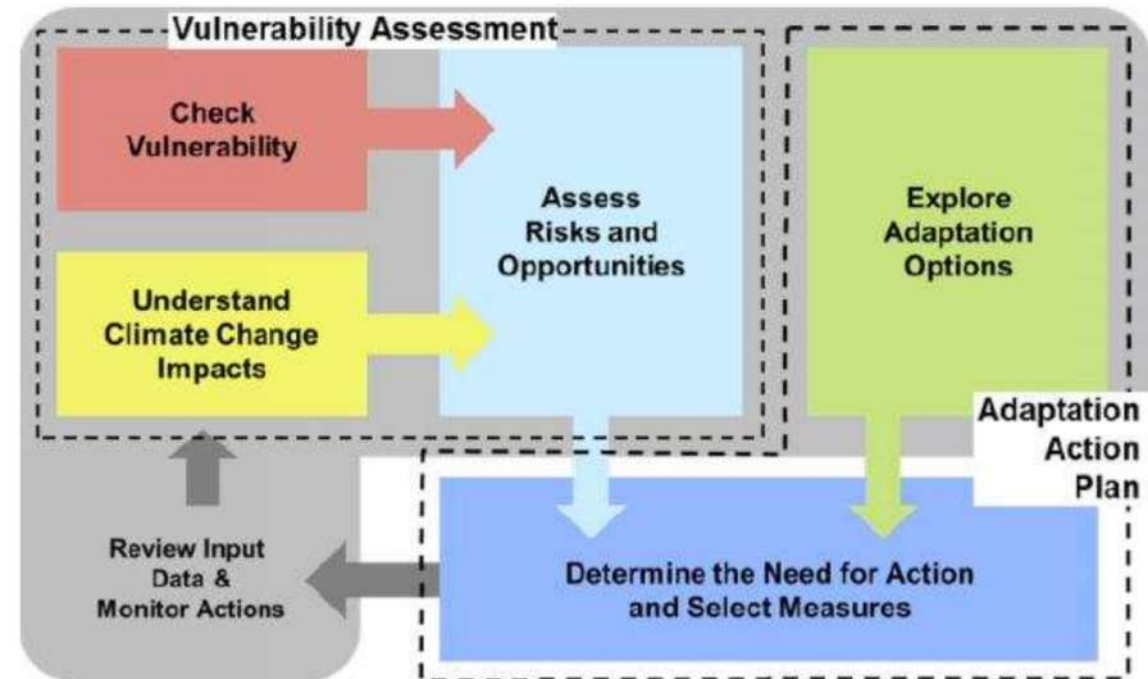
The EU NAP





Tirana Climate Change Adaptation Action Plan (2015)

Overall objective of the project for Tirana City was to integrate climate change adaptation (CCA) into management and planning processes within the different sectors of the city administration and into cross-cutting activities like spatial planning and strategic project development





TIRANA Vulnerability Assessment and Adaptation Action Plan
Annex G: CASE STUDIES

2	
Name	Lana River Neighbourhood
Statistical Data	
Size of area (ha)	14.13
Land uses / urban characterisation	Residential area and Public Services
Main building period (age)	< 25 years
Green spaces (% of area)	~ 30 % of the total area; potential from Lana River
Open water / streams	Lana River: open narrow channel
Air quality	no significance
Inhabitants (ca.)	3673
Density (persons/ha)	260
Persons > 65 years (%)	11.5
Persons < 10 years (%)	12.2
Social level	Upper / medium / lower / no significance



Characterisation (description) of the climate relevant situation: Urban Structure / Texture / Buildings Potential Relevance

Urban texture (elevations)	Mixed use area with different types of buildings (main parts of the buildings are informal developments): 1-3 fl = 61.7 %, 4-6 fl = 17.15 %, 7-9 fl = 18.15 %, 10-12 fl = 3 %	-
Building density (compactness)	0,64 m ² living area/m ²	-
Main material of surfaces	Buildings: plaster, glass, bricks, concrete Roofs: dark black made of tar Streets / sidewalks / squares: asphalt	+
Technical standards of buildings	There is insufficient information about the insulation or the quality of insulation in the higher buildings (38.3 % of total number of buildings), while in the old buildings the insulation does not exist at all.	-
Main Color of surfaces	The main colors of the surfaces: almost beige, brown, gray Roofs: dark black made of tar Streets / sidewalks / squares: asphalt	-
Amount of air conditioning (%)	Air conditioning is used in about 65 % of buildings / apartments	-
Green areas; green structures	Green areas with untreated low vegetation	+
Water in the city (areas, risks)	Lana River flows in a narrow channel (trapezium-shaped cross-sections). The stream floods regularly the banks, gardens and houses along the channel (1-2 times every 5 years; sometimes yearly); individual protection measures were taken (small wall along the channel, banks reinforced with concrete, channel was narrowed partly to lift the bank level).	++
Urban squares (paved / unpaved)	---	-
Ventilation corridors	Lana River functions as corridor (South-North); relatively narrow	-
Social level (indicative / tendency)	Lower than medium; partly (there are mainly poor settlements, but also some new buildings)	0

Infrastructure Potential Relevance

Sensitive punctual infrastruct. (e.g. hospitals, child care, elderly homes, etc.)	In the area there is "Eurovision" Private school	-
Offices (public, private)	There are no public or private offices within the case study area.	-
Water supply system (important installations, observation, works)	The area has a good coverage of the water supply coming from Bovilla drinking water plant and the new Tank of Tirana. The materials used for the water pipes are mixed (steel, cast-iron, and polyethylene).	-
Water drainage system (important installations, observation, works)	The water drainage system is existing in the area but there are also some parts with illegal settlements (on the left bank of the river) and some of the buildings are using septic tanks.	+
Energy infrastructure	---	-
Public Transport	The main traffic lines that pass by this area are the ones that pass in the main streets like the line "Kombinat - Kinostud", the line "Qendër - Sharrë" and some suburban lines. In Teodor Keko street it passes the "Tirana e Re" line. There is no documentation about public transportation affected by weather events.	0
Individual Transport	The most affected area is the one of the "Bread Industry" node (very long traffic lines, even though the transport is directly controlled via traffic light by the traffic center control). In this node the predicted solution is to create a node with different levels as part of the "Outer Ring of Tirana" project.	0
Sport areas, recreation	No sportive or recreation areas	-
Touristic Infrastructure	No touristic infrastructure	-

* Relevance for VA-scoping (potential flood sensitivity): ++ High 00 → Medium -- Low

Maps of the area

Satellite Image: urban situation



Master Plan: Land use / buildings / green areas / etc.



Mixed usage: residential use and public service (Yellow)
Single usage: Residential usage (Orange)

Urban texture / height (or density) of buildings

Map of existing green territories and local general plan



Existing settlement typologies



- Developing area with high buildings (Pink)
- Area with natural usage (Green)
- Compact area with low buildings (Orange)
- Medium compact area with medium height buildings (Yellow)
- Area with low (Light Yellow)

Population - Density



201 - 400 in/ha (Blue)
0 - 200 in/ha (White)

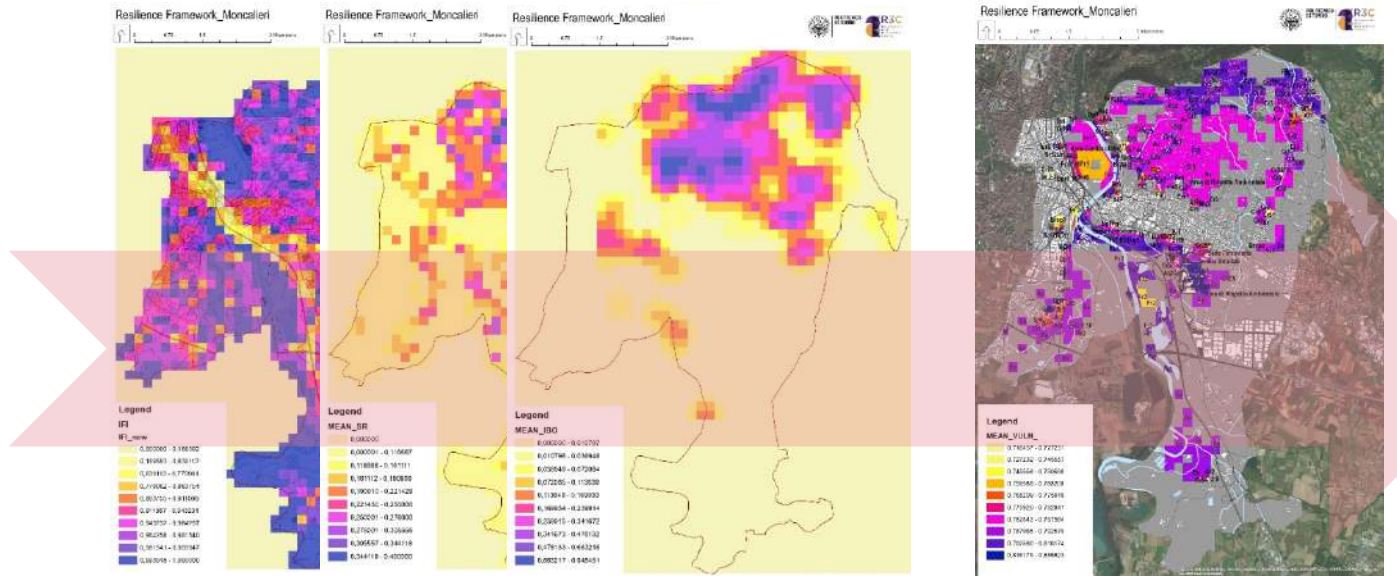
Preliminary knowledge on measuring territorial vulnerabilities for just green transition

RESILIENCE AS AN EMERGING PROCESS



1. Building the **analysis of territorial vulnerabilities** as a tool of technical knowledge for decision making, aimed at defining strategies, actions, preparedness projects towards transformative resilience
2. Promote the **multiscale and intersectoral dimension of resilience**, integrating adaptation objectives into the territorial governance
3. Support the **construction of a set of land maintenance actions** that implement adaptation in a social learning perspective for the resilience of the system

1. Spatially explicit methods and indicators
2. Integrated vision (urban environment, economy, society)
3. Site-specific approach (place-based)



measure

territorial vulnerabilities

for mainstreaming

adaptation

in the perspective of

co-evolutive resilience



Article

Mapping Urban Resilience for Spatial Planning—A First Attempt to Measure the Vulnerability of the System

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Abstract: The concept of ‘resilience’ breaks down silos by providing a ‘conceptual umbrella’ under which different disciplines come together to tackle complex problems with more holistic interventions. Acknowledging the complexity of Davoudi’s approach (2012) means to recognize that ‘spatial resilience’ is influenced by many phenomena that are difficult to measure: the adaptation and transformation of a co-evolutive system. This paper introduces a pioneering approach that is propaedeutic to the spatial measure of urban resilience assuming that it is possible to define a system as being intrinsically vulnerable to stress and shocks and minimally resilient, as described by Folke in 2006. In this sense, vulnerability is counterpoised to resilience, even if they act simultaneously: the first includes the exposure to a specific hazard, whereas the second emerges from the characteristics of a complex socio-ecological and technical system. Here we present a Geographic Information System-based vulnerability matrix performed in ESRI ArcGIS 10.6 environment as an output of the spatial interaction between sensitivities, shocks, and linear pressures of the urban system. The vulnerability is the first step of measuring the resilience of the system by a semi-quantitative approach. The spatial interaction of these measures is useful to define the interventions essential to designing and building the adaptation of the built environment by planning governance. Results demonstrate how mapping resilience aids the spatial planning decision-making processes, indicating where and what interventions are necessary to adapt and transform the system.

Keywords: urban resilience; spatial planning; vulnerability; measuring; mapping; decision-making

1. Introduction

If we look at the international scientific debate around the concept of resilience and its relation with urban planning, also considering some practical experiences, the term creates a “conceptual umbrella” that provides a flourishing perspective for urban planning with a slippery and ambiguous definition [1,2]. This is the limit but also the strength of this concept that represents a metaphor to develop spatial policies of mitigation, adaptation, and transformation to the turbulences of the system [3]. As to what concerns the most cited approaches on urban resilience, two concepts emerge as paradigmatic: the co-evolutive perspective [4] and the multidisciplinary integration of knowledge that is necessary to assess the vulnerable and resilient capacity of a system [5]. Both approaches share the common assumption that urban resilience is a driver capable of steering the policies and the urban agenda of institutions, organizations, and social groups [6,7] towards a multi-level governance of urban systems to a long-period perspective.

The evolutionary definition of resilience provided by Davoudi (2012) is the one that explicitly refers to a co-evolutive condition of a system, and a challenge for planning. Therefore, the dynamic

Sustainability **2019**, *11*, 2331; doi:10.3390/su11082331

www.mdpi.com/journal/sustainability

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 www.tema.unina.it

Assessing territorial vulnerability

Testing a multidisciplinary tool in Moncalieri, Italy

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Abstract

The challenge to make cities and human settlements inclusive, safe, and resilient, including mitigation and adaptation strategies against disaster, is a central issue in achieving sustainability. This research proposes a tool to measure local vulnerability from a multi-risk approach. The municipality of Moncalieri, Italy, was used as a case study within the research activities of the Responsible Risk Resilience Centre from the Polytechnic of Turin to test the vulnerability matrix. The tool consists of a mathematical framework for the territorial vulnerability assessment that integrates multiple indicators clustered into three factors defined as sensitivity, pressures, and hazards, weighted according to a participatory procedure. Space-dependent analyses using the Geographical Information System were developed from the multiple nested indicators to project the vulnerability index onto a homogeneous grid in the territory of interest. Thematic maps referring to the systemic vulnerability by different sensitivity components were generated. The tool not only contributes to increasing the awareness of territorial vulnerability but also offers support to resilience-based decision-making in designing technical measures of policies at a local scale. Further research is required to implement the framework in different scenarios and develop the model’s temporal behaviour.

Keywords

Urban resilience; Spatial planning; Vulnerability; Geographical Information Systems; Multi-risk.

How to cite item in APA format

Beltramino, S. et al. (2022). Assessing territorial vulnerability. *Tema. Journal of Land Use, Mobility and Environment*, 15(3), 355-375. <http://dx.doi.org/10.6092/1970-9870/9069>

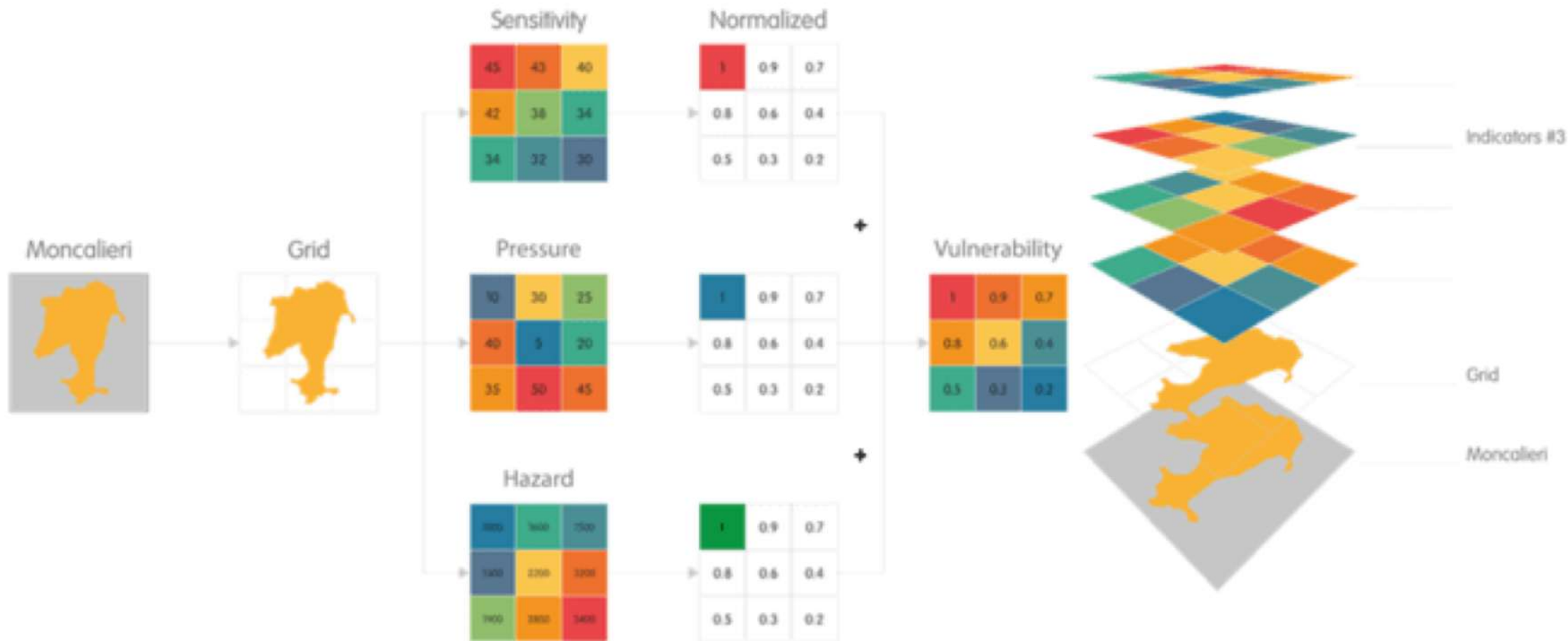











Fig.1 Schematic representation of the methodology

R3C methodology | from vulnerabilities to resilience

	Sensitivities	Pressures	Hazards
Component A <i>Environment and Landscape</i>			
Component B <i>Buildings, Heritage and Infrastructures</i>			
Component C <i>Economy and Population</i>			

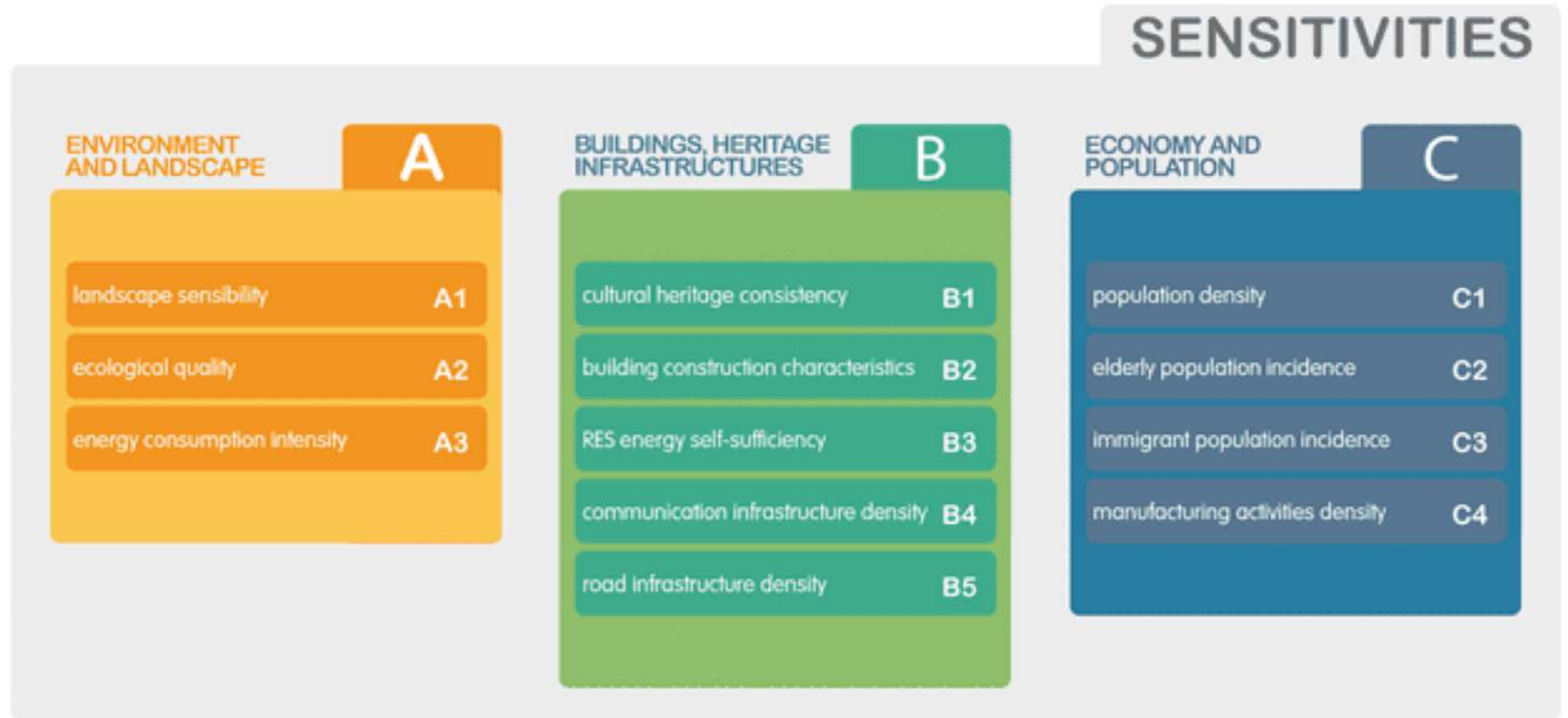


Fig.2 R3C matrix sensitivity indicators for the case study in Moncalieri

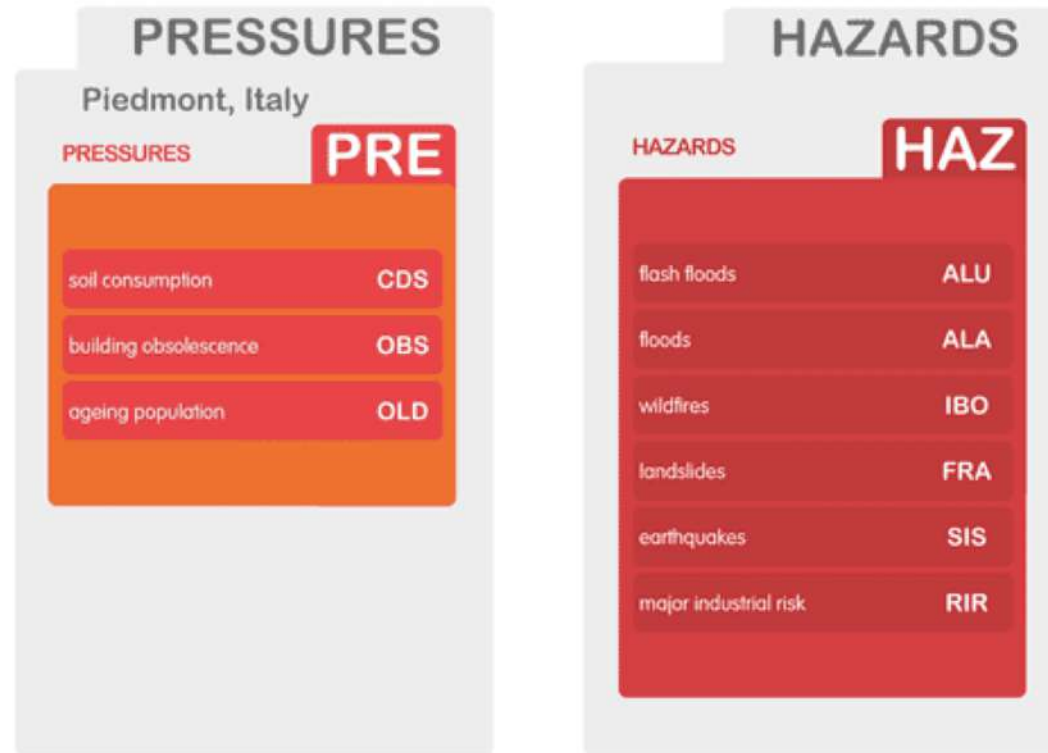


Fig.3 R3C matrix pressure and hazard indicators for the case study in Moncalieri

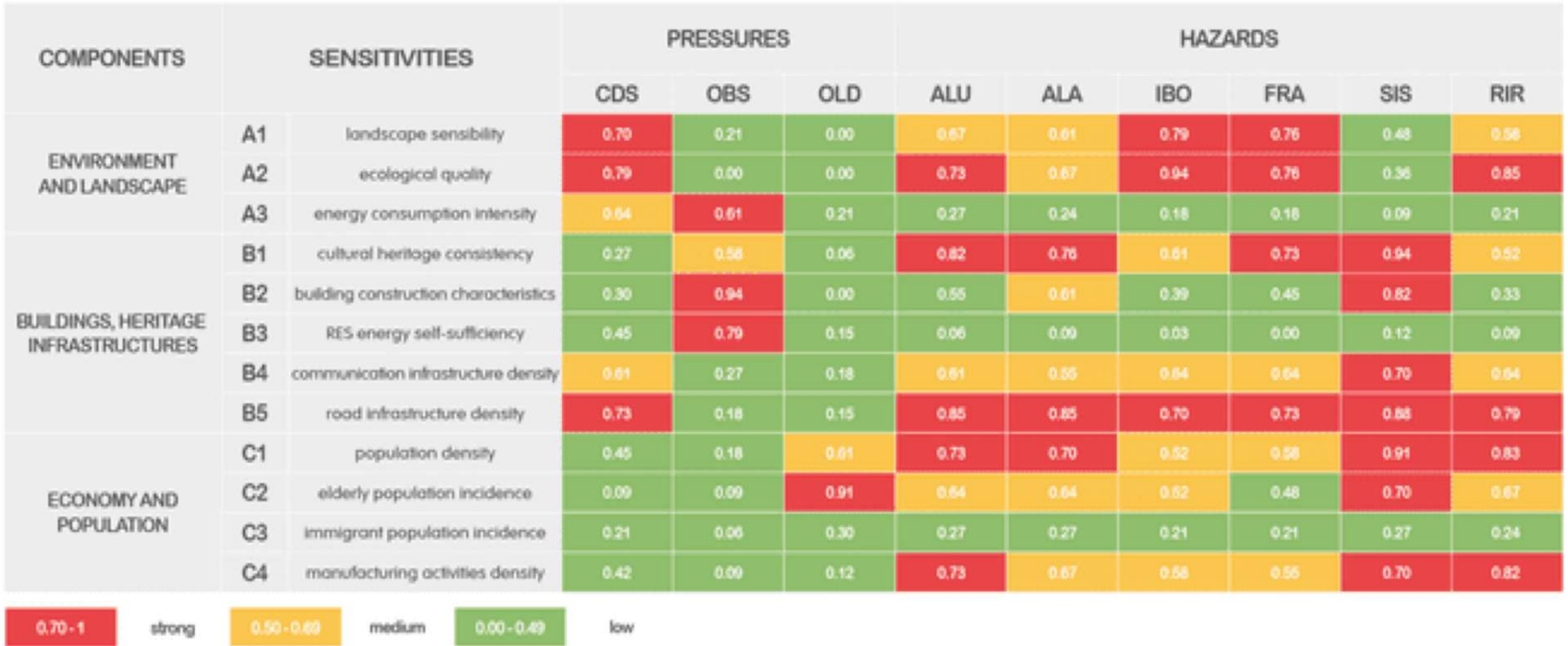
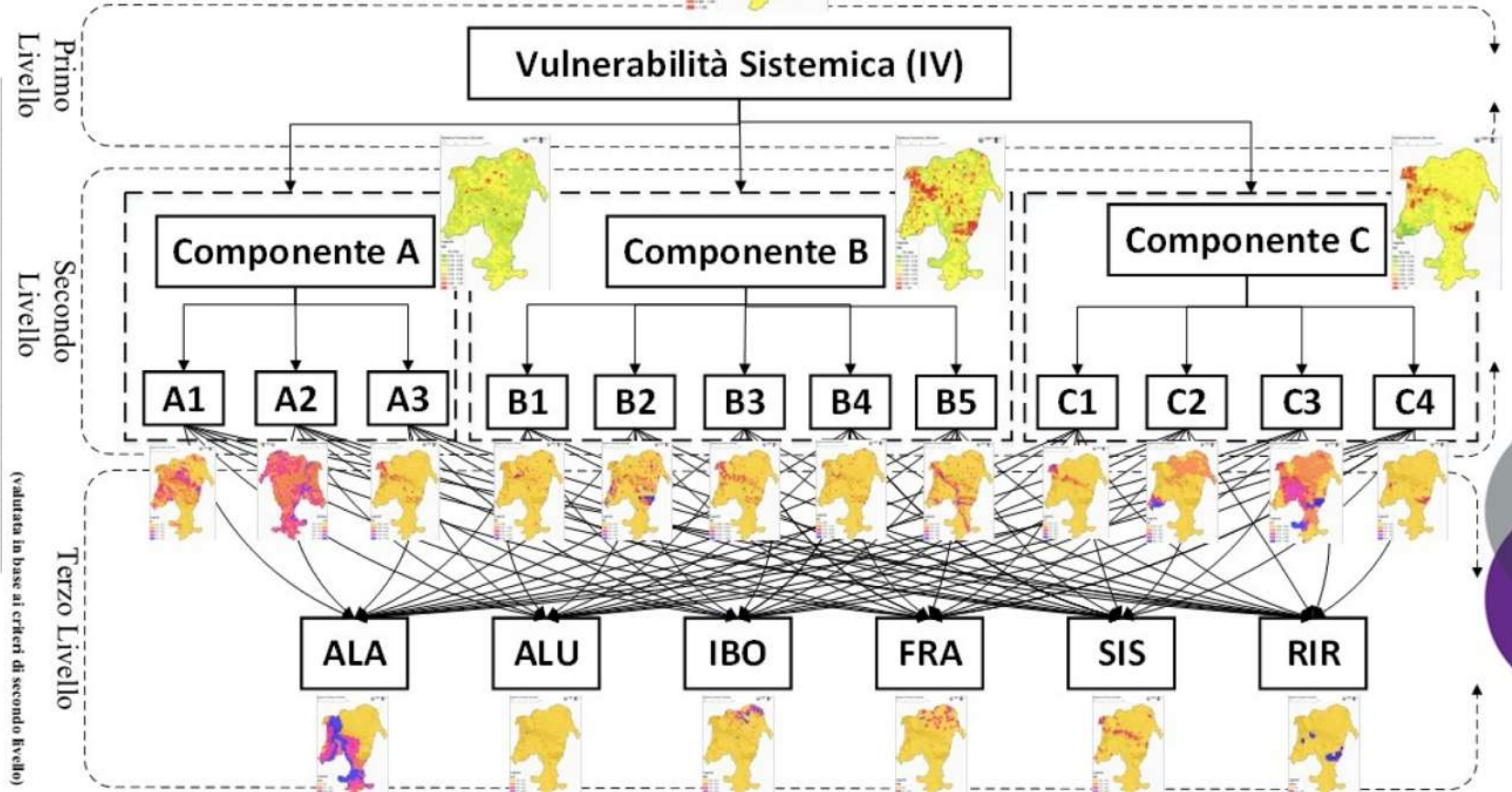
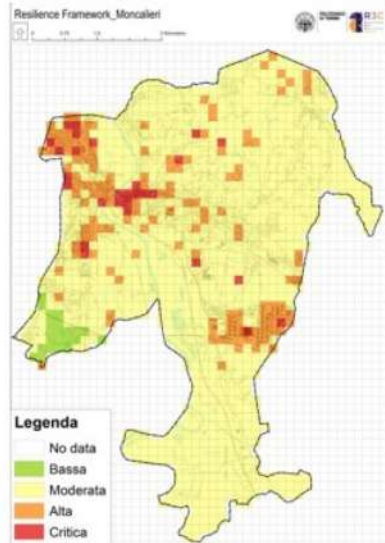
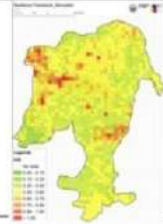


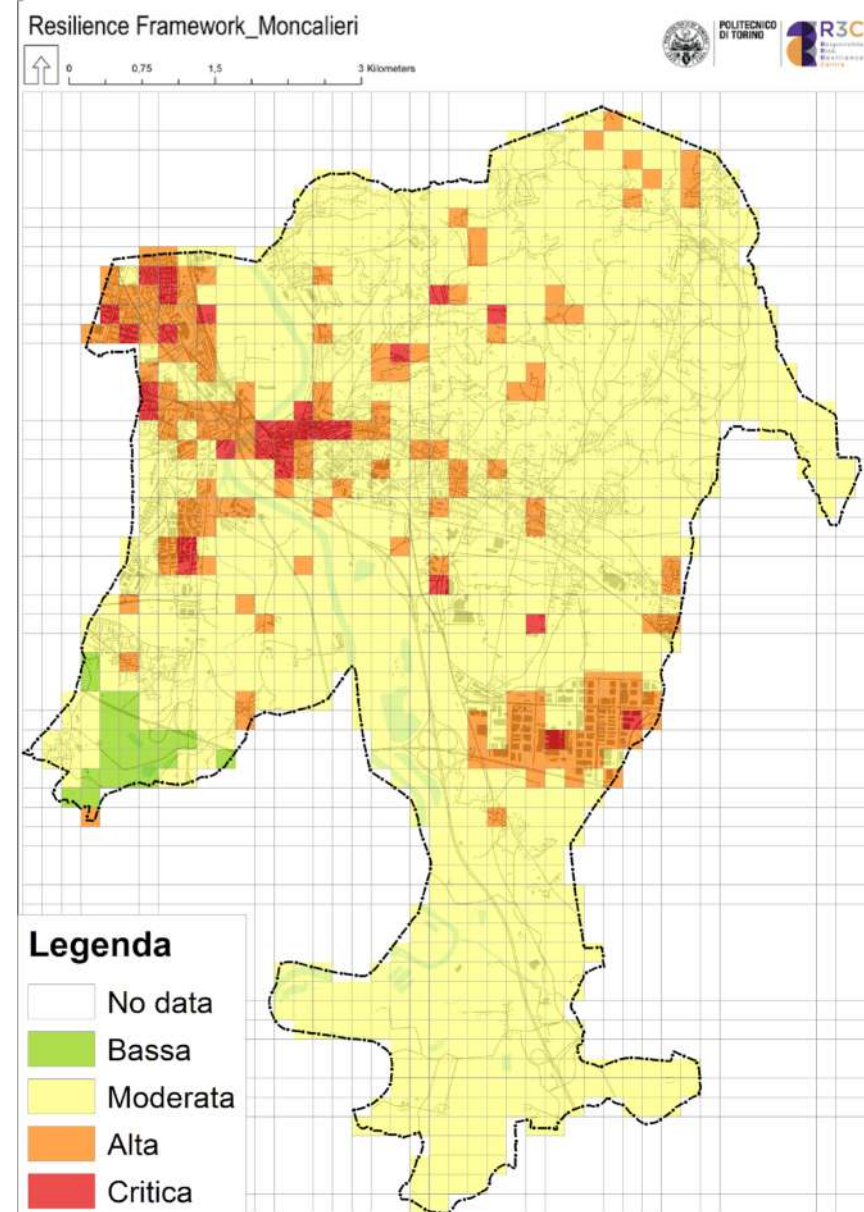
Fig.6 R3C matrix weighing

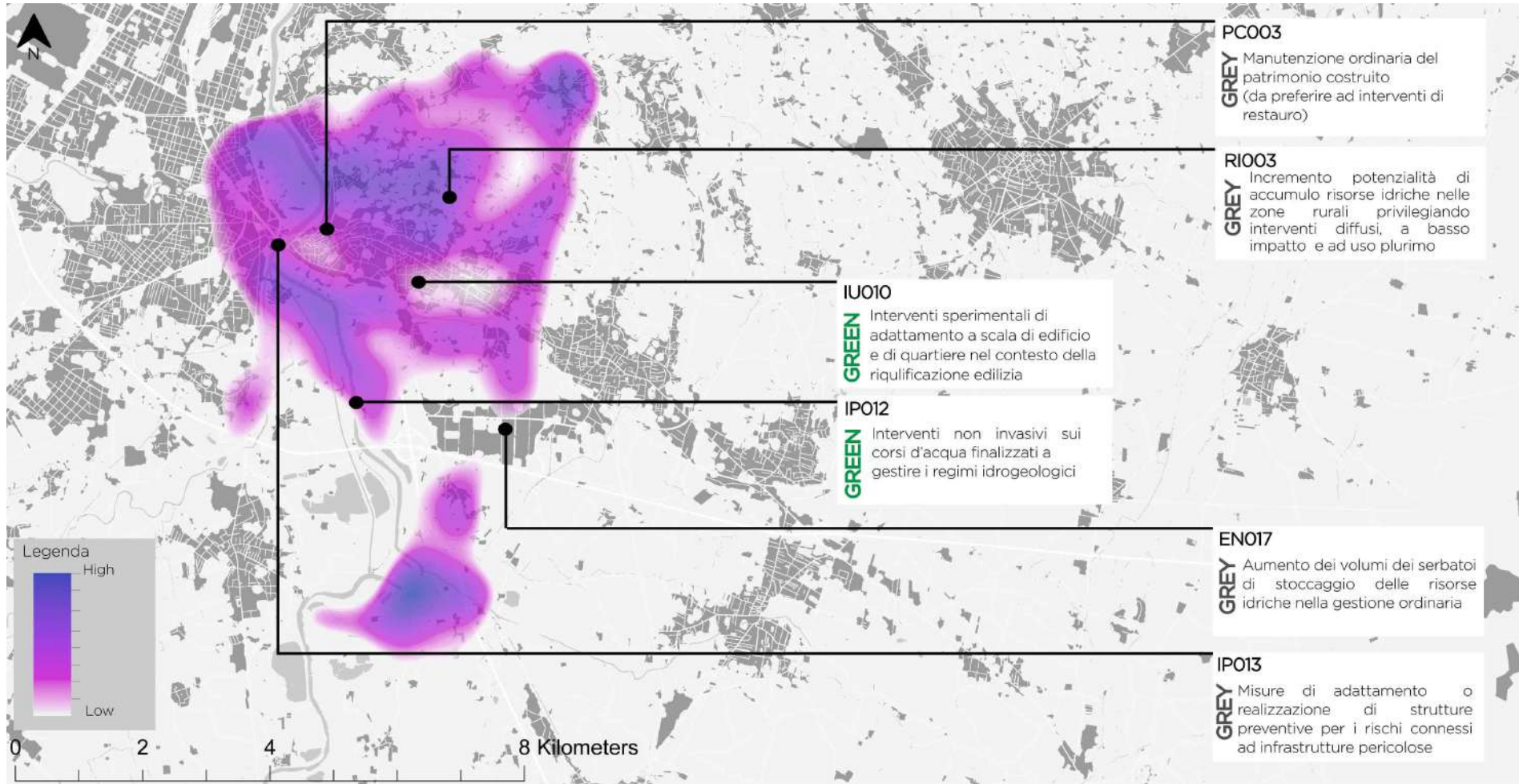
0 --- no relationship
 3 --- very close relationship.
 (Normalized [0:1])

14 Expert from R3C group



Index of territorial vulnerabilities





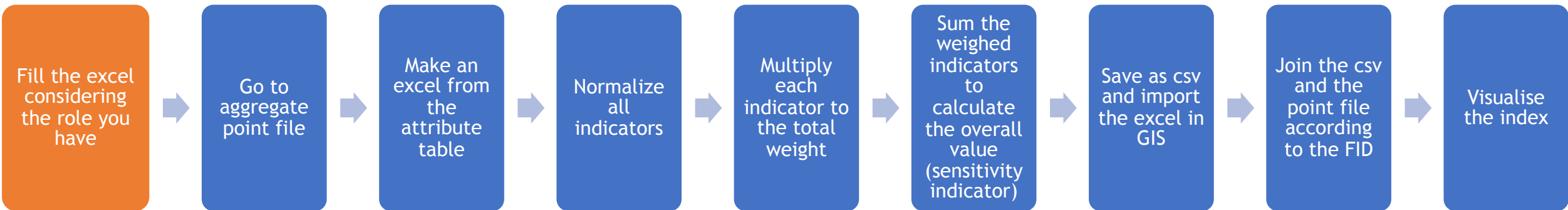
Measuring Territorial Vulnerabilities using R3C Matrix for Just Green Transition



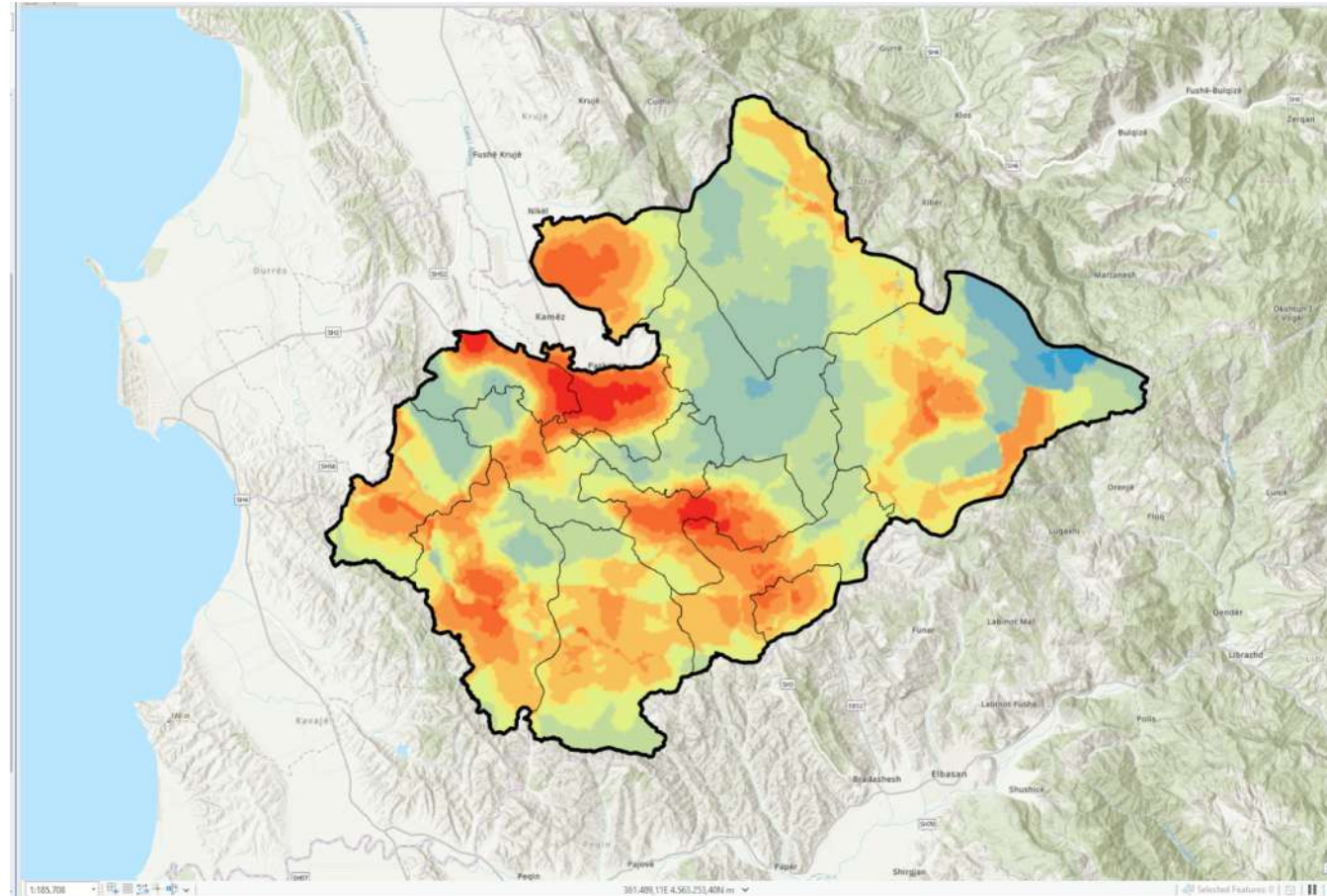
1. Select all indicators
2. Interpolate all indicators
3. Raster to Point (Conversion)
4. Spatial join
5. Calculating the index
 - 5.1. Normalization
 - 5.2. Weighing
 - 5.3. summing

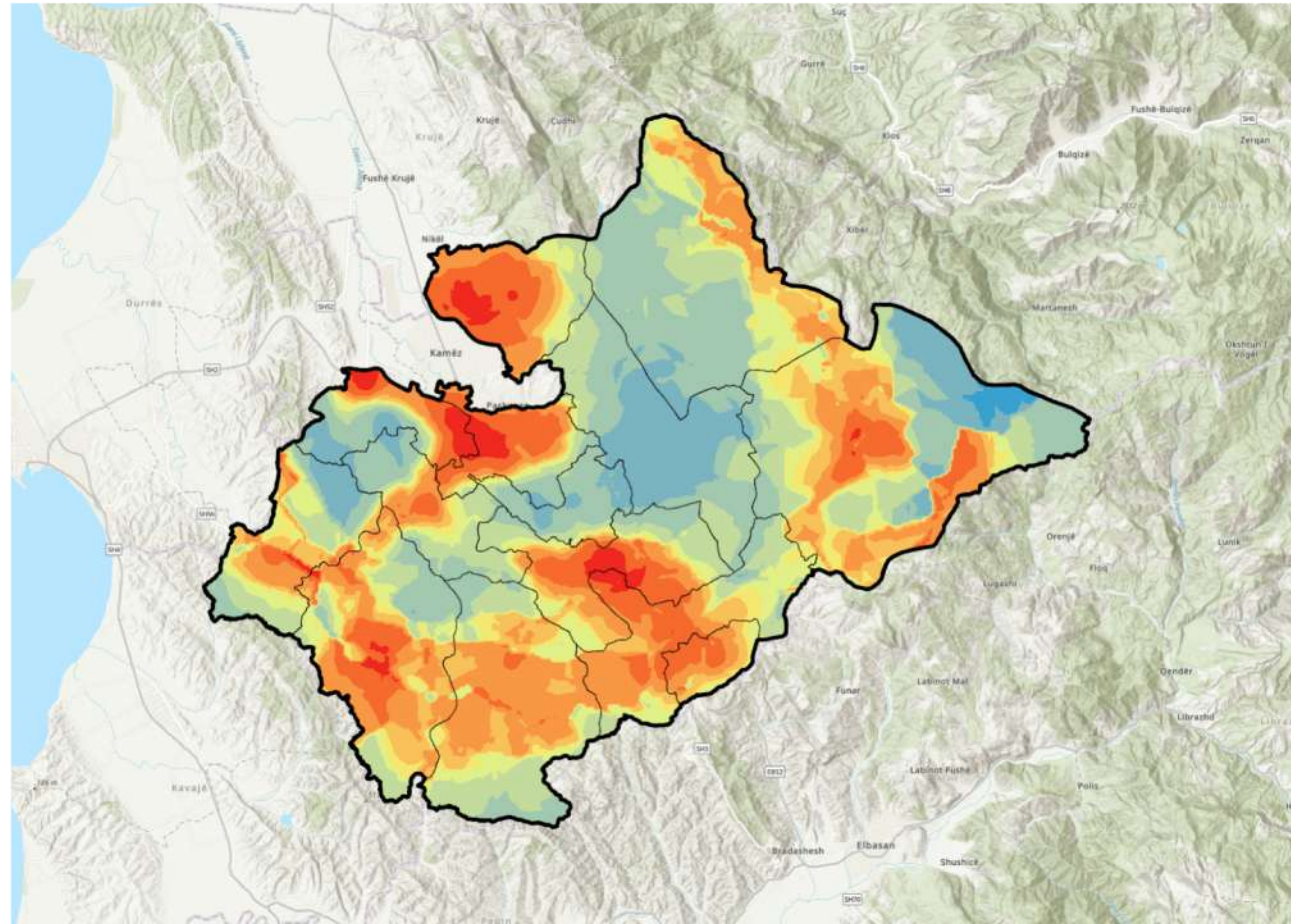
Exercise: calculating vulnerability index in the context of Tirana

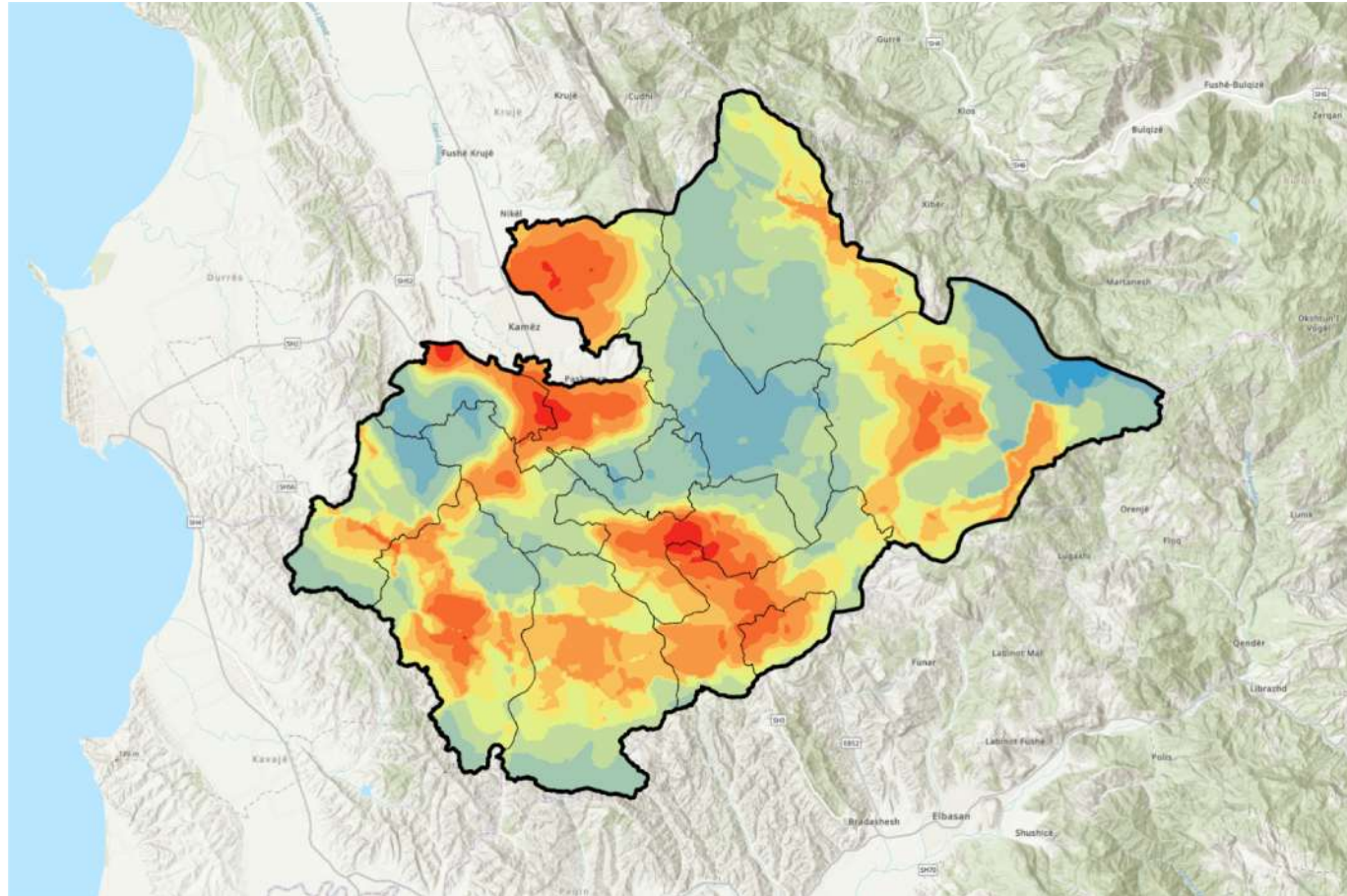
component	indicator of sensitivity	indicator of pressure		
		dynamic of population density (2011-2001)	dynamic of built up area density (2017-2022)	spatiality of economic aids
environment	permeable area =permeable area/total area			
infrastructure and services	Accesibility=road density/inhabitatnts			
	Availability of educational services=schools/inhabitants			
	Availability of health care services=healthcare facilities/inhabitants			
economy and demography	Economic productivity = business for 1000 inhabitants			
	housing availability= number of dwellings/inhabitants			

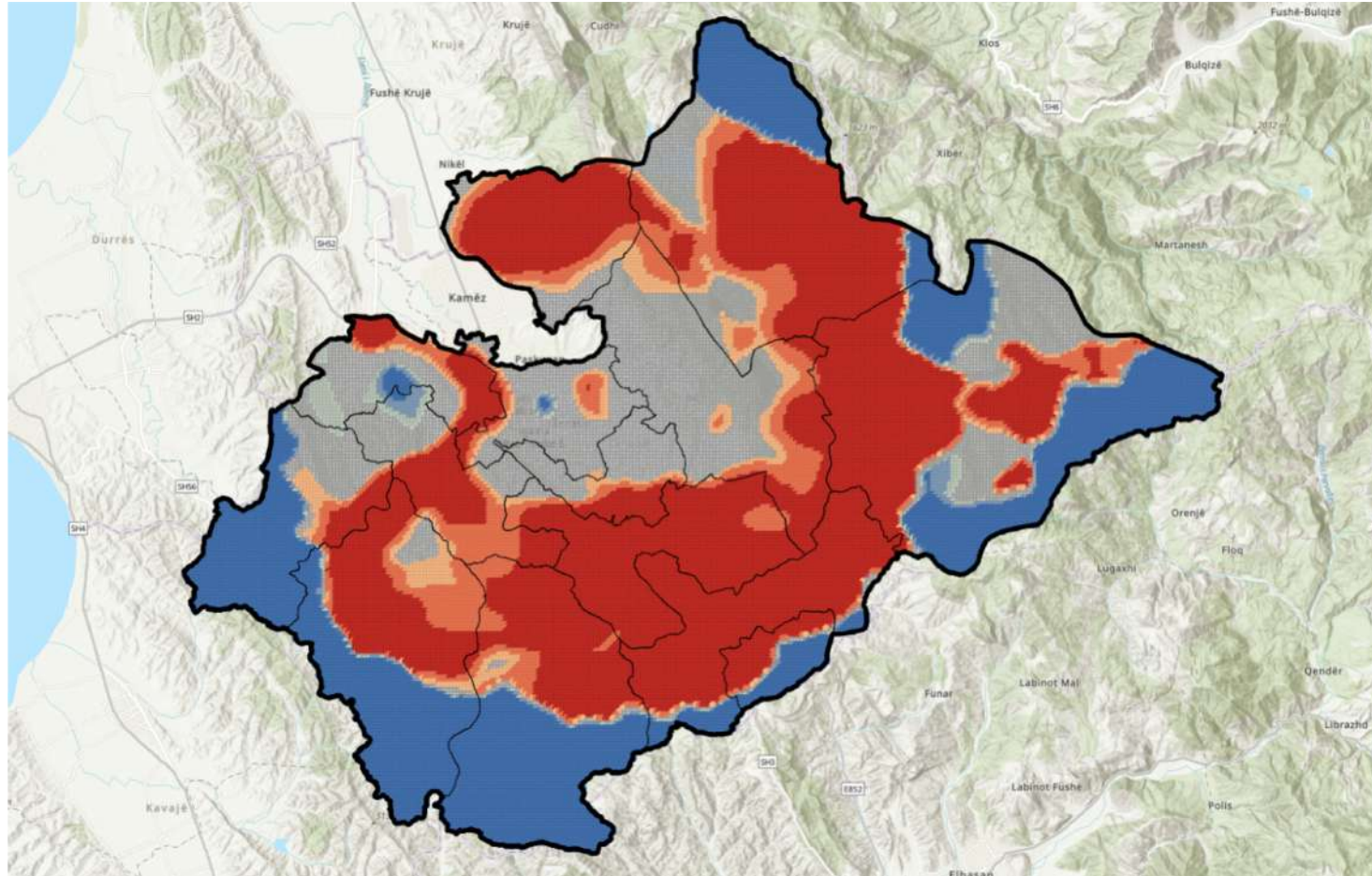


Vulnerability index (without giving weights to indicators)









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