



ENVISIONING RESILIENT CITIES

for a

POST-PANDEMIC ONE HEALTH FUTURE



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The manuscripts in this publication exceeds the contributions to the initial conference. It highlights a variety of other inputs, opinions, points of views, and works of several citizens, international organizations, public institutions, NGOs, NPOs, associations, independent researchers, research centers, universities, and academic institutions from all over the world, who have all come together to envision resilient cities for a post-pandemic one health future.

The book includes Scientific paper and reframing contribution stimulating challenges, highlighting crosscutting phenomena and providing perspectives envisioning resilient and sustainable cities futures.

The Scientific paper were selected after a call launched during the Urban Resilience and One Health international conference and admitted to the publication after a double blinded peer review process guaranteed and coordinated by the Resilience LAB Editorial Committee and REsilienceLAB Scientific Committee.

The procedure of double-blinded peer review involved several expert reviewers selected by the REsilienceLAB Editorial Committee providing valuables inputs in improving the quality of the scientific papers included in the publication. The REsilienceLAB Scientific Committee and the Resilience LAB Editorial Committee would like to express their gratitude and thanks to the reviewers who have allowed this publication with their competence, severity and availability, guaranteeing its high scientific quality.

The reframing and envisioning contributions were reviewed by the Editorial Committee and the Scientific Committee of REsilienceLAB.

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Angela Colucci

KEYWORDS

RESILIENCE; SLUMS; CHILDREN;
INFORMALITIES; GREEN SPACES



[Sch 2] Figure 1. Trento Alpine city. Source: graphic elaboration by Mannocci S., 2019.

[SCh 2] Trento Urban Transformation. Designing Healthy Cities through Adaptive Urban Planning

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1. Background

The drastic decrease in non-renewable natural resources and the negative effects of the climate crisis have made the environmental issue central to debates about the evolution of the 21st century city. In fact, the impacts of global warming are particularly evident in the urban environment: heat waves, flash storms, unexpected fires and hurricanes are increasingly common events that exacerbate existing problems in more urbanized areas, compromising the safety and well-being of citizens. According to the recent United Nations Department of Economic and Social Affairs scenarios (UN DESA, 2019), the global population was less than 1 billion people until the 1800s; by 1930 it had doubled, and 30 years later it reached 3 billion. By the millennium it had reached 6 billion, and by 2015 it measured more than 7 billion. Now, the world's population is expected to increase from its current figure of 7.7 billion to reach 8.5 billion in 2030, 9.7 billion in 2050 and 10.9 billion in 2100, with most of the projected growth expected in urban areas (EEA, 2019). The exponential growth of the global population has produced an increase in anthropogenic pressure on the territories, causing what is called "Great Acceleration" (Steffen et al., 2011; Steffen et al., 2015): since 1950, the changes occurring to the Earth System are directly related to anthropogenic actions that have induced a very rapid and profound change in terrestrial conditions (e.g., temperature rise, loss of biodiversity, mass extinctions, water stress). The change is occurring on such a scale that human activities have significantly altered the Earth system since the Holocene leading to a new human-dominated geological epoch called the Anthropocene (Waters et al., 2016). The United Nations' report "Cities and Climate Change" states that 75% of global CO₂ emissions are produced in urban environments and are largely caused by transportation and buildings. These data show the central role played by cities: they

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Attribution

The research, the themes and the structure of the contribution and relative conclusions have been elaborated collectively by the authors. Coordination of the T.U.T. research project: Mosè Ricci. The affiliations of the paragraphs are as follows: 1, 4.2, and 4.3 Silvia Mannocci; 2, 2.2, 2.3, 3, 4, and 4.1 Anna Codemo; 2.1 and 5 Sara Favargiotti

ABSTRACT

Urban areas constitute key hubs of interventions to drive towards sustainable development: affordable housing, mobility, provision of services, ageing, urban health, social segregation, environmental footprint, and climate action have been shaping urban transformation with unpredictable scenarios. Such challenges require an update of urban planning tools, which need to mirror the complexity of urban patterns and to enhance their capacities to focus on multiple pathways and plurality of goals.

The paper presents the research conducted by the Trento Urban Transformation (TUT) research group at the University of Trento as scientific support to the revision of the General Urban Plan of Trento, an alpine city in the north-east of Italy.

The research project aims to propose innovative, adaptive, and incremental planning tools to allow flexibility, preparedness to extreme events, and capacity to learn from the past.

The proposed city plan draws on a new vision, namely "Trento Leaf Plan". It defines a strategic vision to cope with urban challenges for a healthier and more resilient habitat.

The paper introduces the general approach proposed, and focuses on three tools that have been experimented to shift from a quantitative system based on control to a metabolic, interdisciplinary, and multiscale plan: spatially explicit vegetation and ecosystem services models, the figure of chief resilient officer and integration of environmental criteria in planning tools.

are the main reason for environmental crises, but at the same time they experience the negative effects of these crises and therefore can become priority places to act to provide solutions. As Curitiba Mayor Jaime Lerner stated, "Cities are not the problem; they are the solution." (Planning Report, 2007). At the international level, the adoption of strategies and goals enshrining the need for a more responsive urban development aims to implement the adaptive capacity and the transformation into inclusive, safe, resilient, and sustainable environments at the local level (SDG, 11). The ability of cities to cope with major changes is called urban resilience, which is defined as 'the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience' (Resilient cities network, 2021). The introduction of the term resilience in the vocabulary of urban planning and architecture established a novel systemic and dynamic understanding of urban processes. In this view, the traditional objectives of urban planning aiming at ensuring "an urban life that is at the same time beautiful, healthy, comfortable and economical" (Piccinato, 1938) are combined with the research of models solving the environmental crisis, in the context of constantly changing contemporary cities. Thus, an interdisciplinary and interscalar approach is introduced in spatial planning, to understand the dynamics of the urban environment and to overcome the dualism of humanity and nature. Such approach constitutes the trigger to the necessary ecological transition, guided by the concept of biophilia defined by Wilson as "the innate tendency to focus on life and lifelike processes" (Wilson, 1984). Particularly, the principles of Biophilic Urbanism propose approaches in which urban planning and design processes are influenced by the beneficial qualities of nature. To this end, the regeneration of the urban environment is developed through nature-based, climate positive, and sustainable urban areas for healthier communities (Tabb, 2021). From this point of view, the resilient approach aiming at ecological transition based on biophilic design is an effective response to a state of emergency and an opportunity to reinterpret what we have already planned by proposing new ways of intervention in the urban context. The Trento Urban Transformation (TUT) research project of the Department of Civil, Environmental and Mechanical Engineering (DICAM) of the University of Trento provided scientific support to the revision of the General Regulatory Plan, PRG, initiated by the technical offices of the Municipality of Trento. For the TUT research project, an interdisciplinary group was established, composed of professors and researchers with expertise in urban planning, architecture, landscape planning and environmental engineering. In this framework, the research project aims to investigate and test new approaches to urban planning and new design devices for an "open urbanism" (Sennet, 2020), i.e. able to build a flexible environment, not overdetermined or completely defined a priori, able to overcome the rigidities of traditional urban regulation and able to respond in an adaptive manner to the challenges due to the environmental crisis and pandemic; to preserve the benefits of coexistence in the city but avoid the most dangerous threats.

This contribution reports the ongoing activities of the TUT research group and focuses on a twofold objective: the creation of a flexible and open vision for the city of Trento and the development of tools and strategies to trigger processes of ecological transition to improve citizens' health and well-being. Specifically, the paper focuses on the development of a methodological approach to integrate climate-related issues, including health and wellbeing, in the current planning practices. The proposed method aims to constitute a shift from the traditional plan based on zoning and standards to performative planning tools capable of addressing the current global and local challenges.

2. Trento: alpine city in global urban challenges

The study is carried out in Trento, an alpine city of around 120,000 inhabitants in the north-east of Italy (Fig. 1). The city lies along the Adige valley and is surrounded by mountains. The urban development has been strongly influenced by topography: urban areas are located in the valley floor, while small villages and large natural environments are in the hillsides.

The urbanization of the valley floor has been increasing and leading to problems such as urban heat island effect and stormwater management issues. Despite the increasing urbanization, several areas have been abandoned due to the disposal of several activities, generating urban void and degraded spaces. Thus, urban, and peri-urban development increased land consumption, negatively affecting biodiversity, accessibility and wellbeing. Such challenges, combined with the global ones, constitute a complex system of issues that need to be integrated in the local planning practices.

The Province of Trento promoted studies to acknowledge the climatic condition of the area and to develop its climatic variability. The good system of datasets and their relative studies allowed the definition of trends and possible future scenarios. The topography influences the climatic conditions, being responsible for example of the thermal inversion in summer. In general, a growing trend of temperature is evident in the last 150/200 years, while minor changes have been detected in the precipitations (Codemo et al., 2018). Moreover, Eccel (2015)

reported a drier climate, mainly due to temperature increase. In the city of Trento, the mean temperature trend is increasing, especially in the last decades, and many stations registered an increase of maximum temperature. However, so far, the index of heat waves has not been increasing. The simulations of future trends show a decrease in precipitation and in rainy days, and an increase of mean and maximum temperatures. Moreover, consecutive dry days are expected to increase as well as summer days (Eccel et al., 2016).

2.1 Trento: a landscape in landscapes

In 2000, the European Landscape Convention defined "Landscape" as "an area as perceived by people, whose character is the result of the action and interaction of natural and/or human factors" (ELC, 2000). The human and social perception of the anthropic landscape is placed at the center of the interpretation as well as of the actions in the territory.

Accordingly, landscape design is a valuable resource for regenerating, restoring, and renewing urban, peri-urban, and rural areas, often obsolete or abandoned. Land recovery and transformation processes find an opportunity in urban agriculture to improve the quality of life in cities, interpreting the abandoned areas as reserves capable of managing climatic, ecological, and social complexities. Indeed, natural areas offer unique and precious resources for cultivating biodiversity by providing ecosystem services and public space of quality and happier lifestyles.

The biodiversity loss has significant impacts to health and well-being. Numerous studies have investigated the impacts of climate change on biodiversity and on human health based on the concept of biophilia intended as the "the innately emotional affiliation of human beings to other living organisms" (Wilson 1993, p. 31).

Natural areas and ecosystems can contribute positively to human health in various ways, such as:

- I. by providing ecosystem benefits and services that sustain life and regulate against detrimental health effects from climate, floods, infectious diseases, etc.;
- II. as botanical sources for both traditional and modern medicines; and
- III. by providing direct benefits to physical, spiritual, and mental health through time spent in nature (MacKinnon et al. 2019).

Integrating climate change, biodiversity and human health requires new methodological and operational approaches based on inter-and-transdisciplinary working. Thus, a change of perspective is necessary, based on values such as social integration, climate adaptation, enhancement of environmental and ecosystem services (protecting against erosion, facilitating pollination, supporting tourism and biodiversity) in a perspective of sustainable development and circular economy for urban regeneration.

Within this perspective, TUT research promotes an urban plan and design methodology with the care, promotion, and management of landscape at the center. Indeed, Trento's urban challenges consist of the valorization of landscapes through the preservation of natural ecosystems, the regeneration of "marginal" areas and the promotion of multifunctional landscapes for community, microclimate, productivity, and excellence.

A change of perspective in the opposed relations between city and country leads therefore to an integrated vision of the peri-urban territory that assumes a vital and active role with new productive functions and attractions. This happens in Trento, "a city of landscapes", where the complexity of the territory requires a holistic approach to the territorial policies and urban design, able to properly represent the different challenges and specificities of the territory (Favargiotti, 2020).

In Trento, an ecological approach to landscape design represents an opportunity to take care of the lands, by locally supporting actions of mitigation to climate change, risks protection (mainly from floods and storms), ecological connectivity and biodiversity conservation alongside helping to valorize itineraries at different altitudes and for different targets.

Biodiversity and healthy natural ecosystems underpin and sustain human livelihoods and well-being by providing essential services such as food, clean air and water, and protection against floods, coastal storms, and other natural disasters (Dudley et al. 2010). This approach can become an opportunity to reconnect society with its landscape identity and geographical characteristics (urban, rural, regional, territorial), make initiatives economically sustainable and scalable, build a comprehensive and flexible framework to guide cities to implement projects adapted to multifunctional use on different scales.

2.2 Impacts of climate change in Trento

Even with the reduced dimensions of the city and the presence of large natural areas, Trento is expected to be affected by the most common climate change effects occurring in urban areas.

According to recent reports collecting studies about climatic conditions of Trento (e.g., Codemo et al., 2018), relevant effects of climate change in Trento will include: urban heat island (UHI) effect and increase of temperatures, hydrogeological risk related to extreme precipitation increase, water scarcity due to dry periods. Urban heat islands constitute a microclimatic phenomenon by which temperature in urban areas is higher than in the rural surrounding ones. The phenomenon is due to urban surface characteristics, urban morphology, and anthropogenic activities, such as traffic and heating systems. The study by Giovannini et al. (2011) reports that the intensity of UHI is around 3°C, but in some areas, it can reach 6°C. The effect is exacerbated by the temperature increase, generating risks for human health and ecosystems. Moreover, such effects have been affecting air quality and inducing critical issues for pollutants dilution. However, the values measured in the Trento stations are within the maximum limits imposed by law and the number of exceedances and threshold values is decreasing. Regarding, rainfall, no net trends are observed, however the values analyzed in the study by the Municipality of Trento (2019) show the first signs of the effects of climate change: the intensity of rain, the days of intense and very intense precipitation have been slightly increasing. Furthermore, the analysis reports an increase in consecutive non-rainy days, an index linked to drought. Finally, the analysis shows a slight increase in cumulative annual precipitation, especially in the autumn season, underlining the presence of intense rain events and the increase in non-rainy days. It should be noted that extreme events, in addition to being characterized by intense rains, are also constituted by strong gusts of wind. In the studies carried out in Trentino, an evaluation of wind gusts trend was not possible, due to the difficulty of recording and spatializing punctual phenomena. The risks of changing precipitation are linked to hydrogeological safety and could cause floods with damages in the built environment and scarce availability of water resources, weighing on sanitary, industrial, and agricultural use.

2.3 Climate adaptation and mitigation strategies

The new Provincial Energy and Environmental Plan (PEAP), for the period 2021-2030, has been recently approved. The PEAP sets the objective to decrease emissions by 55% compared to 1990 levels. To achieve it, the plan follows 12 strategic lines concerning deep energy requalification of buildings, increase of Renewable Energy Sources (RES), experimentation of energy communities, enhancement of sustainable mobility (Provincia Autonoma di Trento, 2021). The PEAP states the importance of updating planning tools and introducing mitigation and adaptation in current planning practices. Furthermore, within the "Trentino Clima 2021-2023" work program, the "Provincial Strategy for Mitigation and Adaptation to Climate Change" will guide the administrative action of the province to manage actions tackling climate change impacts. Specifically, regarding the city of Trento, the Municipality joined the Covenant of Mayors in 2014, activating procedures to involve citizens in the development and implementation phases of the Sustainable Energy Action Plan (SEAP). The plan is divided into two phases: emissions inventory (BEI), and identification of actions to reduce the emissions of the inventory. The Municipality of Trento's strategies concern the energy efficiency of buildings owned by the municipality, the progress of projects as pilot cases: for the management of ventilation, heating and cooling of large buildings, the construction of new efficient urban infrastructures, such as street lighting, the introduction of regulations for buildings (Andreucci, 2018). While mitigation efforts are clear, a strategy to adapt to the effects of climate change has not been implemented, as well as the introduction of related parameters in planning policies.

3. Adaptive urban planning: the Trento Leaf Plan [1]

Based on the local vulnerabilities and the challenges that contemporary cities will have to face, the TUT research project proposed a systemic approach to urban transformations based on resilient and adaptive urban planning tools. The proposed method constitutes the baseline for the review of the Trento Urban Plan, adopted by the municipality in 2018[2]. The city plan draws on the Trento Leaf Plan vision, which constitutes a communicative means driving urban transformations towards ecological transition. The revised plan aims to shift the quantitative system based on control to a metabolic, multidisciplinary, and adaptive one, allowing flexibility to future changes. It focuses on health and quality of life, regeneration of the existing built environment and climate-energy transition.

The contribution of the TUT research team to implement the vision is the introduction of an innovative and adaptive planning process: the plan is based on three paradigms focusing on cooperation, flexibility, and performance, and rather than working by objectives, it sets five challenges. The three paradigms constitute the baseline actions to effectively integrate the urban challenges in the urban plan, by understanding the

context of the contemporary city and the Alpine area of Trento, by focusing on sustainability development, and by creating a dialogue with the community.

Plan as an “urban narrative” represents the capacity of interpreting the existing built environment to re-discover and re-active urban spaces. Plan as a “shared urban action” overcomes the traditional participatory processes, and enables an open-source urban planning, based on co-creative processes in all the phases of the policy cycle.

Plan as “performance” reinterprets the urban transformations based on land use in transformations based on required performance. In this view, the criteria to regenerate the built environment are based on socio-ecological measurable parameters.

Five challenges, in accordance with the goals of the European Urban Agenda, have been set for the future development of Trento, and they can be implemented through different action policies.

The aim of the challenges is to allow the transformation of the physical space in a flexible way, through devices that can change over time according to the needs.

- **Eco-Trento:** a sustainable city, prepared to tackle the issues related to climate change and biodiversity loss, and capable of re-using the existing space by avoiding land consumption.
- **Welcoming-Trento:** a city capable of improving the sense of belonging, by recognizing the presence of different identities and enabling integration and quality of life.
- **Accessible-Trento:** a city based on sustainable mobility, by improving the quality of supralocal transports and slow connections.
- **Smart-Trento:** a city that becomes innovative and competitive by creating a network between research and production.
- **Bella-Trento:** a city that preserves historical, cultural and landscape heritage, evaluating the beauty of urban landscape and improving attractiveness and wellbeing.

The adopted strategy is not a conventional general urban plan, rather a clear vision of the city and related networks derived from the interpretation of the city's need and resources, that can be implemented in different stages and with various tools in a long-term perspective (Giroi, 2006; Guallart, 2012).

The proposed approach is based on interaction and standardization of the different components, and studies the relationships and changes occurring in the urban environment. In agreement with the definition of Kennedy et al. 2007, the approach is metabolic, referring to the environmental sustainability issues as well as to the organic system. Indeed, the plan focuses on safe, healthy, and flexible public spaces, reduction of the urban footprint by rehabilitating existing spaces, the role of citizens as the main actors in the interventions, sustainable mobility, and the exchange of experiences. The proposed approach has been developed through a continuous collaboration between researchers and Municipality: it was built on a technical table as a task force composed of representatives from the University of Trento, the City of Trento, and professional associations.

This co-creative approach provided the opportunity to have a broader overview of the challenges related to urban transformations through different scales and steps of intervention. Moreover, the method has been tested through case studies in specific areas by doctoral thesis and by master thesis developed in the Department. Moreover, the proposed approach constitutes the baseline to integrate societal challenges and the local ones in the urban planning tools. The first experimentation developed in cooperation with

[1] In the present paragraph the main considerations about the Leaf Plan and the structure of the Plan refer to the following publications: Ricci, M., “Adaptability: The Leaf Plan concept” in A. Battisti, D. Santucci (eds), *Activating Public Space: An Approach for Climate Change Mitigation*, München: TU München Press, 2020, p. 65-75. DOI: 10.14459/1543270md2020 and Ricci, M.; Favargiotti, S., “Trento Leaf Plan. Cinque sfide per il metabolismo urbano” in *ECO WEB TOWN*, v. 1/2019, n. 19 (2019), p. 1-10. http://www.ecowebtown.it/n_19/pdf/B9_EWT_19_Ricci_Favargiotti_stampa.pdf

[2] Comune di Trento (2018). *Il futuro della città di Trento si costruisce oggi. Obiettivi e percorso della variante generale al Piano Regolatore Generale./The future of the city of Trento is being built today. Objectives and process of the overall revision to the Urban Plan.* Retrieved from: <https://www.comune.trento.it/Aree-tematiche/Ambiente-e-territorio/Urbanistica/Il-nuovo-PRG-Piano-regolatore-generale/Obiettivi-e-percorso-della-variante-generale-al-Piano-regolatore-generale-2018/Scarica-il-documento-Il-futuro-della-citta-di-Trento-si-cos>.



representatives of the Municipality is the revision of urban agreements, to define new requirements in the processes of the negotiations between public and private, as explained in section 4.3. The intention of this first experimentation is to develop a methodology that can be integrated in the current urban and landscape planning tools (e.g., Landscape Chart, Regulatory Plan, Mobility Plan) or to constitute a base for the development of future plans (e.g., climate adaptation plan).

4. Planning tools for healthy and resilient cities

Eco-Trento is one of the challenges identified in the revision of the Urban Plan. The ecological and environmental issues have been recognized as essential since the early stages of the research project. The specific goals of the challenge are related to the enhancement of ecosystem services, mitigation and adaptation to climate change and the implementation of green and blue infrastructure. These goals are set to improve the performance of the urban environment mainly in terms of temperature regulation, sustainable water management, energy transition, and inhabitants' health. As mentioned in the previous paragraphs, Trento has not adopted a climate resilience urban plan yet. Thus, the last phases of the research project have been focusing on the definition and integration of specific tools in the planning practices to drive towards ecological transition. The proposed tools have been developed to be integrated in the current planning tools rather than to create new plans to address the ecological challenges, in order to promote a shift from quantitative to performative planning. This paragraph describes three tools of landscape planning and management that have been studied in the framework of TUT, with different potential uses in the policy cycle.

4.1 Spatially explicit ecological oriented maps

The growing availability of datasets (e.g., drones, airborne imagery, vectorial data) can be a useful tool to spatially represent urban issues, including social, physical, and ecological aspects. Within the most common are land use and land cover studies, built infrastructure layers, social-demographic surveys, and economic data (Wellmann et al., 2020). Recently, a growing number of studies have been analyzing ecological and environmental aspects of urban areas that can be useful for green urban infrastructure planning and climate adaptation. For example, many studies classified urban areas in different levels of heat-related risks (e.g., Morabito et al., 2015, Norton et al., 2015) or hydrogeological risks (e.g., Kubal et al., 2009). Moreover, the definition of bioclimatic zones or Local Climate Zones (according to Stewart and Oke., 2012) has become increasingly common to determine the relationship between urban morphology and microclimate. Spatially explicit studies represent an important asset for planning practices, since they can determine different levels of priority of interventions, and they can support in the decision of the type of actions. In the framework of the T.U.T. research project, two studies focused on the formation of knowledge as well as in its application in urban policies. The first one is the map of ecosystem services (Cortinovis and Geneletti, 2020) and the second one is the map of pervious surfaces and canopy cover (Fig. 3) with airborne images (Codemo et al., under review). Such tools constitute a dynamic map that represents and evaluates the present condition and can be updated to monitor the changes. The integration of supply and demand of urban ecosystem services as well the map of vegetation in terms of perviousness and canopy cover, can be used as tools for a performance-based approach, limiting negative impacts of urban transformations. The aim of the maps is to drive urban transformations by requiring a specific performance according to the location of the interventions. Their application is very flexible, in terms of uses and design tools, since they do not define predetermined transformations, rather functions to be achieved in specific areas (Pelorosso, 2020)

The map of permeability and canopy cover can be used as a baseline to determine the distribution of functions related to microclimate regulation (Zardo et al., 2017) and run-off mitigation (Li et al., 2018) in a very detailed way (resolution of 20cm). The ecosystem services supply and demand maps provided by the study regards the following services: microclimate regulation, habitat provision, recreation, noise mitigation, air purification, runoff mitigation and food provision.

The aim of the maps is to advance from the common standards for green or permeable areas of the urban plans, by assessing different types of urban greening and measuring the capacity to support different ecosystem services (Fig. 4). Thus, by setting minimum requirements in terms of services (e.g., cooling, sustainable water management), the plan allows flexible transformations and types of actions, but limits the negative effects of transformations.

Moreover, spatially distributed maps enable a whole view of the city, and can be useful to determine priorities of regeneration and cluster of typologies of interventions required. Finally, being the maps easy to update, they can be used to monitor the status of the parameters. The maps of canopy cover and pervious surfaces

can constitute a tool to support subordinated planning tools and strategic planning tools. For example, they can support the integration of performative indicators, such as microclimatic wellbeing, in the Building Code.

4.2 Resilience management

Urban resilience is a cross-cutting topic that not only examines aspects related to adaptation and mitigation to climate change but makes a broader reflection on the crisis of urban metabolism and the forms of technical and constructive rationality on which the city and its relationship with natural resources has been built so far (Zupi, 2016). Indeed, cities are complex systems in which the idea of a single “stable” state is replaced by that of a “shifting steady-state mosaic” (Holling, 1986).

It is not possible to predict how the urban ecosystem will evolve and change because it is a complex system, composed of numerous variables interconnected at multiple levels. Its changes are sudden and unpredictable. The awareness that the urban ecosystem is a dynamic, complex, and unpredictable environment has significant implications for city planning and management. It is necessary to accept the inevitable changes that will occur as a normal part of the urban evolution process and through planning and design adapt to the changes in a more flexible and responsive manner (Lister, 2007). This kind of awareness requires an interdisciplinary and multi-scalar approach to solving the problems that anthropized territories have been facing.

Urban resilience is an opportunity to deeply change the way we manage urban transformation. In this sense it is not a new Plan, but an organizational proposal for a complex structure aimed at managing all aspects of the urban system (Caudo, 2016).

To support, investigate and test new processes of urban transformations’ adaptive management, large city networks have been created with the aim of supporting city administrations to collaborate effectively, share knowledge, and lead meaningful actions to implement urban resilience.

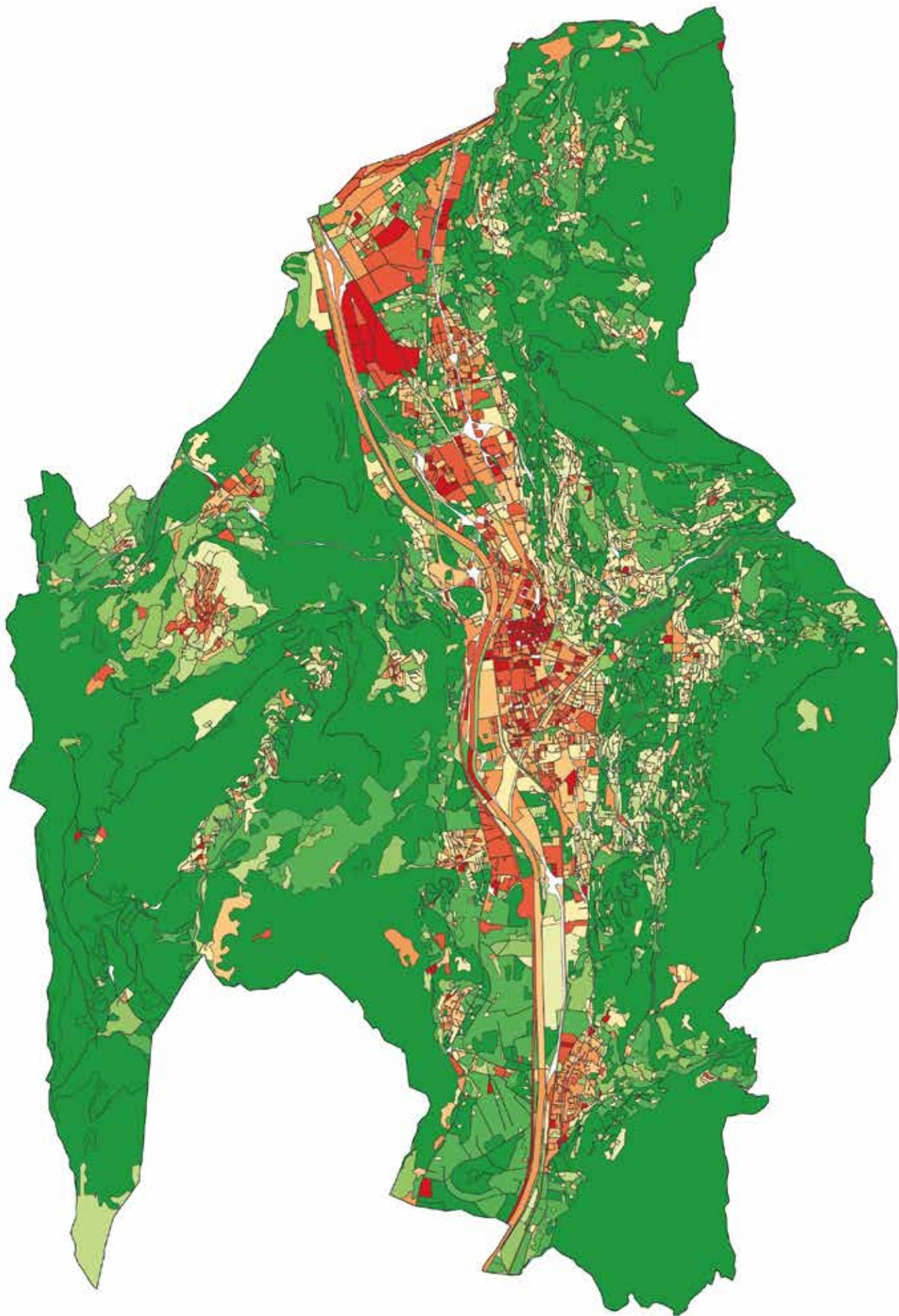
One example is the 100 Resilient Cities (100RC) program, an initiative spearheaded by the Rockefeller Foundation that proposes a vision of resilience including not only catastrophic events, such as fires and floods, resulting from changing climate conditions, but also other chronic stressors that communities face, such as high unemployment, endemic violence, inefficient public transportation systems, and pandemic crisis.

The 100 Resilience Cities platform allows the network member city to access a catalog of tools and services -provided by platform partners (e.g., private sector companies, NGOs, and research institutions)- aimed at strengthening urban resilience.

Moreover, this platform is an opportunity to find new answers. One of the innovations introduced by the program is the inclusion of the professional figure of the Chief Resilient Officer (CRO): an expert in urban



[SCh 2] Figure 3. Spatially explicit map of permeability (a) and canopy cover (b) of the city of Trento. Source: Codemo et al., under review.



resilience, whose task is to act as an intermediary between municipal offices for the construction of integrated resilient practices.

Between 2013 and 2016, the Rockefeller Foundation launched the “100 Resilient Cities Challenge,” a process for cities to be selected to join the 100 Resilient Cities program and obtain economic (approximately \$1 million for each selected city) and technical support to implement urban resilience. The economic support is intended to cover for two years the expenses for the inclusion within the municipal administration of the professional figure of the CRO. The CRO is central to the process promoted by the Rockefeller Foundation and its main responsibilities are as four. First, facilitating communication between the different offices of the administration to avoid wasting resources and promoting synergistic actions between the different projects carried out by the administration. Second, establishing contacts between the different stakeholders (government officials, private sector representatives, active citizenship, non-profit organizations) working on the territory to implement urban resilience. Third, activating, during the first six to nine months of his or her tenure, a participatory process with local stakeholders to identify the city challenges to become resilient and assess the actions needed to achieve the goal. Following the evaluation process, with the assistance of 100RC the CRO implements the identified initiatives. Finally, ensure that the projects implemented maximize their effects by achieving multiple resilience goals with a single project. In the framework of TUT, the adoption and local adaptation of the figure of the Chief Resilient Officer could facilitate a holistic view of the city, being able to coordinate multi-scalar actions to achieve important goals even through the sum of small synergistic actions. Adaptive, resilient, and responsive planning is closely linked to practice as well as research (Lister, 2015). It is therefore useful to connect specialists with different skills, municipal technicians, academics, stakeholders, and citizens, who based on their experiences and skills can build innovative solutions. The professional figure of the Chief Resilient Officer is recognized as an important piece in the transition to what Sennet calls “Open Urbanism”.

4.3 Procedures for collaborative and resilient urbanism: the new process for urban development agreements

One of the TUT research group's objectives is to investigate how to trigger adaptive and flexible governance processes through the revision of traditional planning tools. Particularly, as a result of a specific request from the Municipality, the process of forming and evaluating Urban Development Agreements was investigated, in order to establish how to assess the actual “Public Interest” resulting from each proposed agreement. Urban Development Agreements are urban planning tools which, based on a private initiative, establish an agreement between the public and private sectors, modifying or introducing new provisions to an existing regulatory plan. The possibility of varying the provisions of the existing zoning plan is only granted in cases where a justified Public Interest is being pursued.

In the Province of Trento, Urban Development Agreements are regulated by National Law n. 241/1990, art. 11 and Trentino Provincial Law n. 15/201, art. 25. Particularly important is the discussion on the definition of “relevant public interest”. In the field of urban planning and specifically in the regulations concerning urban agreements, there is no “a priori” definition of public interest (Gualandi, 2008) but it is up to the individual local administrations to define which are the priority Public Interests they wish to set to protect the territory and guarantee the best social and economic development of the communities they administrate (Moro, 2010).

This is because the concept of Public Interest is based on social, economic needs, and requirements that change over time and vary for each community. Local authorities' task is to identify the most suitable criteria and actions to respond to the needs and requirements that arise in the community. For this reason, it is not possible to define a relevant public interest a priori, but each urban and territorial context has its own peculiar needs deriving from its history, economy, social composition, and culture.

The purpose of “planning by agreement” is to obtain the private sector's consent to achieve the best land use in the interest of the community, which would otherwise not be possible (Urbani, 2005). Municipal administrations assess the positive effects of the individual projects and interventions proposed in terms of public interest. The assessment must consider the specificities of each urban context and ensure that the transformations cooperate in a holistic way to achieve the objectives set for the evolution of the city and the well-being of its community. As explained above, urban agreements can modify existing land-use regulations, being what in literature is called “upstream agreements” (Urbani, 2005).

In other words, these tools introduce modifications or new projections to the current regulatory plan. Therefore, they can offer the public body and the private project proponent greater freedom of action in

terms of admitted land uses. The analysis of case studies and approved Urban Development Agreements in Trento has allowed the identification of three characteristics of Urban Planning Agreements:

- **Flexibility:** they overcome some of the regulatory plan's rigidities, allowing the proposition of innovative projects;
- **Adaptability:** they enable the local administration with more control over the building intervention, through the request of specific conditions and requirements;
- **Site-specific:** they evaluate urban transformations and projects without generalizations, but according to the specific context in which they are located.

However, there are potential advantages and disadvantages associated with having the above-mentioned opportunities. From one point of view, Urban Planning Agreements can facilitate the realization of innovative projects and land transformations that would not be allowed by the prescriptive rules of the PRG, offering the possibility to overcome the rigidity of traditional urban planning and the constraints dictated by zoning.

Urban Development Agreements can also be used to facilitate new public policies, such as the ecological transition of the city, by providing greater freedom of action to respond to urgent and specific community needs. On the other hand, the freedom granted through an urban planning agreement may also have potential disadvantages. The risk is that decisions taken through an Urban Development Agreement are made in a fragmented and unplanned way based on use and market values, rather than on the constitutive and conforming values of the territory. Moreover, evaluating single interventions could lead to losing the necessary overview of the urban context.

In the specific case of the city of Trento, the problem encountered is the generic nature of the criteria for assessing the relevant Public Interest, and the absence of measurable parameters to support the formation of Urban Development Agreements.

In many cases, the benefit to the community is reduced to a simple increase in quantitative standards and does not become an opportunity to implement innovative urban transformations. The process proposed by the TUT research group is part of the innovative approach proposed for the revision of the General Regulatory Plan based on the challenges, and interfaces with the planning tools for healthy and resilient cities outlined above: Spatially explicit ecological oriented maps (see 5.1) and the coordinating figure of the Chief Resilient Officer (see 5.2).

The proposed process can be divided into three steps (Fig. 5):

- definition of public interest;
- formulation of the agreement;
- evaluation of the agreement.

The first step is the clear definition of the Public Interest, which in the case of Trento is identified in the five Challenges that the city set, according to the strategic document elaborated for the 2019 General Regulatory Plan review. The second step supports the formulation of the agreement through the identification of the performances to be achieved with the proposed urban transformation.

A handbook of actions and an abacus of project references contain the recommended modes of intervention in relation to each challenge. The proposed actions are associated with measurable parameters and thus become a useful tool for public decision-makers to objectively assess the actual benefits. The abacus proposes a collection of references, which can be constantly implemented, useful for guiding project choices and for sharing innovative urban regeneration projects.

The third step is the project evaluation, consisting of the concertation of requirements and incentives between the public and private sectors, and the location of public interest interventions resulting from the granted transformation. Spatially explicit ecological oriented maps (see 5.1) and the coordinating figure of the Chief Resilient Officer (see 5.2) support the allocation phase of urbanization charges, guaranteeing an overall vision of the city and the maximization of the benefit for the community.

5. Planning tools for healthy and resilient cities

The future state of systems, communities, and individuals has conventionally been of interest for decision makers, as well as policy makers, practitioners, and scientists. It might be said that the future has always been unknown. Yet, nowadays, in the age of Anthropocene, this topic is extremely urgent and poses new governance challenges. Risk assessment is more difficult due to the increasing complexity, especially concerning the capability to forecast events or to reliably guide decision making (Miller, 2015).

The main threats that affect Western countries, like climate change, environmental degradation, globalization, security, migration, automation, crisis, and poverty, are characterized by non-linear, unpredictable, and unstable dynamics.

Lately, the interest in empty spaces, vacant lots, depopulated villages, and obsolete areas in cities and territories and on their recovery is now an inevitable phenomenon in European urban planning, as an emerging dilemma to the well-known debate on the impacts of growing cities and soil consumption in urbanization.

Indeed, understanding and qualifying the impact of those transitory urban space patterns in medium and large cities and their metropolitan areas is a fundamental concern as the growing challenges need urgent measures to ensure human well-being and cities livability and to reactivate the urban metabolism (Favargiotti, 2020).

To do so, the contamination of disciplinary boundaries between landscape, architecture, urbanism, ecology has expanded and redefined the practice of designers and their field of operations.

Following this, such relevant themes as uncertainties, climate change, resilience, urban adaptation, nature-based solutions, call for a re-definition of design methodologies in public and private practices.

It can do so through sharing knowledge, data, perspectives, and design experiences among the fields of urban, landscape and ecological design, as well as environmental and social studies.

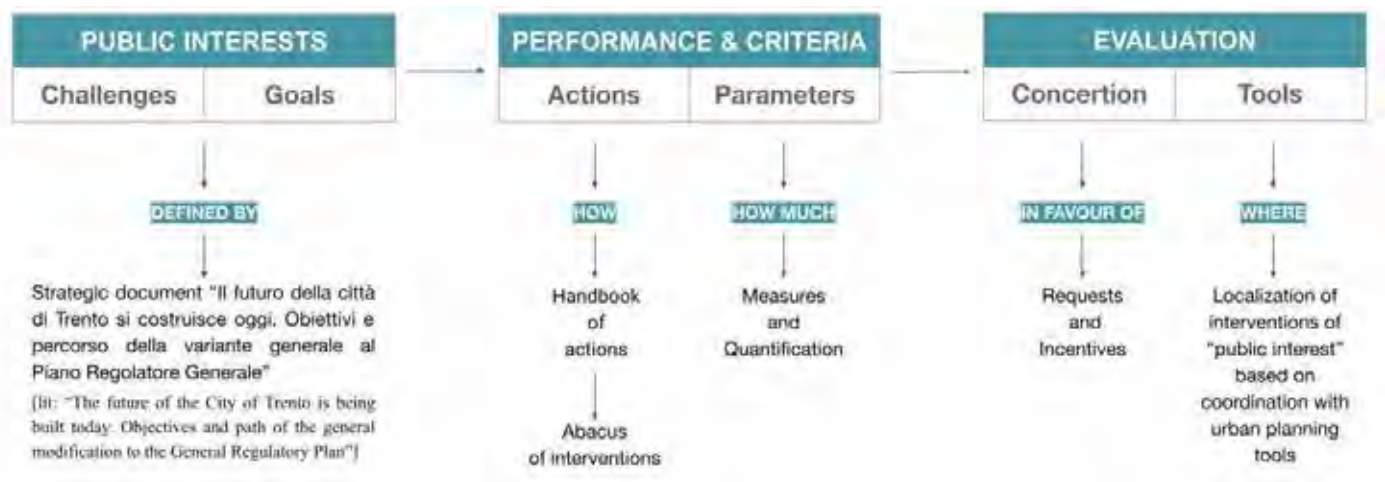
The Trento Leaf Plan constitutes a methodological approach to shift from traditional planning based on zoning, to more flexible and adaptive planning tools, capable of addressing the societal challenges.

The Leaf Plan constitutes the baseline to introduce an approach based on challenges that can be developed through multiple actions.

The present study proposes three tools that have been developed during the research to support the transition of the current planning tools.

With the TUT research we are promoting a new perspective and design approach in response to urban challenges in Trento, in order to rethinking policies and spaces through new paradigms and models guided by strategies of adaptation to change and time.

Underneath a holistic vision of the "Leaf Plan", an ecological framework for the city transformation, the research project offers urban planning strategies and tools capable to promote the ecological transition as well as to improve the well-being of citizens in Alpine cities



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ENVISIONING RESILIENT CITIES for a POST- PANDEMIC ONE HEALTH

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ABSTRACT_ The book explores and discusses the Urban Resilience and Planetary Health concepts to activate synergic dialogues among disciplinary research fields and action domains towards urban vision challenges rooted in resilience and adaptive experiences promoted by academia, experts, the third sector, and communities. Rooted in the outcomes from the Urban Resilience and One Health international conference, the book editorial process enlarged his perspectives to transfer innovations and advancements in urban systems' transformation processes, fostering a radical shift in the decision-making phase, design solutions and tools, and implementation processes.*

This collective manuscript, enriched by multidisciplinary contributions from academic and civil organization perspectives from all the continents, integrates research advancements and experiences discussing and contributing to envision a post-pandemic future for our cities.

The book has been organized into four parts that are core for the envisioning process:

- *PART I: Urban Resilience (UR) and One Health (OH) Proximities, dedicated to discussing and reframing the core concepts*
- *Part II: "Resilience" between Territorial Planning and Healthcare, exploring how the term resilience is being perceived by different scholars from planning, policy, governance and architecture disciplines, and the healthcare sector.*
- *Part III: Reality Check, presenting testimonies, life stories, and social evidence to double check the theories with what truly happened in practice.*
- *Part IV: Key messages, dedicated to the citizens' experiences and role for a healthier future and outlining the recurring key messages and perspectives to academic, institutional, and citizenship actors to envision resilient and Health complex systems.*