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PROLEGOMENON

Urban nature is an essential resource for the Changing City and Urban Greening helps in making cities more liveable, resilient and inclusive. Green spaces not only enhance the aesthetic and ecological value of urban environments but also contribute significantly to public health, social well-being, and climate adaptation. In the face of the climate crisis, the interconnection between urban quality, health outcomes, and environmental sustainability becomes increasingly urgent and must be faced properly in a transforming world.

By protecting physical spaces but also supporting the communities, the main goal is to create a city where to enjoy and live in harmony with urban nature. In this volume you can read advanced planning and design approaches aimed at implementing good solutions and focusing on technical aspects to make cities more resilient. The chapters in this volume examine current discussion on the Changing City, critically reflecting on existing tools and innovative thinking to address sustainability issues and urban complexity.

The first part of the volume presents chapters on green strategies and experiences and the evolution of a variety of proposed tools and solutions to include added value and to make cities more green, more blue, more attractive, more liveable and more resilient. Allowing urban nature to grow the most important goal is to create truly resilient cities and ensure people's health high priority. The chapters of the first part have been selected to cover theoretical insights, policy considerations and practical advice in different urban contexts.

The second part of the volume brings together insights and updates from the award-winning papers that were presented and rated as the best ones at the *Changing Cities VI: Spatial, Design, Landscape, Heritage and Socio-Economic Dimensions* International Conference, held on Rhodes Island, Greece, in June 2024¹. Three conference attendees were awarded for producing scientific work that was evaluated by a nominated 'Conference judging Commission'², based on their aims and scientific scope. The award-winning papers, recognized for their exceptional quality and value to the academic community, demonstrate a strong commitment to advancing literature reviews, architectural research, and best practices. The updated chapters presented here reflect further research intentions and clearly outline the expected scientific outcomes for fostering a more sustainable Changing City.

¹ The *Changing Cities VI* International Conference was held on Rhodes Island, Greece, from June 24 to 28, 2024. It was organized by the University of Thessaly and was coordinated and chaired by Prof. Anastasia-Aspasia Gospodini.

² The nominated 'Conference Judging Commission' was constituted by Prof. Anastasia-Aspasia Gospodini (University of Thessaly, Greece); Prof. Dimitra Babalis (University of Florence, Italy); Prof. Alkestis Rodi (University of Patras, Greece); Prof. Anastasia Loukaitou-Sideris (UCLA University of California, USA).

Dimitra Babalis
The Series Editor

INTRODUCTION

Shaping a Climate-resilient Future for our Cities

Given the growing concerns on climate crisis for urban environments, urban resilience conception is in the centre of recent research studies. Research focuses on the opportunities to deliver climate mitigation and adaptation through spatial planning. Findings emphasized the need for a resilient public space design through urban greening, capacity to threat sustainable urban mobility and connectivity, flood-resilient management and so on. They are also expected to provide key initiatives and tools for urban planners and architects in shaping new urban scenarios.

By highlighting recent advances, evolving knowledge about urban emergencies can be adapted to address climate-related risks while preserving urban quality. Thus, resilient studies can offer positive insights on how cities can be modified to changing conditions. Finally, discussions reflect on how sensitive environments can take advances from urban theory to design and suggest opportunities and solutions.

Climate adaptation and resilience involves undoubtedly city's capacity to respond and recover from various shocks and stresses including natural disasters, social challenges, economic threats. Particularly, in cities, the focus is on incorporating natural elements through planning policy and under the Green Infrastructure (GI) conception to maximize social, environmental, and economic benefits. GI and other forms of Nature-based Systems (NbS) can help address nature conservation and development sectors. In the heritage sector, UNESCO also recognises the NbS concept that can offer opportunities for more resilient heritage conservation, especially focused on the mitigation of urban disasters such as floods and so on.

The role of blue-green infrastructure as a key tool to urban resilience particularly in addressing sustainable urban drainage systems, allowing cities to manage surface water effectively and reduce runoff. Moreover, blue-green infrastructure support mobility and accessibility, improves air quality and adaptation in urban planning has become a priority for cities. Case studies in Europe and in the world highlight the successful integration of flood-resilient parks, and multifunctional public spaces that offer adaptive frameworks to be considered. It is therefore important to explore the ways in which nature can be used to help conserve and enhance built heritage, especially in the context of urban heritage buildings, monuments, and historic sites. Throughout, there are significant opportunities as well as challenges in developing and implementing NbS in Historic Urban Landscapes. In response, Nature-based Solutions have emerged as a promising approach to address these challenges.

By providing a proper discussion on the role of NbS in sensitive urban environments, three key objectives are underlined: (a) To place NbS within existing frameworks for broader urban greening strategies; (b) To explore the potential of NbS to deliver a range of environmental, economic, and social co-benefits; and (c) To propose future directions for more effective integration of NbS within built heritage contexts. By aligning environmental innovation with the conservation and enhancement of built heritage, cities can become more sustainable and resilient.

Structure of the Book

PART I – *Addressing Urban Sustainability through Innovative Initiatives*

This section outlines the methodology and design approaches used to identify key strategies and policy recommendations that inform contemporary design practices and support the broader applicability of urban initiatives. The focus is not only on discovering good frameworks for implementation but also on showcasing innovative design strategies that enhance urban vitality. These approaches aim to improve the quality of urban environments and contribute to the revitalization of public spaces, fostering more resilient, inclusive, and dynamic cities.

Chapter 1 – *Conceptions of Urban Greening and the Management of Heritage Assets. The ‘Green School Plan’ for the Florence UNESCO Area* by Dimitra Babalis shows how Urban Greening, (UG) through Nature-based Systems (NbS) in sensitive historic environments should be considered as ‘a network of multi-functional green spaces’ which can deliver environmental benefits and improve health and well-being for community. The promotion of greening actions can work as a key bridging concept between cultural heritage and nature. They have been also used extensively to address issues of urban risks such as flooding, climate change, biodiversity loss. One of the key benefits of an UG approach is the ability to be adaptive to the spatial design of a site. This flexibility and adaptability of urban greening is crucial to shape historic environments and landscapes in a more responsive way. In this reflective and adaptive way UG can be best linked to urban design. Further, it is essential in integrating urban and ecological design into planning policy. For a more sustainable, accessible, liveable places, greening can provide opportunities to meet these needs.

For sure sensitive sites require specific contextualisation to ensure preservation protection of Urban Heritage that can be a critical aspect of this perspective. Urban greening can provide an added value to the urban design process as can help to maximise aesthetic, functionality, quality of a space.

But, at what point does the UG have a positive influence on the historic environment? How can UG be used to move beyond simple tree planting? These questions are now being taken seriously by local authorities and in terms of local policies and strategies.

The chapter tries to bridge this ongoing gap, through innovative teaching programmes developed at the University of Florence that provide opportunities for students to integrate UG thinking within urban design exercise in historic city centres. At the Department of Civil and Environmental Engineering and specifically within the Master Courses of “Techniques of Urbanism” and “Urban Design” is providing not only the conceptual basis but also to embrace the principles of urban planning and design to manage the well-defined by UNESCO Historic Urban Landscapes (HULs).

Chapter 2 – *Public-private partnerships for Urban Green Infrastructures: A Preliminary Investigation in Milan, Italy* by Maria Stella Lux discusses that the implementation of Urban Green Infrastructure, (UGI) and urban re-forestation is among the key strategies for cities to enhance awareness for climate change. The main concept is to reintroduce natural components and processes into highly anthropized urban environments, providing benefits for residents and liveable urban spaces to face urban risks.

In this context, space management need to be defined. For instance, in dense urban contexts, re-allocating space from roads, parking lots, and other uses to green areas can be politically challenging and conflict prone. Urban Green Infrastructure, (UGI) and forestry strategies should not be conceived solely as top-down initiatives but should be developed through participatory processes involving citizens. Public-private partnerships (PPPs) are an effective approach to supporting the micro-and meso-scale implementation of broader urban strategies. Active citizen involvement is also crucial for strengthening urban resilience holistically, including social resilience, which depends on cohesion, participation, and a sense of belonging.

This chapter presents a preliminary study on public-private partnerships in UGI and Urban Forestry strategies in the Metropolitan Area of Milan, aiming to identify potential areas for improvement.

Chapter 3 – *Open Architecture and Planning for Resilient Cities: Exploring the Dynamics of a New Urban-Nature Dialogue* by Zeynep Uludag and Berhan Uludag outlines on how resilient cities embody a complex relation of interconnected elements, where the realms of

economy, society, governance, and environment converge within the intricate framework of inhabited and open space configurations. Indeed, architecture and urbanism dwell in same space relations and temporalities that is associated with new modes of consumption and production. Architects and planners are exploring ways of rehabilitating the urban environment as they face the challenges of sustainability, the preservation of ecosystems and new modes of space consumption. These discussions focus on the performative qualities of the urban environment as well as the preservation of natural resources in cities. At the heart of the evolutionary discussions of resilient cities lies a quest for lively and sustainable living environments, characterized by safe neighbourhoods, vibrant social networks, and reduced poverty and scarcity. Within this context, the notion of 'resilience' emerges as a key paradigm for modern urbanism, shaped by several factors including industrial diversity, demographic shifts, public sector imperatives, and the evolution of robust infrastructural frameworks encompassing transportation, distribution, culture, and knowledge dissemination.

The chapter argues on open architecture and open planning that can influence the future urban environment by questioning the physical space and social life associated with the changing patterns of public life and open space configurations. The consideration of openness to be more responsive to the needs, requirements, and desires of the public, to provide a system of responsive environments, equality in the distribution of open green spaces, and access to nature will be the discursive issue of resilience in the 21st century. The concept of 'openness' in architecture not only corresponds to the physical qualities of space but it appears to mean so many different performances in architecture like to create a sense of freedom, flexibility, adaptability, accessibility, collectivity and participation. This chapter focuses on the ways of design strategies developed with the discourse of 'openness' enhancing urban vitality, improving living environments, and revitalizing public spaces that mainly based on structural, performative, procedural principles.

PART II – The Award-winning Experience: Updates and Scientific Continuity

This section presents additional conceptual insights drawn from the three awarded papers featured in the Changing Cities VI: Spatial, Design, Landscape, Heritage and Socio-Economic Dimensions International Conference, held on Rhodes Island, Greece, in June 2024. These insights warrant further exploration to deepen understanding and inform future research. Both the general and specific research findings require explicit recognition and should be coherently integrated with complementary components. Moreover, the discussion highlights the extent to which current practices must evolve to fully align with climate mitigation and adaptation goals.

Chapter 4 – Urban Proximity: From Theoretical Evolution to New Planning Strategy. The Case Study of Mantova by Martina Borini underlines how the Covid-19 emergency has contributed to disrupt the 'city of distances' model, (defined by Manzini 2011). The emergency has also accelerated existing urban crises. To improve quality of life and to create more resilient, sustainable, and proximate urban environments there is a need to shift from 'cities of distances' to 'cities of proximities' that at the current represent a significant milestone of urban planning. The concept of proximity predicts a human-scale city with easily accessible amenities for all and reachable on foot or by bicycle. It emphasizes both 'functional proximity' which integrates public spaces, residences, and activities, and 'relational proximity' encouraging social connectivity within the local community.

In this context, implementing proximity as an urban strategy can improve regeneration processes, creating more dynamic cities. Despite the concept of proximity -not new to the urban planning- recently Carlos Moreno has developed a new human-scale city model to be applied in the contemporary city. The model emphasizes availability of primary services, a mix of uses, encouragement of pedestrian and cycle mobility, and the presence of green spaces to enhance neighborhood quality and livability for residents. In this regard, several local governments have initiated the revision of their planning systems.

The chapter shows research studies undertaken by the UNESCO Research Lab at the Politecnico di Milano, Mantua Campus regarding the revision phase of the PGT (Territorial Government Plan) of the City of Mantova. Research contribution consider two key phases: The first one defines the 'Framework of Knowledge', both analytical and interpretative and in terms of qualitative services, green spaces, mobility, and demographics to identifying vulnerabilities and weaknesses in the territory. The second one re-organizes the territory from 'neighborhoods' as defined administratively by municipalities to 'proximity systems.

These systems can work autonomously or in connection with others to support urban growth and development. This transition from neighborhoods to proximity systems offers an opportunity to rethink the role of these areas within a polycentric city vision. Both the 'Framework of Knowledge' and the definition of 'Proximity Systems' represent the first tangible results of the above-mentioned research that could contribute to the creation of an integrated planning tool.

Chapter 5 – *Landscape Planning and Nature-based Solutions: Novel Strategies for Urban Hydraulic Risk Mitigation* by Francesca Miccioli and Antonio Leone discusses on ongoing climate changes that have increasing vulnerability of cities and territories, with a consequent rise in exposure to hydrogeological risk. In urban contexts, soil sealing and inadequate land use have significantly altered the hydrological cycle, increasing surface runoff and generating critical issues, including the inefficiency of traditional urban drainage networks. In this scenario, Nature-based Solutions (NbS) represent a positive strategy for hydrogeological risk management, to confer self-organization and learning properties to urban systems by increasing their resilience and improving the response to future extreme events.

This chapter aims to contribute on investigating the process analysis through a specific case study. The adopted methodological approach is based on the principle 'defend the soil through land use,' with the aim of enhancing existing green networks, integrating their intrinsic naturalistic value with an additional function of hydraulic risk mitigation. The reduction of hydraulic hazard through landscape design is configured as a fundamental step towards integrated risk mitigation, capable of optimizing the effectiveness of traditional hydraulic works by acting on prevention. This results in a new paradigm of sustainable urban design, whose tools are based on the functionalization of landscape structures, such as, specifically, dry stone walls and the green arrangement of strategic areas.

Chapter 6 – *Flood Risk Perception and Urban River Management: A Socio-historical Perspective on Risk Culture Evolution and Vulnerability* by Giorgia-Christina Dreliosi, Eleni Mantziou, Florence Rudolf, Lazaros Mavromatidis discusses on flood risk perception that has evolved throughout history. A contemporary understanding of floods as socio-technical phenomena are shaped by human activities, urbanization, and climate change. This chapter explores the historical trajectory of flood risk culture, highlighting how societies have managed urban rivers from early settlements to the present day. It also examines the intersection between social vulnerability and flood risk, analysing how economic disparities, gender roles, aging populations, and marginalized communities disproportionately suffer from flood-related disasters.

In response to these challenges, contemporary urban planning and risk management strategies can emphasize resilience, adaptation, and the integration of social and technical approaches. Further, Geographic Information Systems (GIS) have emerged as a critical tool in bridging these dimensions, facilitating comprehensive flood risk mapping that considers both environmental and societal factors. This chapter proposes the use of GIS as a powerful tool capable of handling both spatial and non-spatial data, as well as integrating qualitative and quantitative information for a more comprehensive, interdisciplinary flood risk assessment. The study concludes by advocating for a holistic, interdisciplinary approach to flood management that combines historical insights, social vulnerability assessment, and modern technological solutions to foster more sustainable and inclusive urban environments. By incorporating local knowledge, values, and experiences into planning through a bottom-up approach, interventions are more likely to align with the needs and aspirations of affected communities, ultimately strengthening their resilience.



Conceptions of Urban Greening and the Management of Heritage Assets. The 'Green School Plan' for the Florence UNESCO Area

Dimitra Babalis

Urban Greening, (UG) through Nature-based Systems (NbS) in sensitive historic environments should be considered as a network of multi-functional green spaces which can deliver environmental benefits and improve health and well-being for community. The promotion of greening actions can work as a key bridging concept between cultural heritage and nature. They have been also used extensively to address issues of urban risks such as flooding, climate change, biodiversity loss. One of the key benefits of an UG approach is the ability to be adaptive to the spatial design of a site. This flexibility and adaptability of urban greening is crucial to shape historic environments and landscapes in a more responsive way. In this reflective and adaptive way UG can be best linked to urban design. Further, it is essential in integrating urban and ecological design into planning policy. For a more sustainable, accessible, liveable places, greening can provide opportunities to meet these needs.

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tions are now being taken seriously by local authorities and in terms of local policies and strategies.

To bridge this ongoing gap, the University of Florence has developed innovative teaching programmes that provide opportunities for students to integrate UG thinking within urban design practice in historic city centres. At the Department of Civil and Environmental Engineering and specifically within the Master Courses of 'Technique of Urbanism' and 'Urban Design' is providing not only the conceptual basis but also to embrace the principles of urban planning and design to manage the well-defined by UNESCO Historic Urban Landscapes (HULs).

Managing sustainably heritage assets

At the current, in historic cities a great issue is on integrating Green Infrastructure (GI) through planning policies and strategies for adaptation and mitigation. Urban Greening (UG) can help address concerns on climate change and protection of Urban Heritage of other urban risks. On the other hand, the UNESCO perspective also recognizes that the Nature-based Systems (NbS) concept can offer opportunities for more sustainable solutions to Urban Heritage preservation and regeneration.

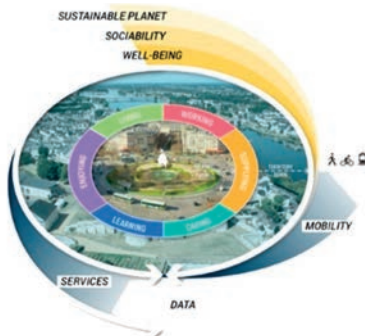
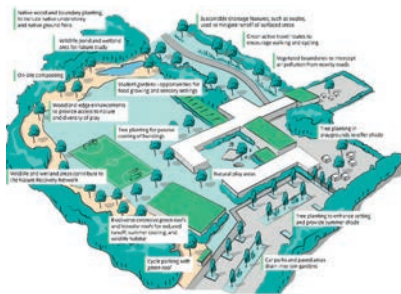
However, there is a gap between cultural values and urban challenges to overcome and deliver GI benefits.

¹ UNESCO's Approach to managing historic urban landscapes is holistic by integrating the goals of urban heritage conservation and those of social and economic development". Historic Urban Landscape Approach at the local context has been adopted by the "Recommendation on the Historic Urban Landscape" in 2011 by UNESCO.

Nature-based Solutions (NbS) as a scheme to indicate actions to be adapted for natural or modified ecosystems, which address societal challenges providing human well-being and biodiversity benefits. (source: ©IUCN, 2016)

Design scheme for schools and colleges that includes green infrastructures, ecological networks and landscaped areas to mitigate climate change effects. (source: ©NE, 2020)

The Carlo Moreno's 15-min City Model is mainly based on the concept of the new 'chronourbanism', The parameter of 'proximity' advocates an urban pattern in which local people can have an easy access to facilities and services within no more than 15 minutes on foot or by bicycle. The study of the new school conception as a 'hub' is included within the Moreno's concept for the city of Paris. (source: MORENO ET AL, 2021)



Given that historic cities contain a mix of green, blue, and grey assets, it is important to recognise that such a focus on heritage conservation can be differently expressed in design practices. Additionally, specific legislative and planning restrictions need to be respected in the case of listed/protected buildings and sites. (COOMBES, VILES, 2021)

In heritage studies where valued buildings and sites need to be preserved and reused sensitively, 'nature' is seen as a threat. Therefore, to embed NbS in the historic environment need expected efforts. However, there are some opportunities to integrate green elements into urban heritage in the face of climate change, biodiversity loss, and sustainable environmental management. At the same time, difficulties of UG initiatives around built heritage and in terms of positive and negative impacts of nature must be acknowledged.

In recent times, upgrading urban spaces through greening and NbS activities seems possible through sensitive applications to preserve heritage assets, aesthetics and authenticity of sites. On the other side, where buildings are valued for architectural reasons, potential nature-based benefits need to be argued by heritage managers and heritage consumers.

In this framework, nature in sensitive environment can offer opportunities in terms of reduction of pollutants, reduction of flood risks and water damage in heritage assets through SuDS. On the other hand, the addition of green elements to the heritage environment might offer social and economic opportunities by making cities more attractive despite the potential conflicts. (COOMBES, VILES, 2021)

Climate change and Nature-based Solutions in sensitive urban environment

Nature-based Solutions (NbS) within different area types can create multifunctional networks at the different scales. Historic environment and green spaces represent a great value whilst still retaining their historic interest. Protection, preservation and regeneration of Urban Heritage is a positive approach to manage change. Climate adaptation and nature-based solutions can often be sensitively integrated into historic spaces and improve the environment for local people and visitors.

There is capability for new green infrastructure that should be designed and

maintained to both enhance the historic environment and add new values for a sustainable development. Understanding the history of the place, its green features and other landscape settings, is a key to apply the green infrastructure principles. Culture and history of a place should be an inspiration to identify opportunities for urban greening and its design while the defined Historic Urban Environment (HUL)¹ can provide advice and guidance for urban characterisation and placemaking. However, historic parks and gardens, squares, promenades and paths, historic buildings and sites often provide valuable combined historic, cultural and natural resources in towns and cities. In addition, waterways whether rivers, lakes or canals have a designed landscaping that needs to be integrated in waterfront management design. Management plans for UNESCO cities and towns are encouraged to improve plan maintenance, conservation, repair, urban regeneration, environmental sustainability and more recently climate change adaptation. In turn, green infrastructure priorities should be integrated in site plans within green space strategies. A historic character-led approach should be used to identify sites and opportunities to maximise quality and benefits. Buildings of historic interest can be retrofitted with green infrastructure features such as green walls and roofs. On the other hand, tree planting needs a more detailed guidance in sensitive historic sites including specific attention for works such as street furniture, traffic management or other environmental improvements.

Urban Greening for educational buildings and sites

Schools and colleges are complexes including several buildings and school grounds and this provides great opportunities for green infrastructure approach. This approach can enhance air quality, reduce excess heat, and water management. Tree planting and appropriate SuDS planters should be used to improve accesses, paths and provide summer shade. The planning of facilities and of a network pedestrian and cycle paths help to improve connectivity and reduce urban traffic. It also can benefit students and staff and improve mental health and well-being. Urban Greening principles for educational sites could include green roofs and green walls for cooling and can reduce the risks

of flash flooding developing rainwater harvesting systems, Sustainable Urban Drainage Systems (SuDS) such as planters, rain gardens, trees pits, with large pits, swales, water squares that store water. (CIRIA, 2015)

Consideration should be given to the role of green infrastructure in improving the health and wellbeing of pupils and students, increasing resilience to climate change. The provision of natural green space, natural playgrounds, active routes to schools and colleges within sustainable walking distance can help to reduce the need for travel by car. Adopting strategies within the city's planning system towards an active travel network can help to reduce traffic times and city pollution, especially in sensitive historic environment. At the same time, to extend types of greening in historic educational buildings should be taken into consideration buildings structure, topography and heritage features to ensure long-term success.

The following Green Infrastructure principles are taken into consideration:

- *Proximity* (creating qualified learning and play environments with accessible green spaces and used by the wider community/ Provide attractive green routes for Active Travel² to and from education buildings and sites) (PUBLIC HEALTH ENGLAND, 2016)
- *Green spaces for all* (opportunities for green spaces for all to enhance connection with nature and the urban environment)

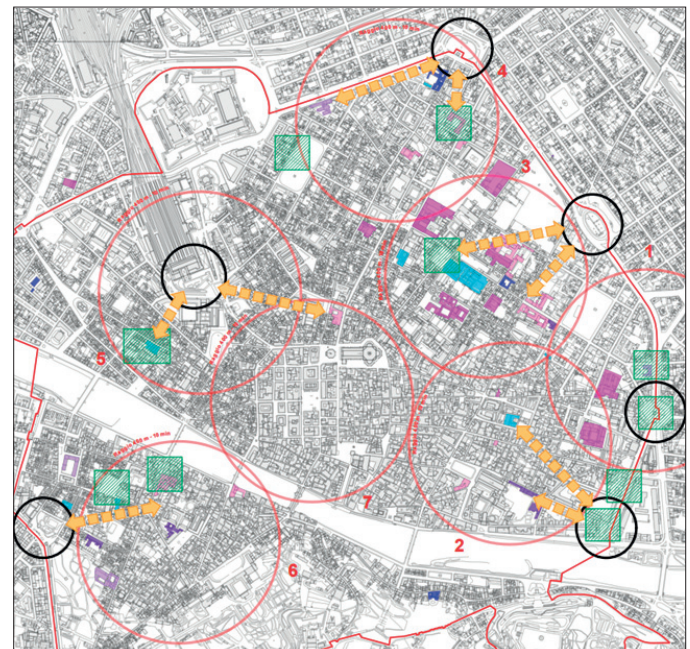
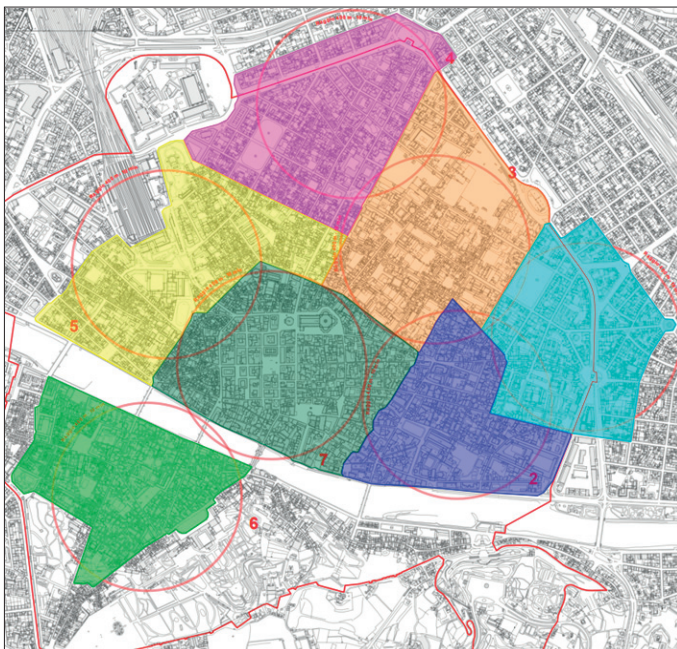
- *Urban Greening* (Create a variety of green infrastructure including rain gardens, green roofs, green walls, permeable pavements to improve water impermeability, water basins, use urban tree canopy to create shade in playgrounds, etc.). (NATURAL ENGLAND, 2023)

The Florence UNESCO Area and the proposed 'Urban Greening Strategy'

The United Nations (UN) Sustainable Development Goal 11 (UN, 2015) has the overall aim of making cities, towns and villages safe, resilient, and sustainable. To achieve this, one of the 10 targets set is to increase challenges to protect and preserve cultural and natural heritage. At the same time, there is a clear recognition that cultural and natural heritage are vital to urban resilient of sustainable communities by connecting historic values, people and nature. Employing Nature-based Systems (NbS)³ to address Urban Heritage conservation and at the same time essential to unlock historic environment potentialities. The main aims of the proposed 'Urban Greening Strategy'⁴ for Florence City Centre are as follows:

- Sustainable Urban Mobility, (SUM) with cycling and pedestrian routes
- Greening Accesses of the Florence UNESCO Area

The proposed 'School Green Plan' for the Florence UNESCO Area considers the principles of the 15-min walking distance around each school district. The Plan identifies the critical points for every school building and site and classifies seven school Areas for specific Actions such as: (a) Sustainable Green Connections and Streets; (b) Sustainable Green Public Open Spaces; (c) Sustainable and Resilient School Sub-districts.



- Enhancement of Public Transport with less gas emissions
- Sustainable regeneration of the identified 'Heritage Open Space in Transformation', (HOST)⁵ (BABALIS, 2018)
- Revitalisation of the 'Waterfront Open Space', (WUS)⁶ for health and well-being (BABALIS, 2017)
- Environmental education for students and young people and Environmental Actions for Educational Buildings and Areas.

The *General Conceptualisation* of the Urban Green Strategy is as follows:

- *Ecology*
 - Greening the UNESCO Area for increasing biodiversity and ecosystems
 - Reduction of emissions and air pollution
 - Sustainability and urban resilience against urban risks, use of technology and Nature-based Systems within City Action Plans
- *Culture*
 - Respecting history and preserving Historic Urban Landscapes (HULs)
 - People involvement in decision-making
 - Management of over-tourism through Urban Greening and culture
- *Site*
 - Regeneration of the city centre through transformation of Public Open spaces
 - Improving accessibility and mobility for both locals and visitors
 - Integration of urban and natural green-blue spaces

The *Specific Actions* of the Strategy are as follows:

- Green Gateways and Green Networks
- Active Travel (cycle, pedestrian mobility and public transport)
- Riverfront Regeneration
- Green School Plan.

The 'Green School Strategy' and the 15-min City Model for the Florence UNESCO Area

The role of the school is exclusively associated as a place of education for learning and knowledge. But recently schools must be considered also as meeting places for the community where cultural, knowledge, sports and other activities are carried out. The new conception of a school function puts the school as a central point for the community and the rest of the city. The study of the new school conception is included within the concept of the '15-min City' proposed by CARLOS MORENO for

the city of Paris. To consider sustainable a neighbourhood, the concept of proximity that considers the 15-min walking distance, is essential to reach all needed services, to reduce environmental impacts, minimizing emissions of public transport.⁷ Specifically, the idea of 15-min City is mainly based on the concept of the new 'chrono-urbanism', that the quality of urban life is proportionally to the time consumed in transport, even more to car-use. The concept advocates an urban pattern in which local people can have an easy access to facilities and services within no more than 15 minutes on foot or by bicycle. Moreno's concept is to respond to the people needs for a better quality of life to effectively fulfil the following six essential urban social functions at the local level such as: *living; working; supplying; health caring; learning and enjoying*. (MORENO, 2021) MORENO has also identified the following four parameters to be taken into consideration for urban life quality: *ecology; proximity; solidarity; participation, density; diversity; and digitization*. In detail, 'proximity' to the neighbourhood services can reduce urban traffic and emissions while adopting sharing technologies (bike-sharing, carpooling and so on) can facilitate lifestyles and reducing private car-use. (MORENO ET AL, 2021)

The proposed 'Green School Plan'⁸ for Florence UNESCO Area developed at the University of Florence, considers the principles of the 15-min walking distance around each educational site. The Plan identifies all the critical points that every school building and site presents after a proper urban analysis. Nevertheless, the urban analysis for the City Centre of Florence confirms that all schools correspond to the 15-min walking distance for the main services. It was, therefore, decided to propose a strategy aimed at resolving facilities and the most in evidence critical points concerning the lack of Sustainable Urban Mobility (SUM) around the educational sites and urban resilience. The following represents a list of targeted priorities have been identified for educational buildings and sites:

- *Sustainable Green Connections and Streets* Enhancement of sidewalks, squares, and other connections to encourage active travel: walking and bicycling and use of public transport; Enhancement of crosswalks and pedestrian landing areas along major streets in the City Centre; Maintain lower traffic speeds In the core area establishing

² Active Travel (cycle, pedestrian mobility and public transport)

³ IUCN defines NbS as: "Actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits."

⁴ The proposed "Urban Greening Strategy" for the Florence UNESCO Area is developing within the ATE Research, Urban Greening to mitigate climate change in the Transforming City (Years: 2023-2024), University of Florence, Coordinator: DIMITRA BABALIS

⁵ Heritage Open Space in Transformation (HOST) has to be defined as "a space of great challenge that is strictly connected with innovative urban change". The HOST notion has been introduced and formulated by DIMITRA BABALIS in the framework of the 4 INTEGRO UAD Annual Meeting held in Florence in March 2018. Follow-up the Publication Heritage Open Space in Transformation. Changing Attitudes, 2018)

⁶ Waterfront Urban Space (WUS) is defined "as a dynamic space to be transformed with evidence to improve health and well-being". A further definition of a WUS "should consider the concept of inclusiveness of an urban space and its transformation towards a place to receive sociability and enjoyment, to integrate local cultural and economic values, to promote health and well-being in accordance with urban resilience. The Waterfront Urban Space, (WUS) notion has been formulated and developed by DIMITRA BABALIS in the framework of the research: Waterfronts and Eco-sustainable Urban Management funded by the University of Florence, Academic Year 2017-2018.

⁷ The '15- min City' is not a new type of city but is a collection of familiar concepts in urban planning such as high-density, mixed-use development, walkable neighbourhoods that at the current they have increasingly shown their value. They seem, in fact, to respond perfectly to everyday life to face the pandemic risks but also to the new environmental challenges in the next years to come. Correspondingly, cities are now looking to develop infrastructure strategy that would support active travel modes more suited at the neighbourhood level. (TCAT, 2021)

⁸ The research methodology mentioned in endnote 4, developed by the Author, has been properly adopted with the proposed "Green School Plan" developed within the Design Studio in the framework of the Degree Course of "Technical Urbanism" (Academic Year: 2023-2024), coordinated by Dimitra Babalis at the University of Florence.

alignment for sidewalks and promenades that would connect the different districts and school sub-districts.

• *Sustainable Green Public Open Spaces*

Regeneration and upgrade of public spaces, including design for streetscapes, and potential civic squares and other small spaces; Integrating landscaping, boulevard trees, site furnishings, to enhance the pedestrian experience.

• *Sustainable and Resilient School Sub-districts*

Consider the creation of a formal priorities policy for further articulation of the sub-districts as identified within the Green School Plan; Consider the desired mix of uses; Consider Design Guidelines on a sub-district basis that articulate the desired resilience to help guide the quality and character of school buildings and sites; Enhancement of shared parking requirements combining school, retail, office and residential.

The Proposed Strategy into the identified 'School Sub-districts'

The Strategy is extended to the entire UNESCO area by defining six school sub-districts of intervention which are: 1. *Viale Gramsci*; 2. *Santa Croce*; 3. *Via della Colonna*; 4. *Via San Gallo*; 5. *Via San Gallo*; 6. *Oltrarno-Santo Spirito*.

These six school sub-districts must all be connected to each other and to the main exiting historic green areas within the City such as the Boboli Gardens and the Cascine Park.

In turn, the proposed Strategy is part of what is intended to be an Urban Framework to make school areas more sustainable and resilient, embracing all principles of the 15-minute City concept as follows:

• *Sustainable Urban Mobility* (Pedestrian and Cycle Paths Network)

To this end, is proposed a pedestrian and cycle paths network to complete the existing connectivity and ensure a better one among the close by schools and existing services. It also gives a special direct connectivity with the existing tram lines.

In summary the initiatives are as follows:

- Traffic Limited System and Gateways
- Roads/Streets/Little Streets
- Tramways
- Cycles and pedestrian streets.

• *Flood Protection and Urban Resilience (EDUCA Parks)*

Urban Analysis shows that Primary Schools (nursery and elementary schools) as the

most are in the inner UNESCO Area and along the River Arno concern urban resilience while Secondary and High Schools located in sites present less risks in the outer Florence UNESCO Area. In summary the initiatives are as follows:

- Nature-based Systems
- SuDS/Green Squares/Watersquares
- Green Corridors
- Schools and Principal Street Nodes, and Crosswalks
- Green streets
- Green Roads/Green Streets/Little Green Streets/Green Parking Plots and Areas.

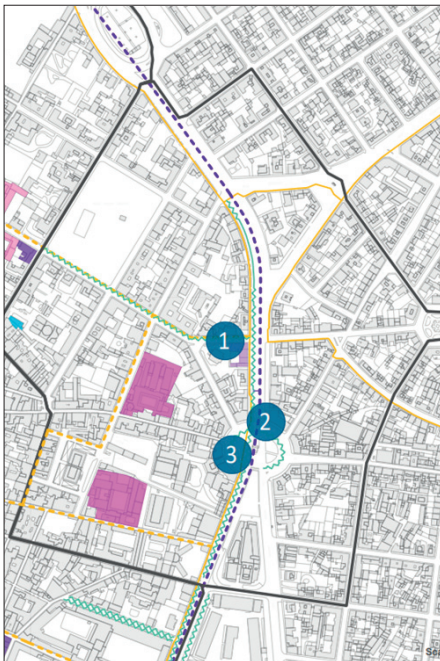
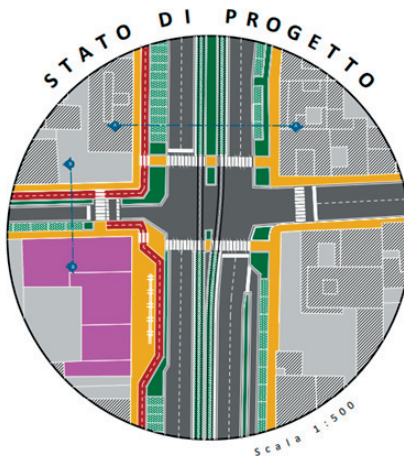
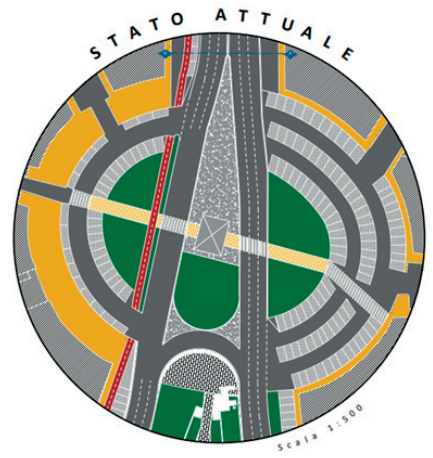
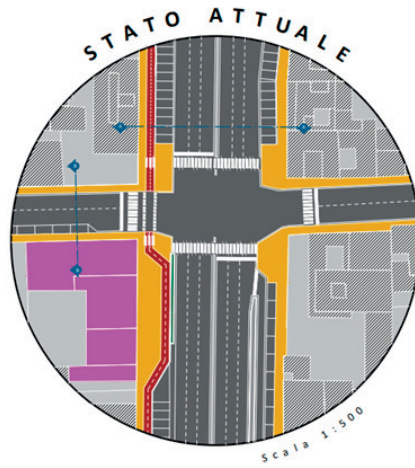
The selected 15-min sub-districts

The major critical points of the school sites have been taken under consideration such as hydraulic hazards, urban green and mobility issues. It was, therefore, essential to refer to the 15-minute model to establish parameters of proximity to guarantee the existence of the central services within a shorter distance from the city centre. To apply the model, fourteen school sites were chosen, arranged by successive spatial triangulations to cover the entire area of the historic centre that can be reached within the time defined by the adopted model.

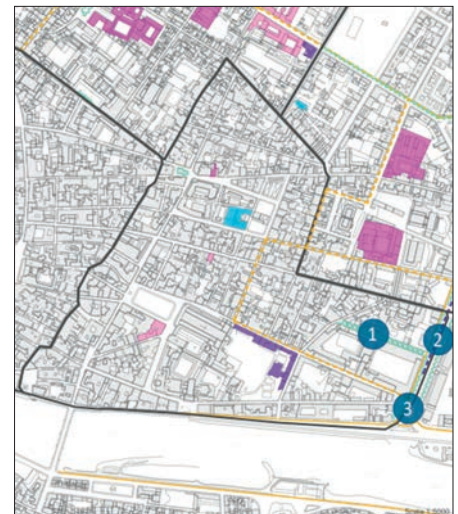
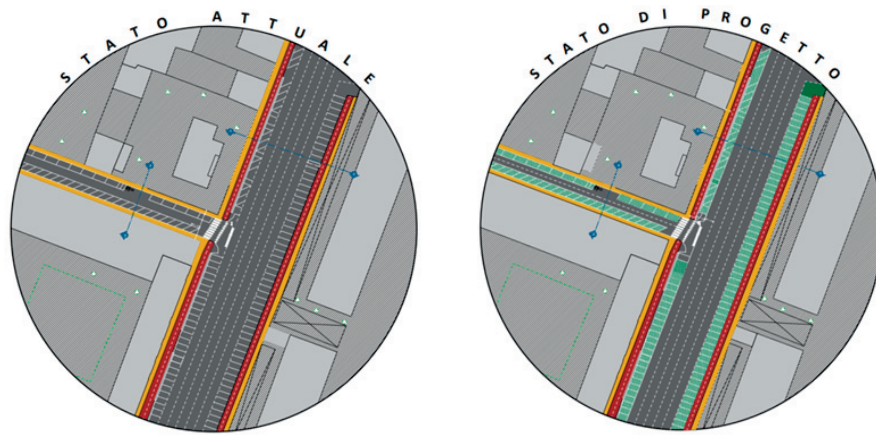
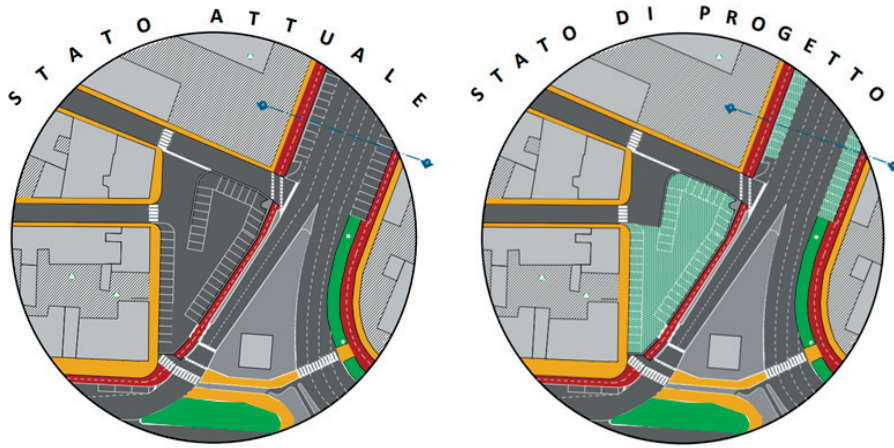
In each of the selected school sites, an urban analysis of the land use types was carried out and the percentages of land use with the different functions were calculated and represented in special diagrams. By comparing the calculated data, the most critical school buildings and sites in terms of: (a) hydraulic hazards; (b) presence of green areas; (c) sustainable urban mobility were defined.

This analysis brings toward the choice of the most important core areas to be considered and the definition of the school sub-districts within the proposed strategy. According to the hydraulic analysis, the schools that are most at risk in terms of flooding, are those close to the River Arno (Pestalozzi and Machiavelli Schools), while others are considered for particularly intense rainfall events (Flash Floods). (Salvemini School was the one most at risk). As far as the existing cycle path network is concerned, to facilitate better connectivity among all the chosen school sub-districts an integrated direct cycle route is proposed. (Galilei School and the University in San Marco).

Florence UNESCO Area / School Sub-district
 1 - Via Giacomo Leopardi: A Green Street is proposed with cycle path, and Sustainable Urban Drainage Systems, SuDS (rain gardens and permeable pavements) - Piazza Beccaria - A Green Square is proposed with a new green tram track, green streetscape a permeable parking areas.



Florence UNESCO Area / School Sub-district 2 - Santa Croce. Viale Giovine Italia: A Green Road is proposed with cycle paths and green parking area with Sustainable Urban Drainage Systems, SuDS (green features and permeable pavements) - Via Pietro Thouar: A Little Green Street is proposed with integrated cycle path and green tree-pits for better accessibility to the school site.



Florence UNESCO Area/Oltrarno-Santo Spirito-School Sub-district 6. A proposal to protect and mitigate School buildings and sites from flooding risks. Plant and rendering before and after of the Machiavelli High School with rain gardens and water square and permeable pavements in the adjacent car parking area.

In turn, the following proper actions are proposed:

- *Street Greening*

To mitigate micro-climate and guarantee protection for wild heat and minor Heat Urban islands effects.

- *Resilient and Sustainable School sub-districts*
The inclusion of Green infrastructures as Sustainable Urban Systems, (SuDS) to reduce hydraulic risks, especially the risks of flooding along the riversides. SuDS must also be understood as a process to regenerate urban open spaces to meeting community needs and a better experience the city's daily life.

The selected six sub-districts within the Florence UNESCO Area are defined as follows:

- *Sub-district 1 - Viale Gramsci*

- Streets and Squares: Viale Gramsci/Via Giacomo Leopardi/Piazza Beccaria
- Critical points: Hydraulic Risks/Viability/Mobility (cycle and pedestrian paths)
- Intervention type: Viale Gramsci vs Green Road/Via Giacomo Leopardi vs Green Street/Piazza Beccaria vs Green Square.

- *Sub-district 2 - Santa Croce*

- Streets and squares: Viale Giovine Italia/Via Pietro Thouar/Piazza Annigoni/Piazza Santa Croce/Lungarno Delle Vecchia Zecca/Pestalozzi School
- Critical points: Hydraulic Risk/Narrow streets in the city's core areas/Lack of green/Schools
- Intervention Type: Viale Giovine Italia vs

Green Road/Via Pietro Thouar vs Green Street/Parking Area in Piave Square vs green parking area/Piazza Annigoni-School of Architecture vs Green Square/Pestalozzi School vs SuDS /Watersquare.

- *Sub-district 3 - Via della Colonna*

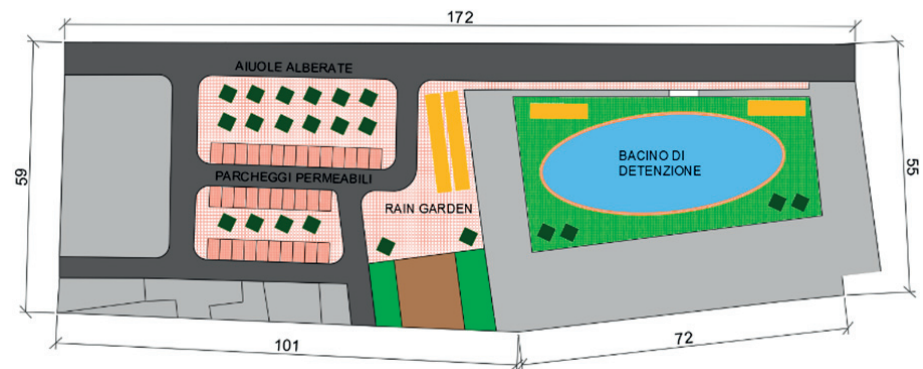
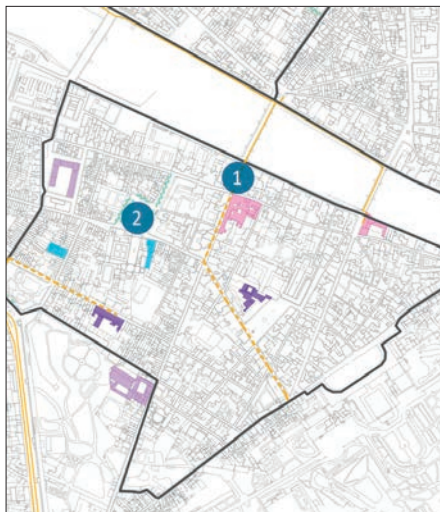
- Streets and squares: Piazza della Santissima Annunziata/Via dei Servi/Via Giusti
- Critical points: Sustainable Mobility/Heat Urban Islands
- Intervention type: Piazza Santissima Annunziata vs Green Square/Via dei Servi vs Green Street with new cycle path/Via Giusti vs Green Street with tree pits.

- *Sub-district 4 - Via San Gallo*

- Streets and squares: Piazza Indipendenza/Via Ridolfi/Via Camillo Cavour/Via Venezia/Via Alfonso la Marmora/Pieraccini Institute/Salvemini School
- Critical points: Viability/Sustainable Mobility/School Buildings
- Intervention type: Piazza Indipendenza vs commercial and amenity areas/Rain Garden/Green Bus Shelter/Via Ridolfi vs cycle path/Via Cavour and Via Alfonso la Marmora vs Green Tramway/Via Venezia vs Little Green Street/Pieraccini Institute vs green walls and roofs/Salvemini High School vs green courtyards and roofs .

- *Sub-district 5 - Piazza Santa Maria Novella*

- Streets and squares: Via Palazzuolo/Via Maso Finiguerra



- Critical points: Viability/Hydraulic Risk
- Intervention type: Via Palazzuolo vs Little Green Street with new permeable pavement/Via Maso Finiguerra vs Green Street.

- *Sub-district 6 – Oltrarno -Santo Spirito*
- Streets and squares: Piazza del Carmine/ Piazza Torquato Tasso/Piazza San Felice/ Piazza Nazario/ Primary School Torrigiani/ Macchiavelli High School
- Critical points: Hydraulic Risk/Schools and street connectivity
- Intervention Type: Piazza del Carmine vs Green Square with tree pits, rain garden and permeable parking area/Ponte alla Carraia to Piazza San Felice vs increasing green cycle way/Piazza Torquato Tasso/ Primary School Torrigiani vs Increasing green cycle path/Macchiavelli High School vs SuDS (watersquare /permeable pavement).

To increase sustainable mobility within 15-min City Model all school sub-districts would improve their connectivity with both schools' sites and the rest of the city. The construction of a new integrated cycle path would satisfy a direct connection with tram lines and the main railway station.

All proposals are aimed at creating a school site as a meeting space for pupils and students. All school sites would be transformed into a green pedestrian area that can improve sociality with more liveable spaces. Those school sites, close to the River Arno, would mitigate the high hydraulic risk. Open spaces with permeable pavements and rain gardens would also help mitigate existing risks.

In all school sub-districts that have a lack of green spaces and lack of equipped playgrounds limits, new opportunities for recreation and social interaction for students are presented. Green protection for the existing cycle paths with appropriate interventions have been proposed for Florence Bilingual School (nursery school), Pieraccini Comprehensive Institute (middle school) and Salvemini State Commercial Technical Institute (secondary school), for a more welcoming educational environment for students.

Those schools with high flood risks such as Pestalozzi Institute within the Sub-district 3 – Santa Croce is proposed to further modify the use of the land in favour of a greater presence of green and permeable areas. Starting from a percentage of impermeable asphalt squares of 24%, thanks to the inclusion of reinforced lawns in correspondence with the new play areas,

half of them are reallocated to permeable squares, thus reaching a total of 73% of permeable green areas.

Regarding the Salvemini Institute within the Sub-district 4 a critical issue was detected regarding particularly intense rainfall events (Flash Floods). This problem is attributable to the massive presence of impermeable areas (asphalted roofs and squares) which together cover 82% of the total area. For this reason, a series of interventions are proposed for the conversion of these impermeable areas into surfaces capable of absorbing and infusing and allow water to infiltrate deeply.

Discussion

Urban Greening should be considered as an added value to heritage assets. The regeneration and upgrading of urban spaces for adaptation and mitigation of urban hazards is obviously crucial to face recent climate change effects. Nature-based Solutions (NdS) could be adapted, developed, and applied to address specific heritage conservation challenges.

For instance, artificial basins can retain the water conveyed into them, reducing the flow rate of run-off water and improving its quality thanks to the purification processes implemented by vegetation. In dry conditions, the basin can be used as a recreational area, improving the quality of an open space accessible to users, while in critical periods these areas are closed to the public and used as storage volumes. The bioretention basins, they are designed to temporarily collect and retain, for up to 48 hours, the run-off water coming from the surrounding surfaces, making it infiltrate the substrate and, if open-bottomed, underground. Rain gardens as green areas can be designed to temporarily collect and retain rainwater intercepted by the surrounding impermeable surfaces, reducing the volume and flow rate of run-off.

On the other hand, the wider benefits of UG as implemented for built heritage conservation should be recognised and promoted. Green roofs and vegetated surfaces to retain rainwater, reducing the volume and extent the run-off water generated by the roofs of buildings, delaying their entry into the drainage system and city's sewerage system. They can also increase thermal and acoustic insulation of buildings, reduce the heat island effect, improve air quality.

The proposed Green School Plan for the

Florence UNESCO Area promotes sustainable mobility with new connecting cycle paths creating a network of cycle paths among schools, facilitating active travel in an environmentally friendly and healthy way, offering a safe and accessible route. In addition the existing bike routes have been modified and improved mobility and public transport.

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Public-Private Partnerships for Urban Green Infrastructures. A Preliminary Investigation in Milan

Maria Stella Lux

The implementation of Urban Green Infrastructure (UGI) and urban forestry programs is among the key strategies cities are adopting to enhance their preparedness for climate change. The underlying concept is to reintroduce natural components and processes into highly anthropized urban environments, providing multiple benefits, from stormwater management to the creation of more liveable urban spaces. One of the main barriers to effectively implementing these strategies is space management and the raising of funds for implementation and maintenance. In dense urban contexts, reallocating space from roads, parking lots, and other functions to green areas can be politically challenging and conflict-prone. Therefore, UGI strategies should not be conceived solely as top-down initiatives but should be developed through participatory processes involving citizens. Public-private partnerships (PPPs) are an effective approach to support the micro- and meso-scale implementation of broader urban strategies. Active citizen involvement is also crucial for strengthening urban resilience, including social resilience, which depends on cohesion, participation, and a sense of belonging. This article presents a preliminary study on PPPs in UGI strategies in Milan, aiming to establish a baseline assessment and identify potential areas for improvement.

Introduction

The exacerbation of climate change risks in cities is largely due to the inadequacy of ur-

ban environments to adapt to the increasing climatic and environmental pressures. Improving the preparedness of cities is the crucial point of urban resilience strategies and policies, which aim to transform the physical and social urban structure to make cities more flexible and adaptable. In this context, Green Infrastructure strategies and Urban Forestry programs play a key role in reintegrating natural components into highly anthropized environments (GILL ET AL., 2007), providing multiple benefits: from mitigating the urban heat island to improving stormwater drainage, from supporting biodiversity to enhancing the aesthetic quality of places (BABÍ ALME-NAR, 2021; PAULEIT, 2011; EUROPEAN COMMISSION, 2012)

The value of these interventions is not limited to the physical transformation of the urban environment and the improvement of its performance but also contributes (or can contribute) to strengthening social resilience (FU ET AL., 2021; WORLD BANK, 2021). This is particularly true when the implementation of these policies involves participatory processes of co-design that enhance the sense of belonging to places, social cohesion, and citizens' awareness of environmental and climate issues (BUIJS ET AL., 2016; BUIJS ET AL. 2019). Over the past decades, urban resilience strategies of many European cities have increasingly involved citizens through consultation and information processes (BALLY & COLETTI, 2023) However, it remains an essentially top-down process, centrally managed by

Public and Private actors in Milan'Urban Green Infrastructure (Image by M.S. Lux).

Table 1: Administrative measures for environmental protection in the Metropolitan City and Municipality of Milan (Source: M.S. Lux).

local administrations. The practical limitations of this approach concern multiple aspects and in particular the management of urban space, the financing of interventions, and long-term maintenance.

Urban space management has always been a contentious issue, especially in dense contexts where many interests compete for limited land (BURTON, 2000; HANSEN ET AL., 2019; RUSSO & CIRELLA, 2018). The conversion of grey areas into green areas is not always welcomed by all stakeholders and requires simultaneous modifications to multiple infrastructural systems (road networks, access to services, public space concessions). The implementation of UGIs is generally easier in low-density peripheral areas with lower land consumption, whereas it faces significant obstacles in central areas, which are extensively built-up and already occupied by other urban functions.

Regarding the financing of greening and reforestation interventions, the fact that the economic burden falls entirely on public administrations limits intervention possibilities to the available financial resources at any given time (TOXOPEUS & POLZIN, 2021; MELL & WHITTEN, 2021). Even more critical is the issue of long-term maintenance. Indeed, in a scenario of increased public greenery, cities would find themselves responsible for maintaining an ever-growing number of square meters of green space and trees over the years, requiring a progressively increasing availability of resources. This further limits the actual implementation of green policies within the practical constraints of each city's realistic action capacity or, worse, affects the long-term success and sustainability of interventions carried out without adequate maintenance plans.

Considering these limitations, actively involving private actors in Green Infrastructure and urban forestry programs could be a promising approach to addressing several challenges. Indeed, sponsorships and public-private partnerships (PPPs) represent valuable tools to complement, support, and integrate the activities of public administrations in the care, management, and maintenance of urban green spaces. Through these mechanisms, private actors are directly involved in implementing actions to expand the urban Green Infrastructure. Nevertheless, PPPs are not without risks and the incorporation of sustainability considerations in the economic-oriented regulation framework of PPPs must be considered (KOPPENJAN, 2015). This

study analyses existing sponsorship and partnership models for urban greenery in the case study of Milan. The aim of the research is to provide a preliminary exploratory study of the specific situation of the city of Milan to highlight potential future development paths and point out critical issues to be taken into consideration.

Public and private roles in urban greenery

Public and private domains are two fundamental categories for studying urban green spaces, their characteristics, and their management approaches. First and foremost, it is important to note that urban green spaces, regardless of whether they are public or private, are recognized as common goods in most European legal frameworks and are consequently protected. Nevertheless, public and private green spaces exhibit distinct characteristics. A quantitative study conducted by COOLEN AND MEESTERS (2012) highlighted that private green spaces are valued for their "combination of affordances and meanings such as being outside, privacy, freedom, and gardening", whereas "public green space is special for its positive contribution to the liveability of the dwelling environment and to the experience of nature." Additionally, the study emphasized that "Although some of the affordances and meanings are shared by the private garden and public green space, for instance being outside, it is the combination of affordances and meanings that makes them more or less unique to one of the two settings".

As part of urban resilience strategies, the need to expand urban greenery primarily concerns public spaces. That is, UGI strategies are predominantly aimed at expanding public green spaces and are generally managed by public entities. However, given the challenges outlined in the Introduction, the role of private actors is evolving and finding new opportunities to integrate into urban green programs.

Private contributions to urban greenery can be categorized into two main areas:

- the role of *private green spaces* within the urban green system (measured in terms of surface area or number of trees, i.e., quantifying private greenery);
- the role of *private actors* in supporting public entities for the development and management of public green spaces, ranging from simple financial contributors to full responsibility for the management and maintenance of public green spaces (con-

sidering economic and managerial aspects, but limited to public green areas).

With regard to the first category, only a few European cities have explicitly recognized and integrated private green spaces into their UGI strategies. A notable example is Rotterdam, which has implemented policies that acknowledge the ecological and social value of private greenery. The inclusion of private spaces in all the strategic and planning policies of Rotterdam is a matter of fact, due to the scarcity of public transformable space and the objective of densification of the inner city (TILLIE ET AL., 2018). Only 40 % of Rotterdam area is public land, so cooperation with private entities and residents is essential. Making reference to the strategic documents, many of the foreseen greening interventions apply to private areas, such as green roofs and walls (GEMEENTE ROTTERDAM, 2020 & 2022). Private initiatives are encouraged and supported through public financing. For instance, in 2023 Rotterdam adopted the Climate Adaptation Grant, which is a subsidy to finance resilience projects made by private owners, tenants, associations, housing corporations and NGOs. The eligible interventions include greenery in private lands, water retention and rainwater harvesting systems, and de-paving actions. The public directive over the private interventions includes the guidelines and constrains for the use native plants, thresholds of green area to be ensured (min 20 m²) and the commitment to provide maintenance for a minimum of 5 years.

The second category encompasses PPPs, i.e. collaborative models between the public and private sectors aimed at achieving

public interest objectives. PPPs offer several advantages over traditional methods, including shorter implementation times, increased efficiency and enhanced maintenance quality. Beyond securing private financial resources, institutionalizing PPPs enables public administrations to retain a certain degree of control over green space projects. Thus, the successful implementation of PPPs requires substantial administrative capacity, expertise, and an adequate regulatory and institutional framework (EUROPEAN COURT OF AUDITORS, 2018; PAULA ET AL., 2024). Referring again to the case of Rotterdam, the municipality promoted the active role of private actors by deregulating certain initiatives and reducing bureaucratic restrictions. For instance, no permission from the municipality is needed for the construction of green façades and the planting of the ground around trees in public areas. Similarly, private initiatives for greening the sidewalks are allowed, with the only condition of leaving at least 1.80 meters free, as well as the greening of vacant lands and courtyards, through the active engagement of project developer or housing corporation, depending on the ownership. PPPs are also foreseen for the maintenance of larger public green areas, such as green strips, parks or neighbourhood park.

At the European level, the main legal framework is provided by the Green Paper on Public-Private Partnerships and Community Law on Public Contracts and Concessions (EUROPEAN COMMISSION, 2004). This reference document defines the main characteristics of PPP operation, stressing the primary role of the public partner in defin-

Examples of public parks: St James's Park in London and Gülhane Park in Istanbul (Images by M.S. Lux).



Examples of semi-private and private gardens: courtyard of Unione Femminile Nazionale and residential courtyard in Milan (Images by M.S. Lux).

ing the objectives to be achieved in terms of public interest.

The evolving landscape of urban green space management increasingly involves private actors, not only as stakeholders but also as active contributors. While public strategies continue to focus on the expansion and management of public green spaces, the role of private green areas and PPPs is becoming more prominent in urban green policies. Moving forward, ensuring the right balance between public interest, regulatory oversight, and private sector involvement will be crucial for the successful and sustainable implementation of urban green initiatives.

Urban Green regulations in the case of Milan

The city of Milan represents a relevant case study as it is a pioneer in Italy in terms of climate change adaptation. Due to its geographical position and its intense urbanisation, Milan experiences significant environmental challenges, including the urban heat island effect, high levels of air pollution and flash flooding events. Pushed by these urgent issues, the city has implemented multi-level strategies aimed at expanding public green spaces and enhancing urban resilience. Milan's UGI projects are integrated with broader urban transformation initiatives, such as the extension of the public transport network (for example, the construction of the M4 metro line included the development of a new linear park (FIOR ET AL., 2022) or real estate and urban regeneration pro-

jects, (as in the cases of CityLife and the Biblioteca degli Alberi (BOROS & MAHMOUD, 2021; CONTE & ANSELMI, 2022).

Before going into the specific examples of Milan green spaces management, it is relevant to shortly describe the legislative framework that currently regulates the management of urban greenery. The active regulations range from national to local policies, encompassing primarily the principles of environmental protection and preservation of existing natural features and second the modes for increasing the natural heritage of places. The national framework is provided by the Code of Cultural Heritage and Landscape, adopted in 2004, which sets up the basis for cultural and natural heritage protection. At the regional level, the evolution of environmental policies in Lombardy region reflects the transition towards an approach of increased land protection, especially since the Region is one of the most urbanised and industrialised in Italy and Europe. Currently, the network of protected areas covers almost 27% of the regional territory and 39% of the land area in the Metropolitan City of Milan. The main instrument for territorial planning at the regional level is the Regional Territorial Plan (PTR), which also includes the Regional Landscape Plan (PPR) and the Environmental Assessment Report (VAS). These broader regulations provide the reference framework for the Territorial Government Plan (PGT), adopted by Milan Municipality in 2019 and providing a vision for the city development up to 2030 (Arcidiacono & Ronchi, 2021). The PGT Milano 2030 es-



establishes, on one hand, the methods for identifying, evaluating, and mapping existing green infrastructure and defines its management rules. On the other hand, it identifies strategies, priorities, and areas for the future development of the UGI. For instance, two out of the nine development strategies defined by the plan specifically refer to the extension of the UGI: Strategy 5 “Creating Space for the Environment” encompasses action for afforestation and green management, while Strategy 6 “Designing a New Ecology” refers to Climate Impact Reduction and Ecosystem Services to be delivered by the improvement of the Municipal Ecological Network. The strategic guidelines provided by the PGT are also complemented by some more specific regulatory documents. In particular, the Building Regulation and the Regulation for the Use and Protection of Public and Private Green Spaces of the Municipality of Milan are technical regulations, providing specific and precise rules for the execution of interventions for both public and private green areas. The local legal framework for the city of Milan is summarised in Table 1.

PPP for urban green spaces in Milan

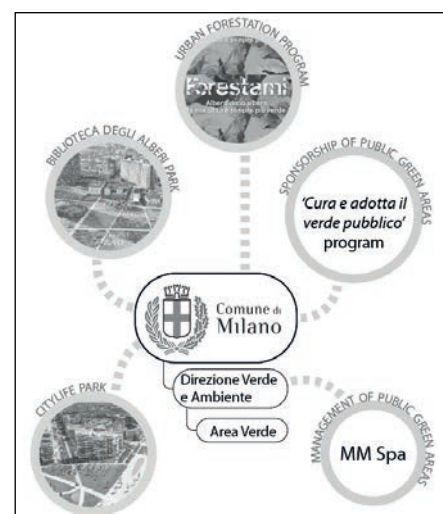
Milan’s public green assets cover more than 18 million square meters, comprising large parks, gardens, flowerbeds, traffic islands, tree-lined squares and avenues, dog parks, and playgrounds within both parks and schools. A significant shift in Milan’s green space management took

effect on October 1, 2024, when the Municipality formally entrusted the management of the city’s green infrastructure to MM S.p.A., a private company, for the next 25 years, until October 2049. The transition from direct municipal management to MM S.p.A. is occurring gradually throughout 2025 through a coordinated process. Specifically: since January 2025, MM S.p.A. has taken over the maintenance of gardens and green spaces in municipal schools; since April 2025, it started also managing the green areas of Municipio 8 (the district with the highest proportion of green space); and by the end of 2025, the company will assume full responsibility for the management and maintenance of all public green areas in the city. This approach is expected to enhance synergies and improve integrated planning, leading to more efficient and coordinated urban green management (COMUNE DI MILANO). In parallel with the continuous development of the Urban Green Infrastructure, the integration of private actors into the management of public green spaces is an increasingly widespread strategy in Milan, allowing the city to overcome some of the challenges associated with the exclusively public management of green infrastructure. PPPs have become a well-established model for financing, maintaining, and expanding urban green spaces, involving businesses, foundations, and citizens in various forms of collaboration. Over time, the Municipality of Milan has promoted tools to encourage private sector involvement through tenders, regulations, and partnership agreements, combining public and private interests. Private actors

Table 1: Administrative measures for environmental protection in the Metropolitan City and Municipality of Milan (Source: M.S. Lux).

Public and Private actors in Milan’Urban Green Infrastructure (Image by M.S. Lux).

Political/administrative measure	Year	Scope
Building Regulation [<i>Regolamento Edilizio del Comune di Milano</i>]	2014	Regulate the transformation of existing building and construction of new ones, concerning also open spaces
Regulation for the use and protection of public and private green areas [<i>Regolamento d’uso e tutela del verde pubblico e privato del Comune di Milano</i>]	2017	Define rules, standards and technical solutions for public and private urban greenery
Territorial Government Plan [<i>Piano di Governo del Territorio -PGT Milano 2030</i>]	2019	Guide and regulate urban transformations for the next 10 years



Example of private sponsorship of a public flowerbed and private-led initiatives on public green areas in Milan (Image by M.S. Lux).



Example of community-managed public-green area: the Lea Garofalo garden is a public green space managed by the association Giardini in Transito in agreement with Comune di Milano. The new playground has been designed by the IED (European Design Institute) students, in collaboration with Francesca Cassani, designer and artist (Source: Giardini in Transito).



can be involved mainly in two ways: sponsorships and green space concessions. Figure 1 provides an overview of the integration of public and private actors in the management of the UGI, introducing some specific cases that will be further explored in the following paragraphs.

Sponsorships represent a more accessible and direct mechanism for involving private actors in the management of public green spaces. They are open to individuals, groups of residents, neighborhood organizations, as well as businesses and corporations. A dedicated program called “Cura e Adotta il Verde Pubblico” (Care for and Adopt Public Green Spaces) facilitates this form of involvement (COMUNE DI MILANO). The program includes both financial sponsorships, where private entities cover the economic costs of creating or improving a green space, and technical sponsorships, in which sponsors also take responsibility for the design and execution of the work. In both cases, the sponsorship agreement requires the private entity to commit to maintenance for a given period, ranging from one to five years, depending on the intervention. This initiative allows citizens to improve green spaces near their residences, preventing illegal parking and urban decay, while also enabling companies to sponsor green areas near their headquarters, gaining visibility and enhancing their corporate image. The advantages of this model include:

- reduced maintenance costs for the Municipality, allowing resources to be allocated to other priorities;
- higher management quality, due to the involvement of stakeholders with a direct interest in maintaining the spaces in optimal condition;
- integration between public and private sectors, creating opportunities for innovative projects and new management solutions.

However, some long-term challenges emerge, such as the risk that only highly visible areas attract sponsorships, while less central ones remain underfunded. Additionally, excessive private branding in public spaces can spark debates about the “commercialization” of urban greenery.

Beyond sponsorships, Milan has adopted a concession model for the management of larger or more complex green spaces. Two key examples of this private manage-

ment model are the Biblioteca degli Alberi Park in Porta Nuova District, managed by Fondazione Catella, and the CityLife Park, managed by SmartCityLife Srl. Both parks have been recently developed as part of large-scale urban regeneration and real estate projects. The major real estate investments in these areas led to the construction of Bosco Verticale in the Porta Nuova District and the three skyscrapers by Arata Isozaki, Daniel Libeskind, and Zaha Hadid in CityLife. In parallel, these interventions have also brought significant investments in public green space redevelopment. As a result, these two new urban parks, while managed by private entities, maintain public space characteristics such as free access and open availability. The involved private entities not only maintain green areas but also organize cultural events and initiatives. Benefits of this approach include:

- *financial sustainability*, as private funding supports the management and development of green spaces;
- *dynamic management*, enabling the organization of events and activities that enhance the park’s role as a gathering place.

However, these parks also adhere to standards aligned with private-sector expectations, particularly regarding security and allowed activities. This management model has led to well-maintained and highly frequented public spaces, yet it has also raised concerns about the loss of informal spontaneity that typically defines truly public spaces, where citizens feel a stronger sense of ownership and agency. Additionally, granting public green spaces to private entities raises concerns about transparency in the selection process for concessionaires.

Finally, Milan’s main urban forestry program is also being implemented through a broad collaboration between various public and private entities. The FORESTAMI project is led by the Metropolitan City of Milan, the Municipality of Milan, the Lombardy Region, Parco Nord Milano, Parco Agricolo Sud Milano, ERSAF, and Fondazione di Comunità Milano, with scientific support from the Politecnico di Milano. This initiative aims to plant three million trees by 2030, actively engaging private companies that contribute through funding, logistical resources, or technical expertise. Additionally, the project encourages direct citizen participation in tree-planting activities and biodi-

versity conservation efforts, such as the Custodiscimi initiative, which assigned a tree to each participant to be planted near their home. The main benefits of this approach include:

- expanding urban greenery without relying solely on public funds;
- engaging citizen in educational activities, increasing environmental awareness;
- positive impacts on air quality and urban microclimate, thanks to increased tree cover.

However, the long-term success of such projects depends on ensuring proper tree maintenance and avoiding 'greenwashing', where private contributions serve branding purposes rather than generating real environmental impact.

Discussion

In conclusion, PPPs for urban green space management in Milan have increased over the past decades and show a potential in supporting the future growth of UGI. Despite their benefits, these collaborations also present several challenges:

- *Spatial equity*: private interest in sponsoring public green spaces for branding purposes, as well as the ability of individuals to finance such interventions, tends to be concentrated in central areas, high-income residential neighbourhoods, and business districts, often at the expense of peripheral and low-income areas. While private funding alleviates the financial burden on the municipality, allowing it to reallocate resources, territorial imbalances should not be overlooked. Given the tendency of private investment to cluster in specific locations, public action must prioritize the needs of disadvantaged urban areas.

- *Ownership and belonging*: Milan's experience highlights that privately managed public green spaces tend to offer higher-quality amenities, services, and maintenance compared to those managed by public entities. While this is a positive outcome in itself, it raises concerns about public perception, sense of ownership, and citizens' relationship with these spaces. The risk is that green spaces may be perceived as semi-private rather than truly communal areas.

- *Balancing interests*: the fundamental principle of PPPs should always be the public interest. Ensuring this principle requires robust regulatory frameworks and vigilant oversight by public institutions to prevent private involvement from leading to

the gradual privatization of green spaces. Strengthening control and transparency mechanisms is crucial to ensure fairness in the allocation of concessions and sponsorship opportunities.

Looking ahead, several opportunities exist to improve and expand the role of PPPs in urban green space management. Based on the challenges identified, the following recommendations can help shape future PPP policies in Milan:

- *Citizen engagement*: for PPPs to be truly effective, they must foster greater public participation in decision-making processes, ensuring that green spaces are not perceived as managed exclusively by institutions and few private entities.

- *Monitoring and digitalization*: advanced monitoring systems and digital tools are essential for supporting PPPs in the long-term management of public green spaces. Smart technologies can enhance efficiency and prevent short-term interventions that lack long-lasting impact.

- *Extending PPPs to private green spaces*: following the example of other European cities, such as Rotterdam, Milan could include private green areas in collaborative strategies for expanding and enhancing the UGI. In this scenario, the roles of public and private actors would be redefined, with the public sector providing technical support and the private sector becoming the host of green infrastructure initiatives. Funding models could also be adjusted, for example, through tax incentives or deductions. As a final recommendation, careful regulation is required to maintain a balance between public interest, economic sustainability, and citizen participation. The insights drawn from Milan's case study may be valuable for other European cities experiencing an increasing role of private actors in urban green space management. Ultimately, PPPs should be systematically integrated into the broader framework of tools contributing to UGI development, defining not only their implementation mechanisms but also their long-term objectives. This approach is crucial to ensuring that collective interests remain a priority and that public green space management does not become overly dependent on the variability of private funding.