

The Urban Book Series

Eugenio Arbizzani · Eliana Cangelli ·
Carola Clemente · Fabrizio Cumo ·
Francesca Giofrè · Anna Maria Giovenale ·
Massimo Palme · Spartaco Paris *Editors*

Technological Imagination in the Green and Digital Transition

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Contents

1	From a Liquid Society, Through Technological Imagination, to Beyond the Knowledge Society	1
	Anna Maria Giovenale	
2	Opening Lecture: Digital Spaces and the Material Culture	11
	Pietro Montani	
Part I Session Innovation		
3	Innovation for the Digitization Process of the AECO Sector	21
	Fabrizio Cumo	
4	The Digital Revolution and the Art of Co-creation	27
	Maurizio Talamo	
5	Toward a New Humanism of Technological Innovation in Design of the Built Environment	37
	Spartaco Paris	
6	A BIM-Based Approach to Energy Analysis of Existing Buildings in the Italian Context	47
	Marco Morini, Francesca Caffari, Nicolandrea Calabrese, and Giulia Centi	
7	Short-Term Wind Speed Forecasting Model Using Hybrid Neural Networks and Wavelet Packet Decomposition	57
	Adel Lakzadeh, Mohammad Hassani, Azim Heydari, Farshid Keynia, Daniele Groppi, and Davide Astiaso Garcia	
8	COGNIBUILD: Cognitive Digital Twin Framework for Advanced Building Management and Predictive Maintenance	69
	Sofia Agostinelli	

9	Design of CCHP System with the Help of Combined Chiller System, Solar Energy, and Gas Microturbine	79
	Samaneh Safaei, Farshid Keynia, Sam Haghdady, Azim Heydari, and Mario Lamagna	
10	Digital Construction and Management the Public's Infrastructures	93
	Giuseppe Orsini and Giuseppe Piras	
11	An Innovative Multi-objective Optimization Digital Workflow for Social Housing Deep Energy Renovation Design Process	111
	Adriana Ciardiello, Jacopo Dell'Olmo, Federica Rosso, Lorenzo Mario Pastore, Marco Ferrero, and Ferdinando Salata	
12	Digital Information Management in the Built Environment: Data-Driven Approaches for Building Process Optimization	123
	Francesco Muzi, Riccardo Marzo, and Francesco Nardi	
13	Immersive Facility Management—A Methodological Approach Based on BIM and Mixed Reality for Training and Maintenance Operations	133
	Sofia Agostinelli and Benedetto Nastasi	
14	A Digital Information Model for Coastal Maintenance and Waterfront Recovery	145
	Francesca Ciampa	
15	Sustainable Workplace: Space Planning Model to Optimize Environmental Impact	157
	Alice Paola Pomè, Chiara Tagliaro, and Andrea Ciaramella	
16	Digital Twin Models Supporting Cognitive Buildings for Ambient Assisted Living	167
	Alessandra Corneli, Leonardo Binni, Berardo Naticchia, and Massimo Vaccarini	
17	Less Automation More Information: A Learning Tool for a Post-occupancy Operation and Evaluation	179
	Chiara Tonelli, Barbara Cardone, Roberto D'Autilia, and Giuliana Nardi	
18	A Prosumer Approach for Feeding the Digital Twin. Testing the MUST Application in the Old Harbour Waterfront of Genoa	193
	Serena Viola, Antonio Novellino, Alberto Zinno, and Marco Di Ludovico	

19	Untapping the Potential of the Digital Towards the Green Imperative: The Interdisciplinary BeXLab Experience	203
	Gisella Calcagno, Antonella Trombadore, Giacomo Pierucci, and Lucia Montoni	
20	Digital—Twin for an Innovative Waterfront Management Strategy. Pilot Project DSH2030	217
	Maria Giovanna Pacifico, Maria Rita Pinto, and Antonio Novellino	
21	BIM and BPMN 2.0 Integration for Interoperability Challenge in Construction Industry	227
	Hosam Al-Siah and Antonio Fioravanti	
22	Digital Twin Approach for Maintenance Management	237
	Massimo Lauria and Maria Azzalin	
23	Digital Infrastructure for Student Accommodation in European University Cities: The “HOME” Project	247
	Oscar Eugenio Bellini, Matteo Gambaro, Maria Teresa Gullace, Marianna Arcieri, Carla Álvarez Benito, Sabri Ben Rommane, Steven Boon, and Maria F. Figueira	
Part II Session Technology		
24	Technologies for the Construction of Buildings and Cities of the Near Future	263
	Eugenio Arbizzani	
25	The Living Lab for Autonomous Driving as Applied Research of MaaS Models in the Smart City: The Case Study of MASA—Modena Automotive Smart Area	273
	Francesco Leali and Francesco Pasquale	
26	Expanding the Wave of Smartness: Smart Buildings, Another Frontier of the Digital Revolution	285
	Valentina Frighi	
27	Sharing Innovation. The Acceptability of Off-site Industrialized Systems for Housing	295
	Gianluca Pozzi, Giulia Vignati, and Elisabetta Ginelli	
28	3D Printing for Housing. Recurring Architectural Themes	309
	Giulio Paparella and Maura Percoco	
29	Photovoltaic Breakthrough in Architecture: Integration and Innovation Best Practice	321
	Guido Callegari, Eleonora Merolla, and Paolo Simeone	

30	Reworking Studio Design Education Driven by 3D Printing Technologies	335
	Jelena Milošević, Aleksandra Nenadović, Maša Žujović, Marko Gavrilović, and Milijana Živković	
31	The New Technological Paradigm in the Post-digital Era. Three Convergent Paths Between Creative Action and Computational Tools	345
	Roberto Bianchi	
32	Technological Innovation for Circularity and Sustainability Throughout Building Life Cycle: Policy, Initiatives, and Stakeholders' Perspective	357
	Serena Giorgi	
33	Fair Play: Why Reliable Data for Low-Tech Construction and Non-conventional Materials Are Needed	367
	Redina Mazelli, Martina Bocci, Arthur Bohn, Edwin Zea Escamilla, Guillaume Habert, and Andrea Bocco	
Part III Session Environment		
34	Technological Innovation for the Next Ecosystem Transition: From a High-Tech to Low-Tech Intensity—High Efficiency Environment	383
	Carola Clemente	
35	Technological Imagination to Stay Within Planetary Boundaries	391
	Massimo Palme	
36	Quality-Based Design for Environmentally Conscious Architecture	399
	Helena Coch Roura and Pablo Garrido Torres	
37	Digital Transformation Projects for the Future Digicircular Society	403
	Irene Fiesoli	
38	The Regulatory Apparatus at the Service of Sustainable Planning of the Built Environment: The Case of Law 338/2000	417
	Claudio Piferi	
39	From Nature to Architecture for Low Tech Solutions: Biomimetic Principles for Climate-Adaptive Building Envelope	429
	Francesco Sommese and Gigliola Ausiello	
40	Soft Technologies for the Circular Transition: Practical Experimentation of the Product “Material Passport”	439
	Tecla Caroli	

41	Imagining a Carbon Neutral University	449
	Antonella Violano and Monica Cannaviello	
42	Life Cycle Assessment at the Early Stage of Building Design	461
	Anna Dalla Valle	
43	Design Scenarios for a Circular Vision of Post-disaster Temporary Settlements	471
	Maria Vittoria Arnetoli and Roberto Bologna	
44	Towards Climate Neutrality: Progressing Key Actions for Positive Energy Districts Implementation	483
	Rosa Romano, Maria Beatrice Andreucci, and Emanuela Giancola	
45	Remanufacturing Towards Circularity in the Construction Sector: The Role of Digital Technologies	493
	Nazly Atta	
46	Territorial Energy Potential for Energy Community and Climate Mitigation Actions: Experimentation on Pilot Cases in Rome	505
	Paola Marrone and Ilaria Montella	
47	Integrated Design Approach to Build a Safe and Sustainable Dual Intended Use Center in Praslin Island, Seychelles	523
	Vincenzo Gattulli, Elisabetta Palumbo, and Carlo Vannini	
Part IV Session Climate Changes		
48	Climate Change: New Ways to Inhabit the Earth	537
	Eliana Cangelli	
49	The Climate Report Informing the Response to Climate Change in Urban Development	547
	Anna Pirani	
50	The Urban Riverfront Greenway: A Linear Attractor for Sustainable Urban Development	557
	Luciana Mastrodonardo	
51	The Buildings Reuse for a Music District Aimed at a Sustainable Urban Development	567
	Donatella Radogna	
52	Environmental Design for a Sustainable District and Civic Hub	577
	Elena Mussinelli, Andrea Tartaglia, and Giovanni Castaldo	

53	Earth Observation Technologies for Mitigating Urban Climate Changes	589
	Federico Cinquepalmi and Giuseppe Piras	
54	A Systematic Catalogue of Design Solutions for the Regeneration of Urban Environment Contrasting the Climate Change Impact	601
	Roberto Bologna and Giulio Hasanaj	
55	Digital Twins for Climate-Neutral and Resilient Cities. State of the Art and Future Development as Tools to Support Urban Decision-Making	617
	Guglielmo Ricciardi and Guido Callegari	
56	The Urban Potential of Multifamily Housing Renovation	627
	Laura Daglio	
57	A “Stepping Stone” Approach to Exploiting Urban Density	639
	Raffaella De Martino, Rossella Franchino, and Caterina Frettoloso	
58	Metropolitan Farms: Long Term Agri-Food Systems for Sustainable Urban Landscapes	649
	Giancarlo Paganin, Filippo Orsini, Marco Migliore, Konstantinos Venis, and Matteo Poli	
59	Resilient Design for Outdoor Sports Infrastructure	659
	Silvia Battaglia, Marta Cognigni, and Maria Pilar Vettori	
60	Sustainable Reuse Indicators for Ecclesiastic Built Heritage Regeneration	669
	Maria Rita Pinto, Martina Bosone, and Francesca Ciampa	
61	A Green Technological Rehabilitation of the Built Environment. From Public Residential Estates to Eco-Districts ...	683
	Lidia Errante	
62	Adaptive Building Technologies for Building Envelopes Under Climate Change Conditions	695
	Martino Milardi	
63	The Importance of Testing Activities for a “New” Generation of Building Envelope	703
	Martino Milardi, Evelyn Grillo, and Mariateresa Mandaglio	
64	Data Visualization and Web-Based Mapping for SGDs and Adaptation to Climate Change in the Urban Environment ...	715
	Maria Canepa, Adriano Magliocco, and Nicola Pisani	
65	Fog Water Harvesting Through Smart Façade for a Climate Resilient Built Environment	725
	Maria Giovanna Di Bitonto, Alara Kutlu, and Alessandra Zanelli	

66	Building Façade Retrofit: A Comparison Between Current Methodologies and Innovative Membranes Strategies for Overcoming the Existing Retrofit Constraints	735
	Giulia Procaccini and Carol Monticelli	
67	Technologies and Solutions for Collaborative Processes in Mutating Cities	745
	Daniele Fanzini, Irina Rotaru, and Nour Zreika	
68	New Perspectives for the Building Heritage in Depopulated Areas: A Methodological Approach for Evaluating Sustainable Reuse and Upcycling Strategies	757
	Antonello Monsù Scolaro, Stefania De Medici, Salvatore Giuffrida, Maria Rosa Trovato, Cheren Cappello, Ludovica Nasca, and Fuat Emre Kaya	
69	Climate Adaptation in Urban Regeneration: A Cross-Scale Digital Design Workflow	769
	Michele Morganti and Diletta Ricci	
70	Adaptive “Velari”	783
	Alberto Raimondi and Laura Rosini	
71	Temporary Climate Change Adaptation: 5 Measures for Outdoor Spaces of the Mid-Adriatic City	801
	Timothy Daniel Brownlee	
72	A Serious Game Proposal for Exploring and Designing Urban Sustainability	811
	Manuela Romano and Alessandro Rogora	
73	Energy Efficiency Improvement in Industrial Brownfield Heritage Buildings: Case Study of “Beko”	821
	Jelena Pavlović, Ana Šabanović, and Nataša Ćuković-Ignjatović	
74	Industrial Heritage of Belgrade: Brownfield Sites Revitalization Status, Potentials and Opportunities Missed	831
	Jelena Pavlović, Ana Šabanović, and Nataša Ćuković-Ignjatović	
75	Challenges and Potentials of Green Roof Retrofit: A Case Study	843
	Nikola Miletić, Bojana Zeković, Nataša Ćuković Ignjatović, and Dušan Ignjatović	
76	Designing with Nature Climate-Resilient Cities: A Lesson from Copenhagen	853
	Maicol Negrello	

77	New Urban Centralities: Universities as a Paradigm for a Sustainable City	863
	Camilla Maitan and Emilio Faroldi	
Part V Session I Health		
78	Environment for Healthy Living	875
	Francesca Giofrè	
79	New Paradigms for Indoor Healthy Living	883
	Alberto De Capua	
80	Healthy and Empowering Life in Schoolyards. The Case of Dante Alighieri School in Milan	893
	Valentina Dessì, Maria Fianchini, Franca Zuccoli, Raffaella Colombo, and Noemi Morrone	
81	Design for Emergency: Inclusive Housing Solution	907
	Francesca Giglio and Sara Sansotta	
82	Environmental Sensing and Simulation for Healthy Districts: A Comparison Between Field Measurements and CFD Model	921
	Matteo Giovanardi, Matteo Trane, and Riccardo Pollo	
83	A Synthesis Paradigm as a Way of Bringing Back to Life the Artistic Monuments Inspired by the Motives of the People's Liberation Struggle and Revolution of Yugoslavia	935
	Meri Batakoja and Tihana Hrastar	
84	Social Sustainability and Inclusive Environments in Neighbourhood Sustainability Assessment Tools	947
	Rosaria Revellini	
85	Inclusive Neighborhoods in a Healthy City: Walkability Assessment and Guidance in Rome	959
	Mohamed Eledeisy	
86	Tools and Strategies for Health Promotion in Urban Context: Technology and Innovation for Enhancing Parish Ecclesiastical Heritage Through Sport and Inclusion	969
	Francesca Daprà, Davide Allegri, and Erica Isa Mosca	
87	Nursing Homes During COVID-19 Pandemic—A Systematic Literature Review for COVID-19 Proof Architecture Design Strategies	981
	Silvia Mangili, Tianzhi Sun, and Alexander Achille Johnson	

88	A New Generation of Territorial Healthcare Infrastructures After COVID-19. The Transition to Community Homes and Community Hospitals into the Framework of the Italian Recovery Plan	991
	Andrea Brambilla, Erica Brusamolin, Stefano Arruzzoli, and Stefano Capolongo	
89	Wood Snoezelen. Multisensory Wooden Environments for the Care and Rehabilitation of People with Severe and Very Severe Cognitive Disabilities	1003
	Agata Tonetti and Massimo Rossetti	
90	The Proximity of Urban Green Spaces as Urban Health Strategy to Promote Active, Inclusive and Salutogenic Cities	1017
	Maddalena Buffoli and Andrea Rebecchi	
91	Environmental Attributes for Healthcare Professional's Well-Being	1029
	Zakia Hammouni and Walter Wittich	

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Chapter 90

The Proximity of Urban Green Spaces as Urban Health Strategy to Promote Active, Inclusive and Salutogenic Cities



Maddalena Buffoli and Andrea Rebecchi

Abstract Urban Green Spaces (UGS) have several positive effects on Public Health, environmental quality, and cities' resilience to climate change; UGS are crucial in urban regeneration actions and urban health purposes. Moreover, to better define the UGS' health impacts, it is important to define and guarantee UGS' proximity, accessibility, and quality. Aim of the research is a quali-quantitative assessment of the UGS in Italian metropolitan cities, taking Milan, Turin, Florence, and Bologna as preliminary case studies. One of the 1st phases was to draw up dynamic and descriptive GIS-based maps of the relationships between density of population and of urban fabric, UGS' availability, and their accessibility. Only the areas with a size greater than 15,000 square meters were considered; three buffer zones of proximity were defined: 250, 500, and 750 m. By combining the UGS' availability with the population's density, it was possible to quantify the citizens included in the three buffer zones. From the 1st analysis, it is observed that about 90% of the population is served by a quality green area within a buffer area of 750 m; 78% by the buffer zone of 500 m; 49% by the buffer zone of 250 m. Both the elaborated maps and graphs obtained show how population is not equally served by close and accessible UGS. Their geo-localization it's a preliminary quantitative step (process started in Italy with the introduction of regulations like green areas' census, mapping, maintenance legislation, and strategic plans), but it's even more crucial to evaluate the UGS' quality in terms of accessibility, safety and security features, provision of services and paths.

Keywords Urban green spaces availability · Urban green spaces accessibility · Urban green spaces proximity · GIS-based approach · Urban public health perspective · Healthy cities

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1017

90.1 Theoretical Scenario

The recent COVID-19 sanitary and social emergency are a crucial demonstration of the dual effects between the ongoing urbanization phenomena that represent the contemporary cities' capacity to be a place of economic, social, and cultural opportunities, and—at the same time—a situation of multiple environmental risk factors for Public Health, well-being, and welfare (Capolongo et al. 2020). The fast change in lifestyles in the period of physical and social distancing (lockdown) which has interested several World and European Countries, its emphasizing and making urgent the cities' transformation into resilient ecosystems, capable to promote healthy lifestyles (Capolongo et al. 2020) and Public Health, and preventing the spread of the infectious diseases, of today and tomorrow (Lee 2020).

In particular, the urbanization phenomena taking place all over the World, with particular reference to the developed countries and emerging economies, imply a series of reflections on population density as a vehicle for social inequalities and Public Health emergencies (Pisano, et al. 2020). In fact, the population living in urban areas today represents 54%, and forecasts indicate that it will increase up to 70% by 2050 (Talukder 2015).

The recent COVID-19 sanitary and social emergency, moreover, have renewed the demands of a social, environmental, and digital needs to those already in development (Azzopardi-Muscat et al. 2020), the link between the morpho-typological and functional features of the urban contexts, and the Public Health conditions, had risen up the attention to the Urban Public Health scenario (Capolongo et al. 2018), which shifts the focus of the “concept of health” from a medical model, merely focused on the individual care, to a social model, in which health is the result of various socio-economic, cultural, and environmental factors (Moscato and Poscia 2015).

Among the health determinants, environmental and behavioral risk factors, such as sedentary lifestyle or physical inactivity, represent a key role within the global health balance, with key reference to the risk of onset by the non-communicable diseases (NCDs). In other words, health is no longer an aspect of life exclusively rely on the health protection and promotion, but an individual and collective condition, strongly influenced by the environmental context and by the strategies implemented by local Governments.

The main *environmental risk factors* that affect our cities are urban heat island effect; air, noise, and soil pollution; vehicular traffic; and urban safety and security.

The possible *health-related outcomes* are non-communicable diseases (NCDs) like cardio-respiratory diseases and sedentary, cause of diabetes; and mental health disorders like stress condition, ansia, sleeping disorders, and cognitive development.

The main *urban health strategies* to improve and promote Urban Public Health, and to renovate cities according to the urban resilience to climate change are increasing green and blue infrastructures; promoting biodiversity protection; increase the quantity and quality of outdoor public spaces; reducing vehicular traffic; promoting walkable environment; improving social and functional mix of the ground floor of the city, looking for the city of proximity; promoting the accessibility of the

city with the universal design approach; realizing free outdoor places to physical activity like playground; and considering the rooftop of the buildings like a common public floor for the communities, and make it livable or greener.

During the spent three/four waves of the COVID-19 sanitary crisis, urban systems were stressed. During this period, the resilience of our cities and population was tested, highlighting the criticalities in both sanitary systems and urban planning. Urban green spaces (UGS) have proved essential role, not only as a safe recreational space but also as an irreplaceable tool to improve Urban, Public, and Mental Health (World Health Organization 2016), due to its formidable restorative capabilities (Capolongo et al. 2015). Unfortunately, the heterogeneous distribution of UGS inside of urban environments (Gianfredi et al. 2021), and the disparity in quality of such spaces, led to some exclusion phenomena, further underlining their relevance in egalitarian and democratic cities (D'Alessandro et al. 2017).

90.2 Research Purpose and Method

Aim of the research is a quali-quantitative assessment of the UGS in several Italian metropolitan cities, taking *Milan, Turin, Florence, and Bologna* as preliminary case studies. One of the 1st phases was to draw up dynamic and descriptive GIS-based maps of the relationships between density of population and of urban fabric (Rydin et al. 2012), UGS' availability and accessibility, and city users' perception in terms of recreational opportunities and healthy lifestyles' promotion propensity.

Geographic information systems (GIS) are a computerized information system that allows the acquisition, recording, analysis, display, return, sharing, and presentation of information deriving from geographic data. The benefits obtained from its application and use are the ability to organize and archive a large amount of geographic data (Zhang and Yu 2020) and to conduct operations that are directly useful for decision-making, within a georeferenced environment (Irvine et al. 2012). GIS is usually conceptualized as a collection of georeferenced layers, which can be classified according to two different types of data: raster and vector. The main difference between the two data series is in the number of properties it can collect. While raster data are able to describe only a single property, vector data can collect a large number of information and therefore of attributes (Oppio et al. 2016). GIS-based software therefore offers the possibility of supporting territorial analyzes allowing a dynamic graphical rendering capable of associating data of a different nature with a direct display of the results obtained in the area under consideration assessment.

The methodological scheme developed and subsequently applied to evaluate the availability of UGS in the major Italian metropolitan cities is presented below. The proposed analyzes exploit the potential of GIS through the use and subsequent processing of vector data. The approach was divided into three phases.

The first phase of data collection consists of three steps: Definition of the decision-making context: It allows to identify the limits of the analysis and to identify the territorial context being assessed; Source map: It consists of the collection of georeferenced data using existing databases; Screening phase: The data previously collected is selected in order to process those deemed suitable for the purposes of the evaluation and research.

The second phase of data processing was developed through spatial operations: definition of buffer areas from the geometries selected in the data collection phase.

The third phase of data analysis consists in reading the partial and total results obtained through the spatial elaborations developed in the previous phase and considering the selected data.

The previously described methodological approach made it possible to evaluate the availability of green areas in metropolitan cities, the most affected in the national context by the COVID-19 pandemic currently underway, which made it possible to highlight the existing vulnerabilities and inequalities, as well as accelerate the most radical dynamics of change.

90.3 Findings

The municipalities of *Bologna, Florence, Milan, and Turin* were selected in the regional and municipal areas and presented comparable open-source GIS data available. One of the first phases of the research, preliminary to the further assessment phases, was to draw up—referring to the GIS-based software QGIS—dynamic and descriptive maps of the relationships between density of population, density of the urban fabric, UGS (in all its forms) availability and accessibility, and city users' perception of those UGS and infrastructures existing in the context of Milano city.

Only the significant green areas for the research purposes were identified and selected; therefore, poor-quality green areas and those insignificant have been eliminated, as they are not accessible, private, and not suitable for recreational / sporting activities, or not capable of creating opportunities in terms of healthy lifestyles' promotion.

Among the green areas previously identified, it was decided to carry out a further selection that allowed to analyze only the areas with a size greater than 15,000 m², as they were considered the most representative for their relevant size and sufficient for outdoor physical activity promotion.

Subsequently, three buffer zones were defined, respectively, of 250, 500, and 750 m, which allow to evaluate the distance from the green areas (Figs. 90.1, 90.2, 90.3 and 90.4). These distances can be easily reached on foot from 3 to 10 min and are significant for assessing the quality of the available green areas into the neighborhoods.

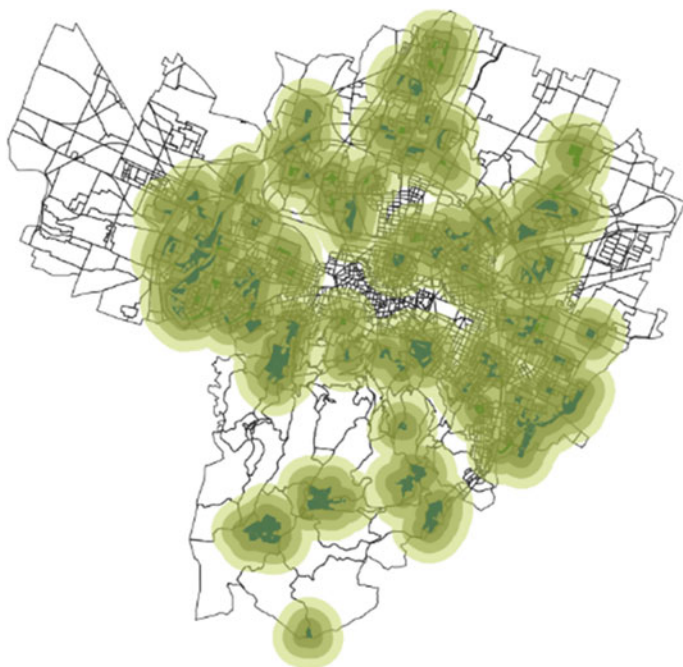


Fig. 90.1 Bologna: buffer for analysis and definition of the distance from UGS with an area greater than 15,000 m²

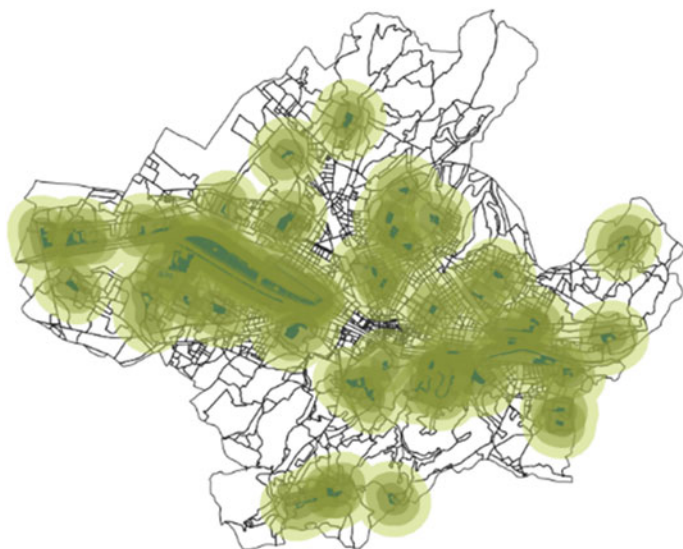


Fig. 90.2 Florence: buffer for analysis and definition of the distance from UGS with an area greater than 15,000 m²

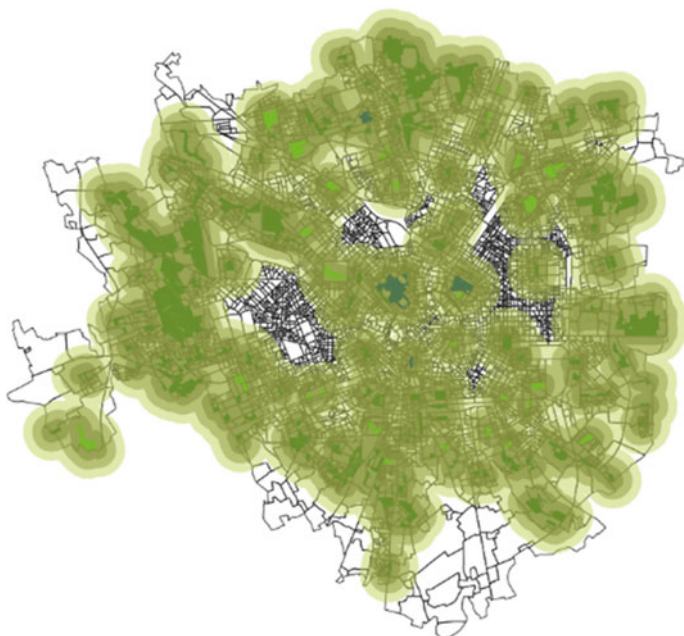


Fig. 90.3 Milan: buffer for analysis and definition of the distance from UGS with an area greater than 15,000 m²

By combining the elaborations carried out with the information relating to the resident population in the several census sections (ISTAT 2011), it was possible to quantify the population included in the three buffer zones (250, 500, and 750 m) and therefore evaluate the availability of green areas in the cities of Milan, considering the served population VS excluded from the three defined buffer zones.

The graphs show the results obtained from the application of the methodological process developed (Fig. 90.5). For the four metropolitan cities analyzed, it is thus possible to evaluate the percentage of population residing in a radius of distance of 250 m, 500 m, and 750 m from the selected green areas.

From a first analysis, it is evident that about 90% of the population is served by a quality green area within a 750 m buffer area, only for the city of Turin, the percentage is lower (81%). The buffer zone of 500 m corresponds to 83% of the resident population for the city of Bologna, 75% for Florence, 78% for Milan, and 65% for Turin. Further reducing the distance and considering the buffer of 250 m, we note that the city with the highest percentage of population served is Bologna (61%), followed by Milan (49%), Florence (44%), and Turin (37%). Both the elaborated maps and the obtained graphs show how the resident population in urban areas is not equally served by quality green areas, in particular the central areas which appear to be those with a higher population density and high land consumption.

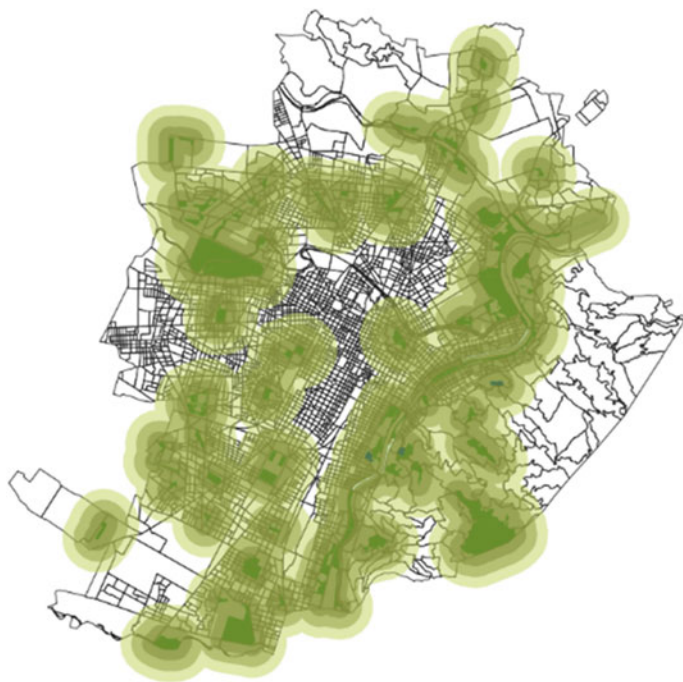


Fig. 90.4 Turin: buffer for analysis and definition of the distance from UGS with an area greater than 15,000 m²

The proximity to UGS positively influences the well-being of people, the livability of the neighborhoods, and the quality of the public space, bringing environmental, social and economic benefits, as well as effects on health. A densely built area with a reduced availability of green areas on the contrary has negative effects on the urban microclimate, on pollution and consequently on all the previously defined dimensions.

Both the elaborated maps and the graphs obtained show how the resident population in urban areas is not equally served by quality green areas, in particular the central areas are those with a higher population density, with a high consumption of land and less availability of UGS.

90.4 Conclusions and Research Outlooks

The conducted research is the basis for developing further methods, tools, and indicators to design and assess the environmental quality of the public spaces (Capolongo et al. 2020). It is necessary and crucial to evaluate the public space with qualitative and quantitative standard, highlighting the urban context and public spaces features



Fig. 90.5 Comparison of the quantification of the population included in the three buffer zones

evidence-based oriented to promote healthy lifestyles. Making cities more walkable and cyclable means to improve their physical factors—as network of public spaces, land use mix, street design, etc.—to create a more convenient, safe, comfortable, and attractive places.

About the outcomes, some benefits are known and certain—like the environmental ones—and published lots of time in the scientific journals that investigate topics like climate change, urban resilience, environmental issues, and Public Health. At the same time, research projects that quantify, at the statistical level, the direct health benefits, are missing (Bedimo-Rung and Gustat 2006). Furthermore, in all urban projects, part of the economic investment should be dedicated to post-intervention forecasting researches (Knobel and Dadvand 2020), aimed to define health evidence-based data and direct correlation with population health status.

The Sustainable Development Goals (SDGs) from the 2030 Agenda for Sustainable Development by United Nations represent the roadmap that we should follow. The number 3 “*good health and well-being*” is strongly connected with the number 10 “*social inequalities reduction*” and social inclusion; the number 11 “*sustainable cities and communities*” and the number 13 “*climate actions for climate resilience*” and environmental sustainability.

A multidisciplinary approach is needed, putting together different stakeholders, like Designers (Urban Planners and Architects), Policy and Decision Makers, Public Health experts and City Users, Citizen and Associations (Lenzi et al. 2020), to enhance a direct interaction with decision-maker (Gianfredi et al. 2019), economist, that evaluates the project feasibility, with a cost–benefit approach; and finally, environmental monitoring agencies.

References

- Azzopardi-Muscat N, Brambilla A, Caracci F, Capolongo S (2020) Synergies in design and health. The role of architects and urban health planners in tackling key contemporary public health challenges. *Acta Biomed* 91(Supplement 3):9–20
- Bedimo-Rung A, Gustat J (2006) Development of a direct observation instrument to measure environmental characteristics of parks for physical activity. *Human Kintetc* J
- Capolongo S, Buffoli M, Oppio A (2015) How to assess the effects of urban plans on environment and health. *Territorio* 73:145–151
- Capolongo S, Rebecchi A, Dettori M, Appolloni L, Azara A, Buffoli M, Capasso L, Casuccio A, Oliveri Conti G, D’Amico A et al (2018) Healthy design and urban planning strategies, actions, and policy to achieve salutogenic cities. *Int J Environ Res Public Health* 15:2698
- Capolongo S, Buffoli M, Brambilla A, Rebecchi A (2020) Healthy urban planning and design strategies to improve urban quality and attractiveness of places. *TECHNE* 19:271–279. <https://doi.org/10.13128/techne-7837>
- Capolongo S, Buffoli M, Mosca EI, Galeone D, D’Elia R, Rebecchi A (2020) Public health aspects’ assessment tool for urban projects, according to the urban health approach. Springer, *Research for Development*, 2020, pp 325–335. https://doi.org/10.1007/978-3-030-33256-3_30
- Capolongo S, Rebecchi A, Buffoli M, Appolloni L, Signorelli C, Fara GM (2020) D’Alessandro D. COVID-19 and cities: From urban health strategies to the pandemic challenge. a decalogue of

- public health opportunities. *Acta Biomedica* 91(2):13–22. <https://doi.org/10.23750/abm.v91i2.9515>
- D'Alessandro D et al (2017) Public health and urban planning: a powerful alliance to be enhanced in Italy. *Ann Ig* 29:452–463
- Gianfredi V, Buffoli M, Rebecchi A, Croci R, Oradini-Alacreu A, Stirparo G, Marino A, Odone A, Capolongo S, Signorelli C (2021) Association between urban greenspace and health: a systematic review of literature. *Int J Environm Res Public Health* 18:5137. <https://doi.org/10.3390/ijerph18105137>
- Gianfredi V, Balzarini F, Gola M, Mangano S, Carpagnano LF, Colucci ME, Gentile L, Piscitelli A, Quattrone F, Scuri S, Mantovani LG, Auxilia F, Castaldi S, Capolongo S, Pelissero G, Odone A, Signorelli C (2019) Leadership in public health: opportunities for young generations within scientific associations and the experience of the academy of young leaders. *Front Public Health* 7:378
- Irvine K, Warber S, Devine-Wright P, Gaston K (2012) Understanding urban green space as a health resource: a qualitative comparison of visit motivation and derived effects among park users in Sheffield, UK. *Int J Environ Res Public Health* 10(1):417–442
- Knobel P, Dadvand P (2020) Development of the urban green space quality assessment tool (RECITAL). *J Urban Forest Urban Greening* 1–8
- Lee VJ et al (2020) Epidemic preparedness in urban settings: new challenges and opportunities. *Lancet Infect Dis*
- Lenzi A, Capolongo S, Ricciardi G, Signorelli C, Napier D, Rebecchi A, Spinato C (2020) New competences to manage urban health: health city manager core curriculum. *Acta Biomed* 91:21–28. <https://doi.org/10.23750/abm.v91i3-S.9430>
- Moscato U, Poscia A (2015) Urban public health. In: Boccia S, Villari P, Ricciardi W (eds) *A systematic review of key issues in public health*. Springer, Geneva, Switzerland
- Oppio A, Bottero M, Giordano G, Arcidiacono A (2016) A multi-methodological evaluation approach for assessing the impact of neighbourhood quality on public health. *Epidemiol Prev* 40:249–256
- Pisano GP et al (2020) Lessons from Italy's response to coronavirus. *Harvard Bus Rev*
- Rydin Y, Bleahu A, Davis M, Dávila JD, Friel S, de Grandis G, Groce N, Hallal PC, Hamilton I, Howden-Chapman P et al (2012) Shaping cities for health: complexity and the planning of urban environments in the 21st century. *Lancet* 379:2079–2108
- Talukder RS et al (2015) Urban Health in the post-2015 Agenda. *Lancet* 385:769
- World Health Organization (WHO) (2016) Health as the pulse of the new urban Agenda. United Nations Conference on Housing and Sustainable Urban Development. Quito, Ottobre 2016. Available on-line: <http://apps.who.int/iris/bitstream/handle/10665/250367/9789241511445-eng.pdf;jsessionid=07F882D99F1E1AF399B57D5546EEB2BB?sequence=1>
- Zhang J, Yu Z (2020) Links between space and public health: a bibliometric review of global research trends and future prospects from 1901 to 2019. *Environ Res Lett* 15

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