

Future City 22

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Urban Botany

Ecological Principles for Green Cities

 Springer

Future City

Volume 22

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As of 2008, for the first time in human history, half of the world's population now live in cities. And with concerns about issues such as climate change, energy supply and environmental health receiving increasing political attention, interest in the sustainable development of our future cities has grown dramatically.

Yet despite a wealth of literature on green architecture, evidence-based design and sustainable planning, only a fraction of the current literature successfully integrates the necessary theory and practice from across the full range of relevant disciplines.

Springer's *Future City* series combines expertise from designers, and from natural and social scientists, to discuss the wide range of issues facing the architects, planners, developers and inhabitants of the world's future cities. Its aim is to encourage the integration of ecological theory into the aesthetic, social and practical realities of contemporary urban development.

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Cities and Urban Green Areas

Nowadays, human beings mainly live in metropolitan areas: almost 60% of the world's population resides in urban contexts, and this share is expected to increase further in the coming years. Cities have become the main centers of development, innovation, and economic growth, with the consequent emergence of important environmental issues such as biodiversity loss, noise, poor air quality, pollution, and rising temperatures that contribute to the formation of urban heat islands. It is therefore clear that the most accessible form of nature in the future will ever more be urban. Consequently, biodiversity and the expansion of urban green areas will represent an increasingly strategic priority for ensuring a healthier coexistence within cities, which will need to accommodate further population growth while remaining livable environments.

Humans, as organisms, have evolved and adapted their functioning to natural environmental stimuli. Today, however, the urban anthropogenic environment influences ecosystems to the point of damaging them and compromising the physiological, psychological, sociological, cultural, and economic relationships linked to the surrounding environment.

Urban life, characterized by traffic, noise, artificial light, technology, screens, frenetic rhythms, time pressure, and crowding, produces stress and continuous stimuli that lead to fatigue. As a result, mental health is significantly affected, with increased problems related to concentration, irritability, anxiety, sleep disorders, depression, aggression, and discomfort across different age groups. Children spend most of their time indoors and many hours in front of electronic devices. Their daily lives in cities leave less and less time for leisure and spontaneous play in contact with nature, while more time is spent on indoor activities with limited or no exposure to natural environments. This deprives them of essential stimuli and experiences needed for healthy growth. At the same time, parents, pediatricians, and educators lose valuable tools for preventing and treating a wide range of disorders, from sedentary lifestyles and obesity to video addiction and attention deficit hyperactivity disorder.

There are also several physiological issues related to the impact on the immune system, which defends the body against external pathogens and internal

“abnormalities” and is strongly influenced by environmental conditions, stress, and pollution.

Human activities also contribute to climate change (rising temperatures and extreme weather events such as floods and droughts), which can directly or indirectly increase the disease burden. Two phenomena make cities particularly inhospitable during the summer months: the “urban heat island,” measured as the temperature difference between urban and rural areas and most intense in the evening, and “heat waves,” which are independent of urban systems, but whose effects overlap with those of heat islands when they occur. During heat waves, concrete and asphalt absorb large amounts of heat and release it at night, causing prolonged physiological stress over consecutive days. Numerous studies have highlighted the profound relationship between nature and well-being. For example, the presence of greenery near residential areas has been associated with reduced medical expenses and a lower incidence of psychological and psychiatric disorders in adulthood among people who grew up in areas rich in urban vegetation.

There are three mechanisms through which nature exerts positive effects on health and well-being in urban contexts: mitigation/protection, through the reduction of environmental pollution (air, noise, water, etc.); restoration, through mechanisms by which contact with nature regenerates and restores proper physiological, cognitive, and psychological functioning; generativity (instoration), providing access to fundamental psychological and social experiences through physical activity, social cohesion, and opportunities for interaction.

The benefits produced by trees and plants derive from oxygen production, the removal of atmospheric pollutants, and the mitigation of heat compared with asphalted and cemented areas. Greenery and biodiversity also play fundamental aesthetic, architectural, and cultural roles, contributing to well-being and reducing stress in the urban environment. Contact with nature reduces psychiatric risk and improves physical and emotional health, social and personal abilities, sensory skills, and the capacity for focused attention, concentration, and creative, healthy, and participatory interests. Experiencing nature supports the harmonious development of the musculoskeletal system and helps prevent cardiorespiratory, metabolic, and cancer-related diseases. Certain molecules released by plants also appear to have direct effects on the immune system.

Many studies show that spending at least 80 minutes a day outdoors reduces the risk of developing myopia in children, while playing and engaging in sensory experiences in green spaces increase creativity and collaboration, contributing to higher cognitive development. Spending at least 20 minutes a day in green areas engaging in activities is also an effective and inexpensive way to manage symptoms of attention-deficit/hyperactivity disorder. The World Health Organization has set specific targets for cities to improve the health and well-being of urban populations, including:

- Promoting safe, inclusive and accessible urban environments for all, with a minimum of 9 m² of green space per inhabitant
- Improving green infrastructure within cities

- Protecting urban ecosystems to ensure sustainability and guaranteeing universal access to green and public spaces

One of the UN Sustainable Development Goals (SDG 11.7) aims precisely to make cities inclusive, safe, resilient, and sustainable, including by creating and making green areas more accessible. To achieve this, we must restore space to nature, conceived as a genuine strategic “infrastructure” for building healthy and resilient communities and territories. Humans are an integral part of the ecosystems in which they live: restoring and conserving biodiversity and ecosystems is the most concrete long-term investment in the health and well-being of the entire population. Since 2022, these principles have also been enshrined in the Constitution, with the reform of Article 9, which states that “the environment, biodiversity and ecosystems shall be protected, also in the interests of future generations.”

To change lifestyles and effectively address environmental, social, and cultural challenges, such as increasing urbanization, an ageing population, and children’s detachment from nature, it is necessary to design new public green spaces, protect existing ones, ensure fair access to green areas near homes, and implement nature-based solutions. These actions are now urgent and essential for growing well, feeling well, and living well. Green spaces are therefore not urban accessories but fundamental structures for well-being, health, and sustainability. They help improve air quality, mitigate urban heat islands, regulate the urban microclimate, and promote natural drainage, reducing flood risk. They also protect biodiversity, restore degraded areas, and provide spaces for socialization, recreation, and environmental education.

Cities, with their high population density and intense human activity, are among the areas most exposed to the effects of climate change. Green Management Plans must go beyond the simple maintenance of existing green areas, enhancing cities’ natural capital, integrating green and blue solutions into the urban fabric, and supporting climate and social justice policies. They offer solutions to:

- Mitigate climate impacts through nature-based interventions
- Increase green and blue infrastructure for greater resilience
- Reconnect urban populations with nature through accessible, high-quality green areas

Urban greenery, integrated with blue infrastructure such as waterways and artificial lakes, forms a complex and multifunctional system that provides environmental benefits (improved air quality, noise reduction, hydrogeological protection, and biodiversity conservation) and socio-cultural benefits (meeting places, educational opportunities, landscape beauty, and tourism attraction). Investing in green spaces means promoting community well-being and responding to global challenges with local, nature-based solutions. Through careful, participatory management, green spaces can become the beating heart of cities of the future.

Contents

Part I Introduction to Urban Botany

- 1 The Urban Ecosystem: Features and Needs 3**
Nicoletta Cannone, Francesco Malfasi, and Mauro Guglielmin
- 2 The Wild Plants in Urban Ecosystems: Characteristics,
Evolutionary Trends and Conservation Needs 25**
Flavia Bartoli, Francesca Bretzel, Ricardo Quinto Canas,
Giulia Albani Rocchetti, and Enrica Roccotiello
- 3 Alien Species in Cities: Issues and Threats 59**
Carmelo Maria Musarella, Ricardo José Quinto Canas,
Giulia Caneva, and Valerio Lazzeri

Part II Plants and People in Urban Botany

- 4 Traditional Ecological Knowledge Versus Plant Blindness:
Plants and Humans in Urban Areas 83**
Giulia Caneva, Ana Cano-Ortiz, Zohreh Hosseini,
Carmelo Maria Musarella, Fabio Orlandi, Miriam Patti,
Luigia Ruga, Nicolò Soldovieri, and Giovanni Spampinato
- 5 Plants in the View of Ecosystem Services and Their Role
in Nature-based Solutions 115**
Fabio Orlandi, Francesca Bretzel, Livia Bonciarelli,
Nicoletta Cannone, Simona Ceschin, Luca D'Amato,
Desirée Muscas, Marco Fornaciari, Valerio Lazzeri,
Francesco Malfasi, Valentina Savo, and Andrea Scartazza

Part III Ecological Integrated Approaches in Urban Green Interventions

- 6 Botany in an Integrated View and in One Health Perspective 151**
Giulia Caneva, Francesca Bretzel, Paolo Belardi, Marco Fornaciari,
Carmelo Maria Musarella, Valeria Menchetelli, and Daniela Romano

7	Forests, Parks and Gardens	183
	Carmelo Maria Musarella, Flavia Bartoli, Mara Bodesmo, Giulia Caneva, Eugenio Domínguez-Vilches, Marco Fornaciari, Carmen Galán, Zohreh Hosseini, Marco Maovaz, Fabio Orlandi, Aldo Ranfa, and Thekla Tsitsoni	
8	Green Ways	231
	Flavia Bartoli, Livia Bonciarelli, Giulia Caneva, Simona Ceschin, Luca D’Amato, Enrica Roccotiello, and Thekla K. Tsitsoni	
9	Green Buildings	265
	Enrica Roccotiello, Flavia Bartoli, Teresa M. Batista, Amii Bellini, Francesca Bretzel, Giulia Caneva, Carmelo Maria Musarella, Marta Pianta, and Giovanni Spampinato	