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## THE FOREST AS A KEY ELEMENT FOR SUSTAINABLE DEVELOPMENT AND IMPROVED QUALITY OF LIFE IN CITIES – SELECTED PROBLEMS AND EXAMPLES

This article focuses on the role of green and blue infrastructure, including forests, in the context of urban planning and sustainable urban development. Using an interdisciplinary approach, the authors highlight theoretical frameworks on resource management, ethics and efficiency in architecture and construction. The remainder of the paper examines practical strategies for sustainable urban development, including the application of natural solutions and resource-saving systems. The case study shows real-life examples such as the 'Madrid Metropolitan Forest' or applications in Poland, including Sopot, where greenery plays a key role in the quality of life of residents and adaptation to climate change. The article highlights that integrated green urban spaces have benefits on many levels – from energy efficiency to social well-being and public health. The authors point to a growing body of evidence demonstrating the effectiveness of nature-based solutions in the context of challenges such as urbanisation and climate uncertainty. Long-term integrated urban planning that considers these aspects is key to creating sustainable and resilient cities.

**Keywords:** urban forest, sustainability, greening strategies, resilient city

### 1. Introduction

In an era of accelerated urbanisation, where more than half of the world's population is urban, a key challenge for contemporary architecture and urban planning is to improve the quality of life in urban spaces. This issue is gaining importance in the context of the increasing number of users of urban public spaces, especially the so-called green zones. Current research and analysis indicate that the systematic reduction of green spaces negatively affects the well-being of residents, leading to the urgent need to find sustainable solutions. In this context,

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green architecture and urban planning are emerging as one of the strategic elements aimed at sustainable development and better quality of life in cities.

The European Green Deal (EGD) is a strategic policy instrument of the European Union that aims to achieve climate neutrality for the continent by 2050 and to reduce greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels. The EGD is a multidimensional construct that addresses various aspects of urbanisation and sustainable development. This is evident in energy measures, where the EGD initiative supports accelerating the transition to renewable energy sources, or in the context of mobility, where low-emission modes of transport are promoted. EGD's impact on urban infrastructure is manifested through its focus on sustainable and resilient architecture, as well as through the promotion of a circular economy. Funds and funding mechanisms, such as the European Fund for Sustainable Development, are key to implementing these initiatives at the local level. It is also worth highlighting that the EGD promotes interdisciplinary cooperation between different administrative units, the private sector and NGOs. This integrated approach to urban management not only supports adaptation to climate change, but also fosters innovation and public acceptance of ecological sustainability measures. In this way, the EGD serves as a strategic compass that guides broad actions to mitigate and adapt to climate change at the urban level in the European context [3].

The aim of this research is to analyse the role of forests in an urban context. Green systems and urban parks, or green and blue infrastructure, are identified as essential components for the effective management of urban development. The introduction of integrated green spaces cannot only enhance the quality of life by promoting social and natural functions, but also provide sustainable solutions to the problems that urbanisation and climate uncertainty bring.

## **2. Theoretical contexts**

The concept of sustainability in architecture and construction is based on clearly defined goals and principles. Thus, the principle of efficiency and economy has been introduced, which emphasises the importance of equipping buildings only with the necessary elements and energy optimisation. Thus, even buildings with low energy consumption, if they are inefficient, cannot be considered environmentally friendly. The management of real estate resources also fits into a broader ethic, suggesting that land is not just private property and therefore its management requires responsibility towards the community. In this context, both design and construction should be oriented towards the needs of the community and not just the financial benefit of the developer. In addition, it is important that the material and spiritual aspects in architecture and construction are treated as a single, integrated whole rather than as separate spheres. These principles add up to a comprehensive paradigm that guides sustainable development practices in these areas [2]. These guidelines provide

a framework for approaching sustainability in architecture and construction, promoting both efficiency and economy as well as ethics and social good. Contemporary challenges to further urban development are therefore, not about development factors, but more importantly about the search for a model or formula for such urban development, which could be called ethical development that respects the value of space and ensures the well-being of its inhabitants. Since an ethical city is both aesthetically pleasing and sustainable [13].

There are a number of proven and effective urban solutions that effectively improve the quality of the environment and urban life, as well as meeting sustainability goals. This includes a reorientation from megastructures to smaller scale buildings, which reduces the use of energy, material resources and water. The choice of low-embodied energy and locally sourced materials minimises the carbon footprint and energy required for transport. The correct solar orientation of designed buildings allows for more efficient use of energy and sunlight. The use of water-saving systems, especially in regions with arid climates, and the use of renewable and recyclable materials are important elements of sustainable architecture. In addition, analysing the location of developments from a public transport perspective and minimising the share of individual transport in terms of energy and time savings, have a positive impact on air quality. Such interventions not only serve to protect the existing urban fabric and adapt it for new functions, but also meet key environmental demands such as environmental protection and the use of renewable energy sources [9].

Nature is recognised as one of the most valuable resources for building resilience to the urban challenges of the 21st century [4]. Nature-based solutions are systemic solutions that harness nature's ability to regulate, restore and regenerate resources. There is growing evidence of the effectiveness of nature-based solutions in addressing complex urban challenges such as urbanisation and climate change. Consequently, cities are increasingly investing in a wide range of nature-based solutions as part of their adaptation and mitigation measures [10].

Recent research and a growing body of evidence suggests that close contact with nature in an urban environment is crucial to the health and wellbeing of communities [5]. Ecosystem services, or the benefits that people receive from natural ecosystems, are diverse and include the provision of clean water, climate regulation, erosion control, plant pollination and many others. These services are not only crucial for human health and well-being, but are also important for the overall stability and sustainability of cities [7]. The availability and diversity of these services in urban environments depend on many factors, such as the naturalness and biodiversity of green areas, but also on their size, design, structure, form and distribution [6].

### 3. Case study

Creating solutions at the urban scale is crucial for the effective implementation of sustainable development goals, as urban agglomerations are major centres of population concentration and economic activity. Properly designed and managed urban spaces can significantly reduce resource consumption, having a positive impact on energy efficiency, water conservation and pollution reduction. Setting standards at the urban level, such as the solar orientation of buildings or the use of low-impact materials, enables scalable and long-term benefits that translate into improved quality of life and environment on a much larger scale than individual interventions. It is also worth mentioning that integrated urban planning promotes the protection and regeneration of the existing urban fabric and innovates in terms of transport and resource management, which is in line with the demands of sustainable development and climate change adaptation strategies. Long-term urban planning for climate uncertainty can benefit from the systematic integration of resilience principles [8].

One of the more interesting concepts and examples of long-term planning is the introduction of forests into cities and their surroundings around the world. An interesting example of urban interventions in green-blue infrastructure to improve the quality of life in a city and counteract the heat island effect is found in Madrid. We are talking about a 75-kilometre-long green wall in the form of a forest to surround the city. The urban transformation concept of the 'Madrid Metropolitan Forest' consists of planting almost half a million new trees on a land area of around 14,200 hectares, which is expected to reduce heat levels and carbon dioxide emissions into the atmosphere [11]. The green ring road of the Spanish capital, by the way, links the natural areas of the Manzanares and Jarama rivers in the south-east of the city and El Pardo in the north, among others, into the system. The project also includes a connection to the existing north-west section of the green cycle ring via the restored San Fernando Bridge. New routes and pedestrian and cycle infrastructure are also envisaged, including the restoration of a natural path along the riverbank. This large-scale investment has been planned over a 12-year period and has been divided into five areas, given the varying conditions, including landscape and environmental.

Greenery is treated as a valuable component in rankings of sustainable cities also in Poland [1]. In the cities at the top of the rankings, the largest area of green space is occupied by forests, which usually grow on the outskirts of cities acting as so-called green lungs. An example of a Polish city with a considerable amount of forest area is Sopot (59 % of the city's area is occupied by green areas). It is interesting to note that Sopot also dominates in the ranking of hedgerows, with nearly 3 km of hedgerows growing within 1 km<sup>2</sup>. The precise definition of actual green areas combines data from the 'Real Vegetation Maps' and areas supporting green areas, including forests and spaces according to local plans intended for urban greenery, but in fact those yet to be planted.

Observing the need for change and the maturing of society to invest in urban greenery, measures have been introduced to revitalise green spaces. One example is the modernisation of Pole Mokotowskie Park, which is one of the largest parks in the Polish capital. The idea of restoring endogenous vegetation in the park was initiated by local residents. The project includes numerous greenery plantings, including more than 6,000 shrubs, 17,000 perennials and nearly 1.5 ha of meadows, as well as thousands of climbers, bulbous plants, rushes and aquatic plants. Thanks to the capital's nature watch, the inventoried stand of nearly 10,000 trees will be enriched with 55 tree plantings. The planned revitalisation will include the creation of educational gardens, new recreational areas and the introduction of diverse greenery into the existing establishment. The existing water reservoir is to be returned to nature by unclogging the concrete restrictions and introducing wildlife as a return of the park's natural water system. The visual quality of the Park will change dramatically and its biodiversity will be enriched. Interestingly, there is a Ryszard Kapuscinski Path in the Park and the revitalised facilities are to become a place of cultural and social activity as a thread to link the space with non-fiction. As a separate investment, the existing Finnish cottages, including the house of Ryszard Kapuściński, will be renovated.

Citizen movements play an important role in protecting existing forest resources. Thanks to their actions, in Warsaw, for example, from 1 January 2022, thanks to the Charter on the Rights of Trees signed by the Mayor of the Capital City of Warsaw, every urban tree will not disappear without the knowledge of residents, and all municipal units and district offices will be obliged to notify the reason for any planned tree cutting. The standards contained in the Tree Rights Charter define the protection and improvement of trees, instructions for controlling their health and specify the conditions for their protection during investment processes. The Tree Rights Charter was created as a response to the needs of residents resulting from their involvement and sense of shared responsibility for Warsaw's greenery, and it also includes principles for designing and caring for urban low-growth greenery, taking into account galloping climate change.

The Tree Felling Information Standard set out in the Tree Rights Charter is intended to provide easy access to proven environmental content. The system itself has been implemented successively by the Warsaw Greenery Board. For many years, legal protection of trees in the capital is part of a modern system of urban greenery management, including the review and care of trees and compensatory plantings [12]. Warsaw is the first city in Poland to develop uniform standards for urban greenery management. The Tree Rights Charter and accompanying documents will unify the principles of tree review and care, developed and applied successfully for several years by the Greenery Board.

But in addition to large-scale interventions in the spatial and functional structure of urbanised areas, local interventions of a small spatial scale and scope are also important. The availability and attractiveness of green areas, parks

and riverbanks is expected to encourage residents to walk, cycle, rollerblade, run and do all kinds of physical activities, which can also increase social contact and bring people back to nature. Measures aimed at implementing better, more efficient and functional solutions in existing green spaces aim to improve the quality and above all the frequency of use of urban green spaces by the public.

#### 4. Summary

Climate change poses a number of challenges for cities, ranging from extreme weather events such as hurricanes, floods or heat waves to longer-term problems such as rising sea levels and changes in the availability of drinking water. In order to counter these threats, cities need to apply a series of transformations at different levels of planning and management. Therefore, in order to be able to adapt to changing circumstances, such as the effects of climate change, it is necessary to create new structures and procedures for the governance and management of public and common goods.

The study presents a selection of problems and some interesting characteristic examples of introducing woodland areas into urban space or protecting existing tall green resources. Green spaces such as parks and rain gardens can help to manage stormwater, reduce the urban heat island effect and improve air quality. Urban vegetation can also serve as 'biological water pumps', reducing the risk of local flooding. The use of Big Data and smart technologies, as in Warsaw, can help monitor and manage urban resources, allowing for a more efficient and flexible response to climate change risks. Effective adaptation to climate change in an urban context is not only a technical issue, but also a social and economic one. These transformations are key to the sustainability of cities and the protection of their inhabitants in the face of an uncertain climate future.

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