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Urban settlements adaptation. Measures for neighbourhood plans

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Abstract Urban areas are particularly vulnerable to climate change due to the presence of a high proportion of population, economic activities, real estate and water, energy and transport infrastructure; extreme weather events climate events such as heavy rainfall, droughts and heat waves, cause impacts whose severity varies according to local vulnerabilities, thus putting the health and safety of inhabitants at serious risk. Faced with these growing risks, cities are increasingly looking to adaptation as an integral part of urban development to increase resilience to climate change and promote urban sustainability. Undoubtedly, urban planning processes can effectively address climate adaptation objectives by incorporating a multi-dimensional approach. They can link adaptation policies with local transport, biodiversity and health-related policies to determine the scale, mix and design of development to ensure resilience to climate impacts. As part of an ongoing research project, the contribution aims to investigate solutions that can be used at the neighbourhood scale to support climate resilience. In particular, it focuses on neighbourhood-scale developments, incorporating principles such as mixed land use, social diversity and the creation of green spaces to address climate challenges. It then considers solutions for sustainable urban drainage such as watersquare, water collection and reuse system and permeable surfaces.
Acting on adaptation targets, the research aims to promote efficient use of urban space.

Keywords: Climate change, adaptation, urban planning

1. Introduction

Climate change is continuing with increasing intensity, forcing cities to take actions to prevent risks and adapt urban spaces to new conditions (Pancewicz et al., 2023). Ongoing and imminent changes are determining new directions and strategic goals for urban policy and pointing to the need to shape urban spaces, taking into account the challenges posed by potential hazards (Carter et al., 2015). Cities, by concentrating people, businesses and institutions, represent not only places of enhanced and clustered vulnerability to climate change, but also places of unique opportunity. Cities are at the forefront of addressing the challenge of climate change, both in terms of direct mitigation and adaptation efforts and resilience building.

Considering the growing economic, social and urban vulnerability of cities, the rapid depletion of resources, the increasing number of disastrous natural events and the progressive environmental degradation of urban centres, adopting adaptation-based planning strategies may be one of the solutions. Adaptation to climate change can be defined as "as an adjustment in ecological, social or economic systems in response to observed or expected changes in climatic stimuli and their effects and impacts in order to alleviate adverse impacts of change or take advantage of new opportunities" (Neil Adger et al., 2005).
This article is focused on the issue of urban planning and design as tools for building specific urban resilience to climate change with reference to urban form. Although the importance of climate adaptation is widely recognized, a significant gap remains in the availability and application of concrete planning and design instruments capable of operationalizing adaptation strategies at the local scale.
The objective of this contribution is to bridge this gap by exploring practical measures that can be integrated into urban planning processes to support climate adaptation. Specifically, it focuses on adaptation actions that can be conceived and implemented within urban spaces, with the aim of embedding resilience directly into the fabric of neighbourhoods. Building on an ongoing research project (Cicalese & Fasolino, 2024), the article presents spatial and design solutions at the neighborhood scale, promoting a multidimensional approach that integrates climate adaptation into urban planning frameworks.

2. Adaptation Measures for Neighbourhoods

The developed methodology relies on strategies for the creation of efficient settlements, according to multiple aspects (such as social, environmental, and economic), developing an assessment method and indicators to measure urban settlements efficiency at local scale. In this context, climate change adaptation strategies are considered significant. The research, with a holistic view, covers various topics, including environmental and social sustainability, economic development, and urban resilience. The theoretical foundation of this holistic framework for sustainable urban design draws from several interconnected concepts in urban planning and sustainability. The research adopts a multi-criteria framework for identifying and evaluating adaptation

measures at the neighbourhood level. It combines literature review and case study comparisons to define a set of actionable solutions. In particular, the study identifies a series of measures that can be embedded within neighbourhood plans to enhance urban climate resilience. Some key focus areas include green infrastructure, compact urban forms, mixed-use and water management.

2.1. Urban green infrastructure

One crucial aspect is the creation and expansion of green spaces. Urban green spaces - such as parks, urban forests, and ecological corridors - play a critical role in mitigating heat stress, improving air quality, and promoting biodiversity. Through mechanisms like evapotranspiration, direct shading, and the lower heat storage capacity of vegetation compared to built surfaces, green spaces help regulate urban temperatures. Increasing urban greenery, especially in densely built-up areas, is therefore recognized as a valuable adaptation response. Furthermore, green infrastructure contributes to creating more attractive, healthier urban centres, which in turn support economic development and enhance social well-being.

2.2. Water management

To address the increasing frequency of extreme rainfall, the integration of Sustainable Urban Drainage Systems (SUDS) solutions is essential. These systems include a wide range of system typologies ranging from green roofs, rainwater harvesting systems, permeable pavements, bioretention areas, infiltration trenches, etc.. These contribute to reducing the pressure on conventional drainage infrastructure, thereby mitigating urban flood risks, while simultaneously improving microclimatic conditions and contributing to urban biodiversity. The research also highlights the importance of water collection and reuse systems, which support water conservation and resilience to drought. Water squares, public spaces intentionally designed to temporarily store rainwater, represent solutions that combine flood mitigation with the enhancement of public realm quality. These nature-based solutions not only mitigate risks but also add recreational and aesthetic value to urban environments.

2.3. Compact and mixed urban forms

Another key principle is the promotion of compact, mixed-use urban development. Compact urban forms, characterized by higher densities and efficient land use, help reduce land consumption, improve accessibility, and lower greenhouse gas emissions by encouraging walking, cycling, and the use of public transportation. A mixed-use development with the integration of residential, commercial, and recreational spaces promotes social interaction, reduces transportation needs, and enhances residents' overall quality of life. This approach aligns with trends in urban planning that prioritize walkability and community cohesion.

3. Conclusions

Urban adaptation is no longer a future-oriented goal but an urgent necessity. In the face of increasing climate challenges, urban planning must prioritize adaptation strategies that enhance the resilience and livability of cities. Neighbourhood-scale planning offers a concrete pathway for integrating resilience measures into the everyday fabric of cities. Adaptive instruments aimed at building urban resilience to climate change should be implemented systemically and strategically, through planning tools to design and technical solutions (Rędzińska & Piotrkowska, 2020). By acting on urban form, infrastructure, and socio-spatial organization, planners can ensure that adaptation is not an add-on, but an embedded principle of sustainable urban development. The research underlines the necessity of moving from isolated interventions to systemic strategies that recognize the interdependencies between climate resilience, social inclusion, and urban quality. Neighbourhood plans represent a promising scale of action, where adaptation can become a tangible component of daily urban life. This contribution calls for further research and experimentation on context-specific solutions and for the institutionalization of adaptation targets in the planning process.

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