

Urban Green Infrastructure (UGI) and Nature-Based Approaches (NBS) in the Context of Green Cities

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***Corresponding author:** Ogenis Brilhante, Green-Ogenis Consulting, Netherlands

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Ogenis Brilhante^{1*} and Julia Skinner²

¹Green-Ogenis Consulting, Netherlands

²Institute for Housing and Urban Studies (IHS/EUR), Netherlands

Opinion

In the Green City Conceptual Framework (GCCF) [1,2] developed by the Urban Sustainability and Climate Change Resilience Department (USCCR) from the Institute for Housing and Urban Development Studies (IHS) in Rotterdam (Holland), the promotion of the extensive use of greenery, the second entry point of this concept, is linked to the idea of bringing back nature to cities. This advocates for an equal balance between green and built spaces through the extensive use of greenery practices, such as increasing the presence of multifunctional Urban Green Spaces (UGS) in combination with water resources, whenever possible, green roofs, green facades, green linear corridors, etc.

Greenery contributes to: An increase in the quality of citizens' lives; an improvement in health, aesthetic values, and city attractiveness; a reduction in environmental pollution, climate change impacts, and heat islands; to the creation of a local microclimate; helping mitigate GHGs (carbon sequestration); reducing urban floods, and to adaptation to climate change [3,4]. All types of UGS contain infrastructure and have the potential to provide benefits to people, so-called ecosystem services. The ecosystem services concept helps define, assess, and value the multifunctional character of UGS [5]. UGS can make important contributions to climate protection and adaptation to climate change, through the use of ecosystem-based approaches and Nature-Based Solutions" (NbS) as part of Green Infrastructure (GI).

Currently, many authors and organizations are using Nature-Based Solutions (NbS) as a substitute for Urban Green Infrastructure (UGI) to deal with urban sustainability and climate change problems. This opinion paper argues that NbS is more a tool than an infrastructure. However, when NbS is used through the tested methods and design principles of UGI it can bring stronger benefits to help cities become greener (more sustainable) and effectively tackle climate change related problems than NbS alone [6].

Ecosystem Services (ES) is a strategy integrating the management of land, water and living resources that promotes conservation and sustainable use in an equitable way and aspires to maintain the natural structure and functioning of ecosystems [7]. ES approaches are a driving force for sustainable development, as they find their input directly into urban planning. The two main approaches for ecosystem services are Ecosystem-Based Adaptation (EbA) and Ecosystem-Based Mitigation (EbM) [6]. EbA and EbM build on the United Nations convention for the Conservation of the Biological Diversity (CBD). It addresses the crucial links between climate change, biodiversity, ecosystem services and sustainable resource management and thus have the potential to simultaneously contribute to the avoidance and reduction of greenhouse gas emissions and the enhancement of sinks.

Nature-based Solutions (NbS) are actions to protect, sustainably manage and restore natural and modified ecosystems in ways that they address societal challenges effectively and adaptively, to provide both human well-being and biodiversity benefits [6]. Examples of NbS to climate change include, among others, allowing forests to regrow, restoring coastal wetlands, using urban green spaces and permeable pavements to infiltrate heavy rainfall

episodes to reduce floods, etc. In many cities, NbS are being carried out as new infrastructure solutions aimed at addressing challenges related to climate change, ecosystem resilience, human well-being, and health [8].

UGI means different things to different people, depending on the context in which it is used. Initially it was defined as the interconnected network of multi-functional green spaces. Nowadays the term has been extensively used in relation to managing storm water and reducing floods. UGI aims to: reintroduce the hydrologic and environmental functions that are altered with conventional storm water management; infiltrate rain water using semi or permeable surfaces such as interlocked bricks; mitigate and adapt sites to climate changes impacts by creating and manage Urban Green Spaces (UGS) using ecosystem services and Nature Based Solutions (NbS), and improve urban beautification by building multi-functional urban green spaces such as green linear corridors, wetlands, green roofs, vertical farms, parks with ponds, etc. [7-10]. For the European Commission UGI is defined as a “strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services” [9]. It includes parks, open spaces, playing fields, woodlands, wetlands, road verges, allotments and private gardens. Green infrastructure also incorporates blue infrastructure including sustainable urban drainage, swales, wetlands, rivers and canals and their banks, and other water courses.

Green spaces or connections can be considered as infrastructure because simple things like trees, green spaces and water courses can provide valuable services in an ecological sense. Green infrastructure can deliver different functions and services such as shelter, access, green corridors for transport, biking and walking, sustainable urban drainage, pollution mitigation and food production-as part of a wider ecosystem. This multifunctional nature of GI is one of its intrinsic benefits and can operate at differing levels. Individual elements can serve a useful purpose, without being connected. However, when GI components are linked together to form green networks further combined benefits can be achieved at a strategic level [11]. GI is based on the principle that protects and enhances nature and natural processes. The benefits human society gets from nature are consciously integrated into spatial planning and territorial development. Compared to single-purpose grey infrastructure, GI has many benefits. It can sometimes offer an alternative, or be complementary, to standard grey solutions [9].

UGI principles such as connectivity, multifunctionality, multi-scale and integration are important elements to promote and simplify the development and use of GI by different academic, planning and implementing organizations. They help practitioners and decision makers during the conceptualization and planning of GI. They help to ensure that GI contributes to a network of quality and functional green spaces, that can meet the needs of a determined urban area and contribute in the best way to the sustainability of a given region or local area, depending on its scale [10] Multifunctionality and integration are two key UGI principles.

Multifunctionality means that multiple ecological, social, and also economic functions, goods and services shall be explicitly considered instead of being a product of chance and integration during the planning process. Integration considers urban green as a kind of infrastructure and seeks the integration and coordination of urban green with other urban infrastructures in terms of physical and functional relations (e.g. built-up structure, transport infrastructure, water management system) [10].

Conclusion

NbS and UGI both share more or less the same objectives to maintain and increase resilience, reduce vulnerability of people and ecosystems, and restore damaged habitats that face the adverse effects of climate change. UGI and NbS complement each other. The authors of this opinion paper consider the urban green as a kind of infrastructure, and as substantial parts of cities are made up of infrastructure, the extensive use of GI through (NbS) incorporating EbA and EbM approaches can contribute more effectively to increasing urban greenery, helping to achieve a better balance between green and built spaces in cities, adapting to the impacts of climate change and helping cities to become greener than NbS alone can.

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