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Green Infrastructure for the city of the future. Perspectives from Europe

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Abstract

Le green infrastructure urbane (Ugi) rappresentano un nuovo approccio allo sviluppo di reti di spazi verdi e blu che offrono molteplici vantaggi alla società. Le Ugi offrono il potenziale per affrontare con successo le principali sfide dell'urbanizzazione, per migliorare la qualità della vita e promuovere la trasformazione verso la sostenibilità e la resilienza climatica. Il contributo si basa sui risultati del progetto Green Surge finanziato dall'Unione europea per sviluppare ulteriormente il concetto e la pratica delle Ugi. Esplora le basi concettuali delle Ugi, fornisce informazioni sullo stato dell'arte delle Ugi in Europa e presenta alcuni casi di buone pratiche per la corretta pianificazione e attuazione delle Ugi. Vengono formulate raccomandazioni per l'ulteriore avanzamento della pianificazione delle Ugi che includono la necessità di adottare un approccio integrato basato sull'evidenza e su dati concreti utili alla pianificazione delle Ugi. Le strategie visionarie dovrebbero essere collegate a diversi mezzi di attuazione. È importante sottolineare che è necessario uno sviluppo collaborativo e partecipativo delle Ugi per colmare diverse politiche settoriali e collegare le iniziative della società civile con approcci guidati dal governo per lo sviluppo delle Ugi.

Urban green infrastructure (Ugi) is a novel approach to developing networks of green and blue spaces that provide multiple benefits to society. Ugi has the potential to successfully address major challenges of urbanization for improving quality of life and advancing their transformation towards sustainability and climate resilience. The background paper is based on the outcomes of the European Union FP7 funded project Green Surge to further develop the concept and practice of Ugi. It explores the conceptual foundations of Ugi, provides information on the state of the art of Ugi in Europe and presents some good practice cases for the successful planning and implementation of Ugi. Recommendations for the further advancement of Ugi planning are made that include the need for adopting an evidence-based and integrated approach to Ugi planning. Visionary strategies should be linked with different means for implementation. Importantly, collaborative and participatory development of Ugi is needed that bridges across different sector policies and links civil society initiatives with government-led approaches to the development of Ugi.

Parole chiave / Keywords

Green Surge, Pianificazione informata, Processi pianificatori partecipati, Resilienza climatica / Murban landscape, Multifunctionality, Connectivity, Integration, Social inclusion

Introduction

Green infrastructure emerged in the 1990s in the United States in response to the challenges of sprawling urban growth that has caused the widespread loss and fragmentation of natural areas. Green infrastructure seeks to counter these trends by developing coherent networks of multifunctional green and blue spaces that are planned and implemented "in concert with land development, growth management and built infrastructure planning" [Benedict and McMahon 2002: 5], rather than doing "conservation in isolation from – or even in opposition to – development" (*ibidem*). In this context, it has been stressed that green infrastructure should be considered just as critical for the sustainability of human society as social and technical infrastructures.

The European Union is promoting green infrastructure as a whole landscape approach both in rural and urban areas since publication of its communication "Green Infrastructure (GI) — Enhancing Europe's Natural Capital" [EC 2013]. Consequently, it has funded research to advance the uptake of green infrastructure, emphasizing urban areas.

Green Surge (greensurge.eu) was a large research project funded in Eu RtdFramework Programme FP7 between 2013 and 2017. A consortium of 23 organisations collaborated in this project to consolidate Ugi's conceptual and methodological foundations, improve understanding of Ugi benefits and values and study Ugi planning and governance. Urban learning labs were instrumental for a transdisciplinary approach whereby science collaborated with practice (Pauleit *et al.* 2019).

In the following background paper, we will provide insights from Green Surge with a focus on Ugi planning to:

- Discuss the conceptual foundations of Ugi as a strategic planning approach
- Give an overview over the state-of-the-art of Ugi planning in Europe
- Present selected cases of good practice of Ugi planning
- Highlight success factors for Ugi planning

Ugi as a planning concept: definition, goals and principles

The concept of green infrastructure has been defined and applied in several ways. Still most frequently quoted is the definition given by Benedict and McMahon [2001:5], whereby green infrastructure is understood as "an interconnected network of green space that conserves natural ecosystem values and functions and provides associated benefits to human populations". The European Commission has widened this definition in ways which are important for application in human dominated landscapes such as

urban areas by emphasising that natural and semi-natural areas can be part of green infrastructure, which is "designed and managed to provide a wide range of ecosystem services" [EC 2013:5; underscores by the authors]. In Green Surge, the definition was further developed for urban green infrastructure (Ugi) as a planning approach (Box 1).

Box 1: Green Surge definition of urban green infrastructure (Ugi) planning (Hansen *et al.* 2016:15)

Ugi planning is understood as a strategic planning approach that aims at developing networks of green and blue spaces in urban areas designed and managed to deliver a wide range of ecosystem services.

Interlinked with GI planning on a landscape scale, Ugi planning aims at creating multifunctional networks on different spatial levels, from regional to city and neighbourhood planning.

Due to its integrative, multifunctional approach, Ugi planning is capable of considering and contributing to a broad range of policy objectives related to urban green space such as conservation of biodiversity, adaptation to climate change, and supporting the green economy.

A wide range of green and blue spaces can become part of Ugi (Fig. 1). Remnants of natural areas such as woodland, historical land use areas, extensive grazing land, and derelict land where succession occurs ("urban wilderness", Kowarik 2011) are target areas for Ugi. Yet, also green and blue spaces that have been designed and managed by humans such as parks, gardens, street tree plantings and green building elements like green roofs and green façades can and need to become part of green infrastructure, as they can function to provide habitat for plants and animals, offer valuable spaces for recreation, or provide regulating ecosystem services such as cooling the city on hot summer days. A comprehensive typology of Ugi types was prepared in the Green Surge project [Cvejić et al. 2015]. Of these different Ugi types, public green spaces play a key role to develop overall coherent networks of green infrastructure, but it should be noted that the majority of tgreen space is in private ownership. There is broad evidence from research that urban biodiversity conservation, urban cooling, storm water retention, and nature experience provision requires consideration of the entire urban open space [e.g. Beninde et al. 2015; Haase 2009; Irvine et al. 2010; Li et al. 2012]. In highdensity urban environments, hybrid spaces where urban green is combined with grey infrastructure are also becoming increasingly important (e.g. Depietri & McPherson 2016).



Fig.1. An urban green infrastructure network can be made up of many elements – from remnants of natural areas to more technical solutions like roof greening (with permission from: Hansen *et al.* 2017)

To unfold its full potential, Ugi should be designed and managed to meet multiple objectives of urban development simultaneously as illustrated in Figure 2. For this purpose, planning of Ugi needs to be grounded in principles related to its content and process. In Green Surge, several principles were identified to characterise Ugi planning, with four lying at its core (Box 2). Other principles such as multiscale planning also need to be considered. None of these principles is new; it is their combination that makes Ugi a distinct planning approach.



Fig.2. Ugi planning should strive to achieve several goals simultaneously (with permission from: Hansen *et al.* 2017)

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Box 2: Ugi planning principles (Hansen *et al.* 2016:15, changed).

Integration – combining green with grey infrastructures such as built-up structures, transport infrastructures and water management systems that are more efficient, multifunctional and resilient.

Connectivity – creating green space networks in order to enhance social connectivity (for better accessibility, recreation), ecological connectivity (dispersal of plants and animal) or abiotic connectivity (regulating water flow or climate functions).

Multifunctionality – delivering multiple ecosystem services by their explicit consideration in Ugi planning to create synergies while reducing conflicts and tradeoffs between different green space functions.

Social inclusion – collaborative and participatory planning to discover and balance the interests of different stakeholders in order to reach a higher level of accessibility to green space services and benefits, with a special emphasis on vulnerable social groups.

State and good practice of Ugi planning in Europe

What is the current situation of Ugi planning in Europe? Is it already compliant with the conceptual approach outlined before? In Green Surge, 20 European urban areas were studied to assess the state of the art and identify good practice for Ugi planning (see Davies *et al.* 2015 for a full account of the study). Results showed that all of the urban areas had some kind of strategy for their green spaces in place. The strategies differed broadly in terms of their size and quality. The term green infrastructure was used only in one case. Moreover, the traditional concerns of green space planning, i.e providing spaces for recreation, were clearly in focus. Biodiversity was also mentionedfrequently. Mitigation and adaptation to climate change was an emerging issue that should be considered more often in future Ugi planning. Even more, little attention was given to the goals of social cohesion and that of promoting a shift towards a green economy.

Of the Ugi principles, connectivity and multifunctionality of green spaces were mentioned frequently in planning documents and interviewed planners showed familiarity with these concepts. However, the consideration in planning documents was often very limited, i.e. more often than not, connectivity thinking only concentrated on an unspecific spatial linkage of green spaces or served just one purpose such as for habitat corridors. Concerning multifunctionality, only a small number of green space functions were usually mentioned, while issues of how to create synergies and minimize trade-offs were hardly treated at all. Mostly, the documents revealed a lack of available baseline information, e.g. from spatially explicit assessments of biodiversity, green space use and perception, and ecosystem services as a basis for the planning of connectivity and multifunctionality. The principles of green-grey integration and a socially-inclusive approach to Ugi planning were the least considered but urban areas in northern and central Europe were more advanced in this respect.

The survey thus showed that there still is ample scope for improving the current practice of green space planning by following the concept of Ugi. At the same time, rich material on good practice showed how the different Ugi goals and principles can be put into practice. Some examples related to Ugi principles are presented in Boxes 3-5.

Box 3: Green-grey integration in Malmö

The Swedish city of Malmö (appr. 300,000 inh.) is situated on soils from glacial till with a reduced capacity to infiltrate water during heavy rainstorms. Moreover, high levels of impervious surfaces due to urban growth generate more storm water runoff. Local flooding is frequently experienced as a consequence. The City of Malmö is responding to these challenges both at the level of strategic planning and local projects. Strategies, plans and policies promote the integration of storm water facilities into the city's green structure. Projects such as the regeneration of Augustenborg, a multi-storey housing area from the 1950s, and the Bo01, a building exhibition area from the early 2000s, have served as testbeds for local storm water management that create synergies with multifunctional green infrastructure (Fig. 3). A "Malmö Water Plan" has been under development containing a "Storm Water Plan" and a "Cloudburst Plan" which is aligned with the development of Ugi (still ongoing when the project came to its end).



Fig. 3. Sustainable urban drainage systems are integrated into the green spaces of Bo01, a new residential area in Malmö (Images: S. Pauleit).

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Box 4: Creating multifunctional green space corridors in Berlin

The city of Berlin makes great efforts to create physically connected networks of green spaces that provide multiple functions. The Landscape Programme (2016), which is binding for authorities, designated priority areas for developing green corridors that connect existing green spaces in an inner and outer ring and two green axes. The corridors will promote connectivity between habitats, bring cool air to the inner-city, better link recreational areas and enhance scenery. Required nature compensation for urban development elsewhere in this densifying city is used as an instrument to create new green space corridors in the target areas (Fig. 4). An example is the Schöneberger Loop, a seven kilometre long green space corridor on former railway area in the heart of the city.



Fig. 4. a) the priority areas for green space corridors in the General Urban Mitigation Plan (with permission from: Senatsverwaltung für Stadtentwicklung und Umwelt 2015), and b) the Schöneberger Loop - a recently created green space corridor on former railway land (Image: R. Hansen)

Box 5: Socially inclusive Ugi planning in Aarhus

Improvement of green spaces has been an important element of the regeneration of Gellerup, Aarhus, a social housing area that had been classified as a slum due its manifold social problems (Fig. 5). A range of participation tools were used such as public hearings, participatory workshops (in different languages), and joint walks to involve the inhabitants, of which over 75% come from non-western countries. Particular efforts were made to reach out to women and young people, which are usually difficult to involve, for instance by employing "leisure time workers" from different ethnic groups that served as middlemen. The regeneration plan is being implemented over a 20-year period.



Fig. 5. The Gellerup housing area, a successful case for participatory planning of Ugi (with permission from: SLA Architects 2014, p. 23)

Success factors for Ugi planning

Several key requirements were identified in Green Surge for the successful planning of Ugi [Davies *et al.* 2015]:

- Ugi needs to be planned according to local needs and conditions with a comprehensive social, ecological and economic perspective on urban green spaces.
- Systematic assessments are required for evidence based planning of Ugi as well as investments into Ugi which clearly depict the value of urban green and blue spaces. In this context, it is recommended to conceive of Ugi planning as an inter- & transdisciplinary approach that builds bridges between different scientific disciplines and practice. Approaches such as urban learning labs (see Pauleit *et al.* 2019) if well planned, are an appropriate tool for such an approach.
- Ugi strategies should be visionary, but also flexible for integration into different plans, policies and instruments, also at different spatial scales, and underpinned with different means for implementation. Short-term local actions should be related to medium-and long-term actions in a strategic planning process.

- Adopting an incremental process with a stepwise progression, from awarenessraising to spatial implementation is key, as is creating room for experiments for learning and adaptive planning.
- Formal and informal planning instruments as well as regulations and incentives should be combined and linkedto different spatial scales.
- Good cooperation across administrative sectors and collaboration with nongovernmental stakeholders in co-governance arrangements is key to successful Ugi planning and development. A good relation to different actor groups should be sought and citizen-led initiatives should be supported as they can make important contributions to the development of Ugi.

Guides for Ugi planning and governance were produced within the Green Surge project, providing literature-based evidence for implementing Ugi planning and governance as well as presenting project outcomes, bringing together case studies, key messages and practical resources, including a checklist for self-evaluation [Hansen *et al.* 2017; Ambrose-Oji 2017]. These can be downloaded from the project's website (greensurge. eu).

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