

Planning multifunctional green infrastructure in urban areas – advanced approaches based on case studies from Denmark, Germany and the UK

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Introduction

Green infrastructure (GI) is considered to be a planning concept that has potential to improve green space planning in urban areas by offering a holistic, integrated approach (e.g., Pauleit et al., 2011; Davies et al., 2015). In this paper we focus on multifunctionality as an important principle of GI planning. By scrutinizing case studies in Germany (Berlin), the UK (Edinburgh), and Denmark (Aarhus), we examine how multifunctionality is acknowledged by urban green space practitioners and provide recommendations on how to consider multifunctionality more proactively and comprehensively.

Background

The principle of multifunctionality– together with connectivity – is considered to be a core element of GI planning (Kambites and Owen, 2006; Pauleit et al., 2011) and is lately often linked to the notion that GI is supposed to provide multiple ecosystem services (e.g., Mazza et al., 2011; Lovell and Taylor, 2013). Multifunctionality implies that multiple ecological, social and also economic functions or services are explicitly considered in green space planning instead of being regarded as a product of chance (Pauleit et al., 2011). It also means aiming at intertwining or combining different functions and thus using limited space more effectively (Ahern, 2011).

A review of urban green space planning practice in Europe by Davies et al. (2015) revealed that several ecological and social functions or services of green space are mentioned in plans and taken into account by planners. Nevertheless, increasing multifunctionality is rarely mentioned as an explicit planning aim. In general, there seems to be uncertainty about how to actively plan and design for multifunctionality of GI (Sussams et al., 2015).

This extends into academia, where multifunctionality and ecosystem service assessment approaches tend to focus on mapping and assessing single functions and services instead of considering their interlinkages, synergies, and

potential trade-offs (Hansen and Pauleit, 2014). However, as a holistic and integrated approach, GI planning for multifunctionality must offer more than mapping and quantifying services. It should also not be understood in a sense of “the more functions the better” (Roe and Mell, 2013), but correspond to the capacity of a certain green space type to provide services (e.g., forests provide different services to different degrees than ornamental parks or allotments). To avoid negative outcomes and trade-offs between functions and services, an understanding is needed of 1) the relationship between GI and individual benefits and 2) the kinds of interrelations, synergies and trade-offs between these benefits (Sussams et al., 2015).

Methods

This paper sheds light on how cities approach these aspects of multifunctionality in green space planning by examining three case studies. These cases are all part of GREEN SURGE, an EU 7th Framework Programme research project where further development of urban GI as a strategic planning approach is one of the major aims. The material used for analysis was based on interviews with local stakeholders and a review of planning documents and other written material (Hansen et al., 2016). Data collection was done by researchers familiar with green space planning in the respective cities.

Results

To capture a variety of interpretations of multifunctionality the case studies represent green space planning approaches with different focus and on different spatial scales: 1) a strategic framework for landscape planning (Berlin), 2) a city-wide green space plan with action plans on the neighbourhood level (Edinburgh), and 3) a local green space development plan prepared as part of an urban renewal project (Aarhus).

Case 1) Berlin: The Landscape Programme (LaPro) is an important strategic instrument to ensure that ecological concerns are incorporated into urban development and to provide green spaces for recreation in the city of Berlin. The LaPro is currently being updated and the 2015 draft aims at a strongly integrative approach, seeking to create close linkages to urban development (Senatsverwaltung fuer Stadtentwicklung und Umwelt, 2015). This means, for instance, including projected urban development areas into the habitat network to provide additional habitats for species.

The LaPro contains four thematic plans: 1) a “Habitat network” plan to protect urban biodiversity; 2) the “Natural environment” plan which includes measures for climate change adaptation; 3) the “Recreation and use of green

spaces” plan; and 4) the “Scenery” plan, the latter two of which focus on increasing quality of life for humans. In addition, as a fifth plan, the “General Urban Mitigation Plan” (Gesamtstädtische Ausgleichskonzeption – GAK) is an instrument for implementing landscape measures based on the legally binding impact mitigation and compensation regulation under the Federal Nature Conservation Law. With the different thematic plans in place, multiple functions and services of Berlin’s urban green spaces are taken into account and linked up as priority areas for action in the GAK. This way, the GAK promotes multifunctional development of Berlin’s green space network. The version from 2004 facilitated park projects such as the “Park auf dem Nordbahnhof” which was envisaged to provide an attractive place for recreation, function as a green corridor, respond to the history of the place as part of the Berlin Wall, and promote biodiversity through lush spontaneous vegetation.



Figure 1. The Park auf dem Nordbahnhof in Berlin is characterized by spontaneous vegetation with extensive use and maintenance with interspersed “isles” for intensive recreational use (R. Hansen)

As a result of the current population growth and related urban development in Berlin, decision-makers become increasingly aware of the need to secure and improve quality of life in dense urban areas and thus promote multifunctional solutions. Population growth, however, brings about a simultaneous and conflicting process of increasing pressure on urban green spaces. Brownfields such as former railway areas developed into habitats of interest for biodiversity conservation but are also considered for urban development. The landscape planning authority aims at maintaining corridor functions and improving the habitat quality for rare species in development areas but is aware that remaining habitats will be too small for certain species such as birds.

Furthermore, Berlin's natural and semi-natural green space also needs to be accessible for humans. This requires a careful balancing of conflicting interests and solutions such as zoning and visitor management on a case-by-case basis.

Case 2) Edinburgh: The Edinburgh Open Space Strategy (OSS) is a plan of the City of Edinburgh Council (CEC) and aims to provide multifunctional green spaces in the city. The OSS comprises three core components: the audit, the standards, and action plans (CEC 2009 and 2010). The audit took place in the years 2008-9, classifying all significant open spaces of 500 square meters and larger and providing basic information about quantity and quality of different types of open space. The audit provides quality assessments for Council-owned parks and gardens, residential amenity spaces, green corridors, cemeteries and other semi-natural green spaces (e.g., sports areas) using three different grades: poor, fair and good. Extensive consultation of citizens and stakeholders helped to improve green space standards by taking the needs and demands of different types of users into account.

During the audit, the quality of green spaces was assessed based on criteria to measure different green space benefits. These criteria covered the quality from a human user (access and appearance) as well as biodiversity (diversity of habitats and connectivity) perspective. In addition, the suitability for green space uses that need facilities (e.g., informal ball games or dog exercise) was recorded and the appropriateness for others uses such as cycling or picnicking was assessed in relation to the context (i.e. size, location, adjacent use), all of which contributed to the overall quality score.

Together, the audit and the standards support the delivery of multifunctional green spaces providing both ecological and social functions. Furthermore, the OSS was developed in cooperation between the Planning Department and other CEC departments. As a result, it has become a plan that is used across different departments and has improved strategic investment in green spaces. Along with the OSS, 12 neighbourhood action plans were introduced to improve green and open space provision across the city in line with the standards. These standards aim for providing adequate access to a high quality a) local green space, b) large green space and c) play space for all of the city's residents. The OSS is currently being reviewed, with plans for updates every 5 years.

Case 3) Aarhus: In 2007, the municipality of Aarhus decided to develop a new masterplan to transform the Denmark's largest social housing area, Gellerup, from a socially disadvantaged housing estate into an attractive urban area. The masterplan, subtitled "New multifunctional urban district in Aarhus" (Aarhus

Municipality, 2011) was intended to radically transform the Gellerup area from a monofunctional housing estate with high unemployment, high crime rates, and a weak sense of safety into a multifunctional urban district with new residences, institutions and workplaces.

Large-scale green space restoration was envisaged to be an important part of the project, and hence, the overall approach of increasing urban multifunctionality is directly linked to restoring green space functions and place-making. The green structure plan includes plans to change the existing park, mainly in order to increase perceived safety but also to include new, attractive recreational facilities, engage in climate change adaptation by Water Sensitive Urban Design, improve biodiversity, and increase connectivity with the existing green structure of the city. For doing so, multifunctionality has been assessed as part of the planning process (SLA Architects 2014). For the latter, an approach for assessing sustainability had been applied to illustrate the multifunctionality of different green space elements (social, ecological, and economic functions).

While green space restoration was initially focused on social aspects such as perceived safety, climate change as a topic dominant in urban planning discourses also influenced the project. Additionally, extreme local events (cloudbursts and stormwater flooding) promoted multifunctional thinking towards integrating climate change adaptation as well as biodiversity measures. Substantial participation of local users and residents helped to identify demands and increased awareness for green space multifunctionality.

Discussion and Conclusion

The three cases shed light on different approaches and tools for multifunctionality in green space planning. While the LaPro considers multiple functions of Berlin's green spaces in separate thematic plans, the GAK combines them to identify priority areas. Objectives and target spaces for a certain theme such as the habitat network are overlaid with those for other objectives in a second step. In the OSS from Edinburgh, the same set of criteria representing multiple functions are considered for each green space. Both approaches appear to be promising for planning for multifunctionality if they ensure that synergies and trade-offs are taken into account.

Citizen consultation in Edinburgh and Aarhus played an important role to identify different needs and interests. They increased awareness of the need to provide multifunctional green spaces. In Aarhus, local issues such as flooding promoted the consideration of water management functions and biodiversity and thus broadened the scope from initial consideration of social issues towards multifunctionality. However, interviewed planners from Aarhus noted

the need for an even more explicit focus on multifunctionality as a planning objective. Silo-thinking and the separation of professional disciplines in different sectors were mentioned as important barriers to multifunctionality approaches.

While in Berlin, no particular methodology had been applied in relation to multifunctionality, both other cases applied assessment tools. In Edinburgh several criteria were scored to capture variables such as use, access, and biodiversity and in Aarhus, a sustainability assessment was undertaken to describe the social, ecological, and economic functions of the new park. However, interviewees from Aarhus mentioned a need for more knowledge on tools and methods for the consideration of multifunctionality in planning.

Compared to the limited application of multifunctionality strategies in current European green space planning (Davies et al., 2015), the case studies were quite advanced. Compared to tools that assess and value ecosystem services (ESS) in quantitative and monetary terms – often spatially by using geographic information systems (GIS) – there appears to be potential for adding more layers of information and developing more detailed information in both cases, e.g. in the form of multifunctionality maps (e.g., RICS, 2011) or by quantifying ecosystem service provision with tools like InVEST or TESSA (<http://www.naturalcapitalproject.org/invest/>; <http://tessa.tools/>). These tools, however, often do not take interrelations between services or functions into account.

While there is still a need for the development of comprehensive assessment tools for multifunctionality, our findings reveal advanced approaches based in planning practice that may aid GI planning in Europe and beyond. Based on these findings, five recommendations for GI planning can be made:

1. Include *standards* or *guidelines* on the *strategic city-wide planning* level to promote and ensure that multifunctional approaches are considered and implemented on the project-level (cases 1 and 2).
2. Foster *interdisciplinary cooperation* across authorities and departments to identify common goals and synergies (e.g., related to climate change adaptation or car-free mobility). *Citizen participation* further helps to identify needs and interests of different social groups and to ensure that green space planning can address these demands (cases 2 and 3).
3. *Assess* multifunctionality on the *site level* based on indicators that correspond to the capacity of green spaces (e.g., adequate set of indicators for a particular type of green space). This should include mapping of functions/services but also of synergies and trade-offs between them (case 2).

4. Carefully *balance different demands* in decision-making, such as for recreational and regulative services or biodiversity protection, aiming at synergies but corresponding to the capacity of a certain green space to provide such services (case 1).
5. Consider *spatial and temporal effects* to develop tailored approaches for *different spatial scales* (cases 1 and 3), and *site-design* that handles conflicts and trade-offs locally (e.g., zoning or visitor management, case 1).

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