MULTI-FUNCTIONALITY AND COST ANALYSIS OF URBAN BLUE-GREEN INFRASTRUCTURE

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Extended abstract

ABSTRACT

As urban areas are expanding and densifying, applications of blue-green infrastructure (BGI) are proposed as a panacea for both social and environmental urban challenges. However, BGI includes a great diversity of individual subtypes. From hedges to streams, flowerbeds to green walls, urban forests to single street trees, each subtype comes with specific potential of improving environmental and social conditions. Whilst there is an ever-growing body of literature of the performance and planning of BGI subtypes for specific environmental or social benefits - for example, parks for recreation, and rain gardens for stormwater management – integrated approaches between subtypes and potential benefits are lacking. Thus, it is difficult for planners to compare how different BGI subtypes may provide solutions to the problems facing their local context.

In an attempt to integrate the potential of BGI subtypes to provide heat stress reduction, stormwater management and recreation with the associated short- and long-term fiscal costs, a tentative cost-benefit analysis is presented. Different BGI subtypes potential for reducing heat stress, stormwater management and recreation in an urban Nordic context has been ranked based upon systematic literature reviews for each of the blue-green infrastructure subtypes. Moreover, the paper in which theses assessments will be published (currently under review) provides steps towards integrating the potential benefits frameworks with the costs of construction and maintenance – as the benefits can only be garnered if BGI elements are both constructed and maintained at the appropriate levels. Due to lack in the BGI literature concerning construction and maintenance costs, the costs were estimated by suitably qualified planners within the author's local context.

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It is this integration between assessment of potential benefits with the estimated costs for construction and maintenance that brings novelty to the paper, as well as the combination of physical (stormwater management and heat stress reduction) and social benefits (recreation). Yet it is this novelty which has thrown up a number of challenges which has led the authors to question a great diversity of different issues whilst conducting the research. It is these questions, rather than the outcomes of the forthcoming paper, that will be discussed within this presentation.

When? Temporality was questioned throughout both the literature review assessments and the cost approximations. Whilst temporality was inherently built into the assessment of heat stress, over daytime and nighttime, the seasonality of trees to provide potential recreational and aesthetic benefits was questioned. The general assessment was that the recreational and aesthetic benefit of trees was greater in the summer, but issues of temporality and seasonality were not made explicit within the majority of research papers. Moreover, it was difficult to ascertain the time scales at which the approximations of maintenance costs were made by the respondents. For example, lawns require a great deal of summer maintenance, but mowing is relatively inexpensive, compared to the manual pruning of trees, yet this is only undertaken once or twice a year.

Where? Spatiality, at all scales, is of critical importance to not only the potential benefits that different BGI elements can provide, but also the construction and maintenance costs. At a country scale, the literature review focused on research conducted in countries that were 'relevant' to the Nordic context, loosely, this meant research conducted in Western, industrialised countries. However, at the local scale, the construction and maintenance costs may vary considerably dependent on the geographical context in which the BGI element is to be situated. For example, the costs of constructing a pond or waterway may differ dependent on bedrock and existing groundwater environments; the costs of planting a street tree may be different when subsurface conditions such as pipes or soil types are considered; and maintenance costs of a lawn or meadow may vary depending on the slope of the ground. Moreover, it has become evident through this research that BGI subtypes often provide the greatest number of benefits when used in combination with each other – that is that BGI subtype benefits are often more than the sum of their parts. This, however, is an area that requires further research and consideration, beyond the scope of the paper that is currently under review.

Who? The research papers included as part of the literature review were written from a diverse range of academic perspectives, from water system engineers to sociologists, from medical doctors to architects. As such, each paper was written with a different purpose, audience, and reasoning in mind, which made comparison between them and assessment of potential benefits challenging. Moreover, it was unclear as to who the audiences they were aiming at, not only because this is rarely explicitly articulated within research papers, but also because there is not only one person, profession or department who are responsible for making decisions about what BGI subtypes to include in any geographical context. Furthermore, minimal attention was put on discussing for whom the recreational aspects of BGI are intended for (the users), due to the scope of the study.

Why? Whilst multifunctionality is considered the panacea for many urban problems, in itself it is not without its issues. In this context multifunctionality refers to the ability for

the same BGI subtype's potential to provide a number of different benefits, yet in order to do that they may need to be constructed and maintained differently. Moreover, one benefit may always outweigh another. The balance of potential benefits, and the reasoning for using one BGI subtype over another, may also be influenced for a great number of reasons, for example, the origin of any funding, a requirement of a certain population group or geographical location, or the preference of an individual decision maker. However, this critique is underdeveloped in the current literature, and would require further exploration.

Whilst within the forthcoming paper we aim to present a tool which planners can use to evaluate how different blue-green infrastructure subtypes that meet the needs of their physical environments and citizens in terms of heat stress reduction, stormwater management and recreation. This presentation will explore some of the, often unspoken, issues and questions which the authors wrestled with in coming to their conclusions. As such, the realisation of the proposed multifunctional panacea from BGI is discussed and questioned.

Keywords: blue-green infrastructure, cost-benefit analysis, urban planning, climate risk management, multi-functionality