Rethinking Urban Nature: The Rise and Value of Nature-Based Solutions (NBS) in Europe

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Abstract

Nature-Based Solutions (NBS) have been proposed by the European Union as the most contemporary approach to delivering resilient cities in Europe. Through official guidance and funded projects, the Horizon 2020 programme, the EU has positioned nature at the centre of landscape and urban planning debates. However, there remains a scepticism regarding whether the support of NBS as an alternative to green infrastructure (GI) planning is meaningful and appropriate or damaging to existing practices. Furthermore, the framing of NBS does not, to date, extend the conceptual, practical or political parameters of 'green space' planning beyond terminological changes. Its most significant contribution to urban planning is the emphasis it places on urban ecology as a foundational principle of all development. To assess the added value of NBS in the planning and management of urban landscapes the paper reflects on the academic discussions surrounding the approach. This examines how NBS are being used to shape support for investment in urban nature but also argues that it potentially creates a schism between advocates of existing green space terminology and approaches. It concludes by setting the parameters for further analysis of how NBS are being, and may be used, going forward to socio-economic and ecological agendas in the EU.

Introduction

Nature-Based Solutions (NBS) have emerged as an approach to promoting sustainability due to population growth, which has impacted upon the functionality of many socio-economic and ecological systems. This includes the overuse of water and terrestrial resources leading to impacts on the quality of environmental, human health and the economic viability in European cities. To counteract these changes, the European Commission (2015) is supporting the delivery of NBS through Horizon 2020 projects. The programme adds to the evidence that investment in "*nature*" can act as a viable solution to changing urban circumstances. Based on the promotion of ecosystem services and the connectivity, accessibility and multi-functional principles of green infrastructure (GI), NBS are being promoted as a smarter way to integrate ecological thinking into the built environment (Liquete et al., 2016). NBS are not a new concept, as evidence exists discussing the value of investment in urban nature, cf. urban ecology. However, the promotion of "nature" as the central principle of investment does differ from previous forms of landscape planning (Nesshöver et al., 2016). By working with nature as a core delivery principle investments in NBS

promotes cost-effective, innovative and responsive forms of urban management supporting more sustainable growth (Eggermont et al., 2015). Unfortunately, stakeholder understanding and to implement NBS varies geographically and between administrations (Kabisch et al., 2016). Consequently, although advocates argue for investment in NBS there remains a limited understanding of the added-value they provide. This compounds the technical, legal and political challenges faced by practitioners and decision-makers working in cognate sustainability disciplines, who struggle to integrate the evidence supporting NBS into environmental management and urban planning practices (Nesshöver et al., 2016;).

Goals and Objectives

This paper discusses the proposed uses and limitations of NBS. Drawing on a range of academic and practitioner material, it illustrates where complementarity exists between locations, policies and approaches, and identifies where knowledge gaps in NBS thinking need to be addressed to take the concept forward.

Background and Literature Review

Within the broader literature focussed on GI and ecosystem services there is a prominence of categorising whatever resources are being debated. Whilst this provides a set of parameters that managers can use to frame discussions of NBS some commentators have stressed it may not be a necessity for effective management. Moreover, any review of the types of spaces/resources under consideration in NBS varies depending on ecological perspective or socio-political approaches to landscape management (Kabisch et al., 2016). A review of the literature identifies several key types of NBS, namely:

1. Water; wetlands; flood prevention; floodplains; storm water management; rain gardens; SUDS
2. Terrestrial resources including forests; sustainable agriculture; soil management; rewilding of urban areas; meanwhile and untidy spaces; trees and hedges as health benefits;
3. Biodiversity and ecologically diverse habitats; bio-retention schemes;
4. Societal based values; horticulture therapy; forest schools; community gardens; urban regeneration projects; decreased UHI;
5. Carbon storage; biomass storage and sequestration;

NBS is essentially an umbrella term referring to established practices that provide ecosystem services, build natural capital and generate co-benefits beyond those provided by standard green space planning (Raymond et al. 2017). It is this alignment with familiar landscape management practices that has helped NBS gain traction.

Much of the literature on NBS discusses what they can offer above and beyond more familiar ecosystem service approaches. Pontee et al. (2016) identify a range of natural and hybrid approaches to NBS in coastal areas, demonstrating that they are often cheaper than standard engineering approaches. This is supported by Raymond et al. (2017), who propose that NBS provide scope for planners to move beyond

simple discussions of ecosystem services to a more holistic, cost-effective and adaptive form of management in urban areas. Such findings should be generalised with caution, as the variability of NBS interventions mean costs-benefit analysis will differ between locations. Other authors, such as Scott et al. (2016), suggest that NBS are a way of operationalizing ecosystem services approaches within spatial planning, arguing that the added value of NBS is in integrating ecological concerns alongside traditional planning activities breaking down sectoral or spatial barriers facilitating a more comprehensive way to deliver benefits in urban areas. Most authors highlight the ecological dimension of NBS as a pathway to achieving co-benefits, and stress that socio-economic and governance dimensions require more focused attention if NBS are to deliver benefits in these areas.

Meanwhile, other authors highlight the socio-economic benefits of NBS e.g. Lafortezza & Chen (2016). They argue that NBS can be centred on key ecosystem services provided to people, particularly health, to enable advocates to successfully shape policy. They suggest that this is a way of promoting a transition from the use of natural resources without reflection on socio-economic values to a more explicit discussion on the environmental values that can be embedded within development. Thus, NBS offer planners a portfolio of investment options that can help support and diversify an urban resource base without harming its productivity or value as a landscape (Bennett et al., 2016). A clear demonstration of the wide range of benefits provided by NBS is provided by Connop et al. (2016), who outline a biodiversity-led approach to urban greening that attends to governance and policy aspects and delivers extensive co-benefits beyond increasing species richness in green space. This includes building adaptive capacity in formal and informal sectors, enhancing policy and scientific learning, overcoming negative public perceptions, and quantifying both costs and benefits.

NBS, built infrastructure and greener investment

One of the key debates regarding NBS is its focus. Should NBS represent only natural systems and practices or is there scope to integrate more technological approaches to their use? Moreover, questions arise focussing on where NBS should be situated in the environmental practices being used to shape urban development e.g. biomimicry, and how this influences the choices being made by built environment specialists (Pontee et al., 2016). This is a crucial debate, with Nesshöver et al. (2016) promoting NBS as a challenge to existing "grey" infrastructure arguing that NBS are needed to facilitate a transition to a more ecologically sensitive approach to urban management; whilst Liquete et al. (2016) consider NBS as a companion and not a replacement for engineered solutions.

A key aspect of the debates supporting NBS has been the subtle shift in emphasis placing 'nature' at the centre of development debates. This extends the discussion of human-environmental interactions inherent in GI, and is a major departure from the broader policy/practice evaluations proposed in the 'green space' literature. The NBS literature concentrates on the inclusion of 'nature' in its widest sense, and promotes its ecological value as being of equal importance to socio-economic benefits (Kabisch et al., 2016). This has shifted the framing of landscape planning as although GI became widely-accepted in landscape debates it emphasised the broader links between people, place, policy and the landscape, not a

predetermined nature-centric approach to investment (Eggermont et al., 2015). This does not necessarily undermine the need to consider the social and economic benefits but alternatively promotes nature as the *key* development principle. Moreover, there is an argument to extend existing green space discussions through the use of NBS to deliver GI principles including accessibility and multi-functionality (Cohen-Shacham et al., 2016).

For example, Germany has retained its use of "green space planning" despite the ubiquity of GI in planning research (Mell et al., 2017), whilst in Italy urban forestry remains prominent (Sanesi et al., 2017). Thus, in locations where green space planning dominates the proposal for nature to be the central characteristic of development is, potentially, more accepted, as it maps more effectively onto existing practices. Despite a perceived need to reconsider the terminology used to support NBS scope exists to align the principles of existing green space planning with the definitions of NBS proposed in the literature.

A key aspect of this process is the presentation of NBS as a complementary approach to urban development. Partially, this reflects the scope of investment opportunities associated with NBS but also supports Fan et al's (2017) proposal that NBS are more responsive and can address the climatic, physical and socio-economic problems associated with urban development. Thus, NBS are viewed as being more adaptive than traditional investment practices. Fink (2016) also argues that NBS support a developing equilibrium between people, technology, and environmental policy to achieve a sustainable balance between social needs, ecological systems and economic growth. However, Fink provides a caveat that in addition to natural resource management, "green technology" in the form of green walls, roofs and ecologically sensitive buildings, can play a key role in delivering sustainability.

NBS also sit within wider discussions about the interactions between socio-economic and ecological systems, and approaches for managing such interactions in a more comprehensive way. Eggermont et al. (2015) contribute to this conversation, discussing how biodiversity and human interactions with nature need to be placed at the centre of the future urban development. They identify NBS as a continuum of approaches to investment that complement engineered solutions but importantly promote the use of ecological systems thinking as a basic principle of development. Although this leads to pluralistic forms of development it ensures that environmental considerations are embedded in investment conservations. Moreover, van Wesenbeeck et al. (2014) state that NBS are one of the family of options among a broader range of urban "solutions". They discuss how NBS aid urban adaptation by providing planners, developers and architects with ecologically sensitive choices that can be used to reverse some of the cost, maintenance and delivery issues associated with engineered solutions, e.g. such as hardscaping. Consequently, NBS shouldn't be used to "solve" problems, but to promote greater interactivity between people/nature to support the development of resilient and sustainable systems.

Scale

Scale is a significant aspect of NBS thinking. Although a substantial proportion of NBS the research concentrates on smaller interventions, they are applicable as a landscape-scale management tool. Scale is

discussed by Fan et al. (2017) who argue that multiple-scales offer additional options for nature to be used across urban boundaries. Within this there are clear links between the framing of NBS and the principles outlined by Hellmund & Smith (2006) reflecting the arguments found in the greenways and GI literature. In both ecological and socio-economic benefits are attached to linking resources across boundaries, as they provide connective resources that promote use (Andersson et al., 2014). In addition, the promotion of a systems approach to landscape management requires planners to understand the ways in which biodiversity, water systems and urban development shape the use of the landscape (Ahern, 1995). The diversity of NBS therefore provides planners with greater scope to assess a range of investments that can enhance accessibility. Raymond et al. (2017) also emphasise the need to implement NBS at multiple scales and collate the evidence collected from localised interventions into further advocacy.

However, there is a need to reflect upon the implicit challenges of implementing NBS as the scale of intervention increases. The creation of multi-actor partnerships are essential in supporting a more collaborative process of governance (Meerow & Newell, 2017). While scale should always be aligned with the nature of the challenge, large-scale interventions are particularly important as they support broader ecosystem needs. Thorslund et al. (2017) argue that the large-scale nature of many environmental challenges, e.g. climate change, lead to calls for large-scale interventions if we are to restore hydrological function and water balance. Hellmund & Smith (2006) propose this view examining the role greenways can play in establishing equilibrium between protecting environmental systems, economic cost, and access. While scientific understanding needs to occur at multiple scales, these authors suggest that for important ecological features, large-scale interventions are essential.

The concept of a 'cascade' is therefore a useful way of understanding the relationship between the scale of intervention and outcomes in NBS investment. This is captured in the ecosystem services cascade framework developed by Maes et al. (2012), which demonstrated the link between ecosystem services and human health through a cascading of spatially explicit processes. Their approach provides a more consistent methodological framework for deciding the spatial distribution of costs and benefits and the evaluating the effectiveness of NBS, thus providing a knowledge base for making decisions.

Policy environment

Finally, there is a need to consider the pace at which the policy environment for NBS is changing. With the support of the Horizon 2020 programme NBS are gaining traction within policy across the EU. Some authors, e.g. Fink (2016), have argued that NBS enhance ecosystem services, but also support growing environmental awareness and a more environmentally conscious public helping to cultivate a greater sense of stewardship and behavioural change. In this sense, Fink views policy as a "context destabiliser" providing a window of opportunity to disrupt 'business as usual' practices and enabling NBS to facilitate policy changes. The potentially "disruptive" nature of NBS, and the requirement that interventions be implemented through multi-stakeholder partnerships has integrated discussions of responsibility establishing who has rights to the landscape, and who should be managing it (Connop et al., 2016). The impetus for implementing NBS in a democratic, collaborative way is bolstered by Scott et al. (2016), who

argue that NBS are a public good and one that should be included in policy. These authors illustrate the policy changes required to support NBS and overcome existing silo thinking.

To help facilitate the establishment of NBS within policy there is also a need for it to be linked with existing data sets, analysis and practices to ensure they are seen to complement existing practices (Meerow & Newell, 2017). However, although we may be witnessing a growing catalogue of NBS projects producing evidence of its socio-economic and ecological benefits there remains a slower pace of change in national/sub-national policy utilising NBS (Nesshöver et al., 2016). Success therefore is dependent on an understanding of the benefits of NBS, which continues to vary due to sovereign approaches to land use planning across the European Union (Shwatrz et al., 2014). Thus, an understanding of the existing resources, geographical differences in planning frameworks, and the scale of interventions are important characteristics to consider when embedding NBS into policy.

Much of the policy focussed on NBS has developed through instrumental leaning based on analysis and reporting ensuring that decision-making is promoting NBS in partnerships between policy-makers, environmental experts and academics (Kabisch et al., 2016). In many locations, the uptake of NBS thinking has followed from advocacy generated from green space planning, i.e. in Germany (Vujcic et al., 2017; Cohen-Shacham et al., 2016). The innovations embedded within NBS delivery programmes reinforce this process, as the focus of urban nature interventions is to illustrate the added-value that investment in urban greening have.

Conclusion

NBS are an increasingly popular approach for addressing environmental, social, and economic challenges in urban areas, and one where Europe has been leading the way in terms of defining and implementing such interventions (Eggermont et al., 2015). Beyond this, however, there remains debate regarding where NBS sit alongside other approaches to urban and environmental management (Kabisch et al., 2016). There is general agreement that NBS provide ecosystem services, but whether they are an extension of ecosystem service approaches or merely a means to operationalise the concept remains a point of discussion (Cohen-Shacham et al., 2016). Most authors promote NBS as an innovative suite of approaches that are complementary to more conventional engineered approaches or greening approaches like GI. There is potential for NBS to solve local challenges, as well as bigger global challenges but NBS interventions need to be tailored to specific contexts. The use of NBS may be politically challenging, but the literature on policy learning and adaptive governance offer insights into mainstreaming NBS to change the 'business as usual' approach to urban planning. The diversity and flexibility of NBS is also a positive, making them a more effective choice for building adaptive capacity and resilience, reducing vulnerability, and providing tailored solutions that incorporate both scientific evidence and community needs.

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