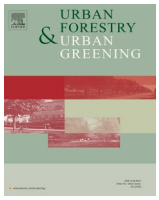
Urban Forestry & Urban Greening 74 (2022) 127663

Contents lists available at ScienceDirect

Urban Forestry & Urban Greening

journal homepage: www.elsevier.com/locate/ufug



Editorial

Urban transitions towards Nature-based Solutions

1. Introduction

Urban areas are complex socio-ecological systems, simultaneously hubs of challenges and centers for innovative actions to tackle those challenges (McPhearson et al., 2016; Florida et al., 2017). One of the latest approaches that could holistically address environmental, social, and economic issues is conceptualized as Nature-based Solutions (NbS) (Dorst et al., 2019; Albert et al., 2017; Bauduceau et al., 2015). The basis of the approach is a multidimensional perspective on green infrastructure (GI) and its ecosystem services (Almenar et al., 2021). NbS interventions that, overall, aim to improve quality of life occur at varying scales: from single sites such as pocket parks to large citywide projects, including multiplications and scaling up of small-scale solutions (Nesshöver et al., 2017; Eggermont et al., 2015). The transition from well-established grey infrastructure approaches to innovative applications and conscious usage of NbS is built on the involvement of policy-makers and stakeholders, society and science, as well as the business sector, and requires recognition of emerging cooperation and co-creation models (Nesshöver et al., 2017; Davies and LaFortezza, 2019).

With the ambition of positioning Europe as a world leader in NbS innovation, the European Union encourages the experimentation and implementation of NbS, supports cooperation and exchange of experiences between cities, and promotes good practices and their dissemination across the world (Faivre et al., 2017; Collier and Connop, 2020). Since 2016, the European Commission has been funding a large number of NbS research and innovation projects, and developing several initiatives and studies recommending this approach (Xie and Bulkeley, 2020). The support in this field is projected to continue as part of the Green Deal, coherently with the objectives and targets of the EU's Biodiversity Strategy for 2030. As demonstrated in several European cities (e.g. Zwierzchowska et al., 2019), the potential for extending the use of NbS even in developed countries is still considerable.

This Special Issue aims to present contemporary knowledge, recent conceptual developments, and practical experiences related to urban transition towards NbS to foster the design and construction of sustainable and resilient cities. The collection provides new scientific evidence on the impact of NbS in solving urban problems as the basis for informed decision-making. The variety of urban locations analyzed and methods applied in the studies illuminates the complexity and multidimensional facets of NbS. At the same time, it demonstrates a progressive uptake of NbS concept in several urban policy domains.

2. NbS and GI in the urban structure

Nature-based solutions in urban contexts can be viewed through an existing matrix of GI and urban structure. Planning, design, implementation, and maintenance approaches presented in this special issue refer either to existing green spaces that are re-discovered or re-assessed within the frame of NbS concept or novel components of urban GI. In this regard, novel land uses and diverse green space types or plant species are presented as NbS means to urban transitions. While there is a wide range of NbS interventions that can be applied in cities, most papers refer to one or at most few types of interventions. Adem Esmail et al. (2022), in the case study of Stockholm, showed that the evolution of greening concepts has so far contributed only to some extent to recognizing the diversity of NbS and greening interventions, as scientific papers most often focused on parks and (semi-) natural urban green areas, including urban forests.

Four studies in this Special Issue look at existing green spaces and green elements through the lens of NbS. Coville et al. (2022) and Kampelmann (2021) focus on urban forests in two residential catchments in Fond du Lac, Wisconsin (USA), and the two cities of Brussels (Belgium) and Montreal (Canada), respectively. Maćkiewicz and Puente-Asuero (2021) investigate private and public allotment gardens in Seville (Spain). Sikorska et al. (2021) emphasize the importance of spontaneous vegetation in cities and bring into the framework of NbS an intentional abandonment of green space cultivation and promotion of wilderness to maximize the provisioning of ecosystem services and improve the life quality of city dwellers.

Three other studies reflect on NbS as actions to integrate green spaces and green elements into the grey matrix. Tan et al. (2021) provide detailed insight into the potential to mitigate the urban heat island of ten plant species (turf grasses, shrubs, and climber/creeper plants) under different shade conditions, emphasizing the importance of site scale design for the efficiency of NbS. D'Ambrosio et al. (2022) highlight the crucial role of Sustainable Drainage Systems (i.e., previous pavements, rain gardens, and infiltration trenches) for resilience to urban flooding, while Cortinovis et al. (2022) assess the potential of different cities to integrate various local scale interventions, including installing green roofs, de-sealing parking areas, enhancing vegetation in urban parks, and planting street trees, thus emphasizing the options for scaling-up various solutions recognized as NbS.

The integration of green components in planned interventions is also discussed by Gałecka-Drozda et al. (2021), who reveal the use and misuse of green spaces associated with multifamily housing areas as NbS in developers' marketing strategies. Finally, Coombes and Viles (2021) present the potential opportunities and existing limitations in applying

https://doi.org/10.1016/j.ufug.2022.127663

Available online 28 June 2022

NbS into urban built heritage conservations that highlight the unique needs of some parts of the city in terms of NbS implementation.

3. Impacts of NbS

The collection of articles showcases the wide variety of impacts NbS can produce on urban areas, well synthesized by the list of urban challenges linked to the greening interventions investigated by Adem Esmail et al. (2022). Two main impacts related to two of the most common urban climate change adaptation challenges are especially prominent in the articles. The mitigation of urban heat island is analyzed by Tan et al. (2021), who assess different plant species in comparison with a range of grey solutions, including high-albedo materials. D'Ambrosio et al. (2022), and Coville et al. (2022) focus on stormwater management and the mitigation of urban flooding and highlight important limitations and risks from incorrectly applying common models. Both climate change-related impacts are also considered by Cortinovis et al. (2022) together with three other benefits (i.e., carbon sequestration, biodiversity potential, and overall greenness) in an attempt to provide a multifunctional assessment of NbS scenarios.

The role of NbS in providing societal benefits beyond the reduction of environmental hazards is emphasized in other papers. Maćkiewicz and Puente-Asuero (2021) found that health and well-being impacts were the most acknowledged among other societal, ecological and economic benefits by plot holders of allotment gardens in Seville. Similarly, bringing together the concepts of NbS and built heritage conservation, Coombes and Viles (2021) highlight the societal benefits of education, inspiration, sense of place, and identity that can derive from acknowledging and safeguarding the cultural value of certain NbS.

From a different perspective, Gałecka-Drozda et al. (2021) investigate how developers and real estate companies use the attractiveness of NbS, often in a misleading way, to increase the market value of housing estates. Economic impacts are also discussed by Kampelmann (2021), who shows that suitable business, financing, and governance models can make local NbS a viable solution for the provision of wood, with positive impacts on the local economy.

4. Urban policy for NbS

Urban policy pertains to NbS utilization depending on how far the operational knowledge is available, whether policymakers are aware of the possibilities of using these solutions in practice, and whether they are socially justified and financially feasible. In this respect, the situation is arguably very heterogeneous due to various natural conditions, diverse spatial structures in cities, and funding opportunities.

All papers included in this Special Issue relate either directly or indirectly to urban policy for the implementation of NbS. The review by Adem Esmail et al. (2022) includes methodological aspects focusing on the relation between science and practice. They conclude that, although scientific publications on greening interventions broaden the knowledge about the role of nature in the socio-ecological system of the city, they do not always promote the proper use and integration of research results in urban planning.

The feasibility of NbS implementation in cities, especially their scaling up, is the focus of scenario analysis studies. Cortinovis et al. (2022) and D'Ambrosio et al. (2022) adopted a similar approach in showing what is possible to do considering the physical constraints imposed by the urban structure. However, barriers to NbS feasibility are not limited to physical conditions, as discussed by Coombes and Viles (2021), who analyze the possibility of introducing NbS to historical parts of cities, pointing to the related challenges, opportunities, and prospects. The issues of NbS implementation are addressed also in the paper by Kampelmann (2021), who deals with the financing of NbS as a key factor. The viable business, financing, and governance models developed in the presented case study demonstrate that NbS can be successful also from an economic point of view.

Beyond implementation, urban policies are required to manage NbS appropriately in order to ensure the long-term sustainable provision of their benefits. This includes maintaining existing vegetation (Coville et al., 2022) and verifying that green spaces designed together with new developments are actually implemented (Gałecka-Drozda et al., 2021). But it also entails selecting the most appropriate governance structures for green areas, as highlighted in the comparison between private and public allotments in Seville (Maćkiewicz and Puente-Asuero, 2021), as well as the proper management actions, as discussed in the context of spontaneous vegetation (Sikorska et al., 2021).

5. Summary

The collection of papers presented in this Special Issue presents the development of NbS concept that is applied to existing and new interventions intentionally to overcome various urban challenges. We hope that this collection stimulates discussion among researchers and innovators in the urban NbS community and wider afield, and we expect that the growing number of NbS projects and initiatives will supply further examples of efficacy and impacts. The studies in this Special Issue come from cities across the globe, and used multiple methods from literature review, scenario-based and case study approaches. The scope of papers highlights the need for an integrated approach that is crucial for translating scientific knowledge into practice. The urban transition is progressing inevitably, and further studies on NbS, governance processes and impact evaluations are needed to support evidence-based decision-making.

References

Adem Esmail, B., Cortinovis, C., Suleiman, L., Albert, Ch, Geneletti, D., Mörtberg, U., 2022. Greening cities through urban planning: a literature review on the uptake of concepts and methods in Stockholm. Urban For. Urban Green. 72, 127584 https://doi.org/10.1016/j.ufug.2022.127584.

Albert, Ch, Spangenberg, J.H., Schröter, B., 2017. Nature-based solutions: criteria. Nature 543, 315. https://doi.org/10.1038/543315b.

Almenar, J.B., Elliot, T., Rugani, B., Philippe, B., Gutierrez, T.N., Sonnemann, G., Geneletti, D., 2021. Nexus between nature-based solutions, ecosystem services and urban challenges. Land Use Policy 100, 104898. https://doi.org/10.1016/j.landusepol.2020.104898.

Bauduceau, N., Berry, P., Cecchi, C., Elmqvist, T., Fernandez, M., Hartig, T., Krull, W., Mayerhofer, E., N, S., Noring, L., Raskin-Delisle, K., Roozen, E., Sutherland, W., Tack, J., 2015. Towards an EU Research and Innovation Policy Agenda for Nature-based Solutions & Re-naturing Cities: Final Report of the Horizon 2020 Expert Group on 'Nature-based Solutions and Re-naturing Cities'. Publications Office of the European Union. https://doi.org/10.2777/765301.

Collier, M., Connop, S., 2020. Urban living labs: nature-based solutions experiences in the EU. in: Herzog, H., Freitas, T. and Wiedman, G. (ed.) Soluções Baseadas na Natureza e os Desafios da Água: accelerando a transição para cidades mais sustentáveis European Commission - Directorate-General for Research and Innovation.

Coombes, M.A., Viles, H.A., 2021. Integrating nature-based solutions and the conservation of urban built heritage: challenges, opportunities, and prospects. Urban For. Urban Green. 63, 127192 https://doi.org/10.1016/j.ufug.2021.127192.

Cortinovis, C., Olsson, P., Boke-Olén, N., Hedlund, K., 2022. Scaling up nature-based solutions for climate-change adaptation: potential and benefits in three European cities. Urban For. Urban Green. 67, 127450 https://doi.org/10.1016/j.ufug.2021.127450.

Coville, R.C., Kruegler, J., Selbig, W.R., Hirabayashi, S., Loheide II St, Avery, W., Shuster, W., Haefner, R., Scharenbroch, B.C., Endreny, Th.A., Nowak, D.J., 2022. Loss of street trees causes 6,000l/tree increase in leaf-on stormwater runoff for Great Lakes Urban Sewershed. Urban For. Urban Green. 74, 127649 https://doi.org/10.1016/j.ufug.2022.127649.

D'Ambrosio, R., Balbo, A., Longobardi, A., Rizzo, A., 2022. Re-think urban drainage following a SuDS retrofitting approach against urban flooding: a modelling investigation for an Italian case study. Urban For. Urban Green. 70, 127518 https://doi.org/10.1016/j.ufug.2022.127518.

Davies, C., Lafortezza, R., 2019. Transitional path to the adoption of nature-based solutions. Land Use Policy 80, 406–409. https://doi.org/10.1016/j.landusepol.2018.09.020.

Dorst, H., van der Jagt, A., Raven, R., Runhaar, H., 2019. Urban greening through nature-based solutions – Key characteristics of an emerging concept. Sustain. Cities Soc. 49, 101620 https://doi.org/10.1016/j.scs.2019.101620.

Eggermont, H., Balian, E., Azevedo, J.M.N., Beumer, V., Brodin, T., Claudet, J., Fady, B., Grube, M., Keune, H., Lamarque, P., Reuter, K., Smith, M., Van Ham, C., Weisser, W. W., Le Roux, X., 2015. Nature-based solutions: new influence for environmental management and research in Europe. Gaia 24 (4), 243–248. https://doi.org/10.14512/gaia.24.4.9.

Faivre, N., Fritz, M., Freitas, T., de Boissezon, B., Vandewoestijne, S., 2017. Nature-Based Solutions in the EU: innovating with nature to address social, economic and environmental challenges. Environ. Res. 159, 509–518. https://doi.org/10.1016/j.envres.2017.08.032.

Florida, R., Adler, P., Mellander, C., 2017. The city as innovation machine. Reg. Stud. 51 (1), 86–96. https://doi.org/10.1080/00343404.2016.1255324.

Gałecka-Drozda, A., Wilkaniec, A., Szczepańska, M., Świerk, D., 2021. Potential nature-based solutions and greenwashing to generate green spaces: developers' claims versus reality in new housing offers. Urban For. Urban Green. 65, 127345 https://doi.org/10.1016/j.ufug.2021.127345.

Kampelmann, St, 2021. Knock on wood: business models for urban wood could overcome financing and governance challenges faced by nature-based solutions. Urban For. Urban Green. 62, 127108 https://doi.org/10.1016/j.ufug.2021.127108.

Maćkiewicz, B., Puente-Asuero, R., 2021. Public versus private: Juxtaposing urban allotment gardens as multifunctional Nature-based Solutions. Insights from Seville. Urban For. Urban Green. 65, 127309 https://doi.org/10.1016/j.ufug.2021.127309.

McPhearson, T., Haase, D., Kabisch, N., Gren, Å., 2016. Advancing understanding of the complex nature of urban systems. Ecol. Indic. 70, 566–573. https://doi.org/10.1016/j.ecolind.2016.03.054.

Nesshöver, C., Assmuthe, T., Irvine, K.N., Rusch, G.M., Waylen, K.A., Delbaere, B., Haase, D., Jones-Walters, L., Keune, H., Kovacs, E., Krauze, K., Külvik, M., Rey, F., van Dijk, J., Vistad, O.I., Wilkinson, M.E., Wittmer, H., 2017. The science, policy and practice of nature-based solutions: an interdisciplinary perspective. Sci. Total Environ. 579, 1215–1227. https://doi.org/10.1016/j.scitotenv.2016.11.106.

Sikorska, D., Ciężkowski, W., Babańczyk, P., Chormański, J., Sikorski, P., 2021. Intended wilderness as a Nature-based Solution: status, identification and management of urban spontaneous vegetation in cities. Urban For. Urban Green. 62, 127155 https://doi.org/10.1016/j.ufug.2021.127155.

Tan, J.K.N., Belcher, R.N., Tan, H.T.W., Menz, S., Schroepfer, T., 2021. The urban heat island mitigation potential of vegetation depends on local surface type and shade. Urban For. Urban Green. 62, 127128 https://doi.org/10.1016/j.ufug.2021.127128.

Xie, L., Bulkeley, H., 2020. City for Biodiversity: The Roles of Nature-Based Solutions in European Cities, NATURVATION, (Access 04.03.2022) city_for_biodiversity_the_roles_of_nature-based_solutions_in_european_cities_2.pdf (naturvation.eu).

Zwierzchowska, I., Fagiewicz, K., Poniży, L., Lupa, P., Mizgajski, A., 2019. Introducing nature-based solutions into urban policy – facts and gaps. Case study of Poznań. Land Use Policy 86, 161–175. https://doi.org/10.1016/j.landusepol.2019.03.025.

Iwona Zwierzchowska[a,*], Chiara Cortinovis[b], Marcus Collier[c], Andrzej Mizgajski[a]

[a] *Department of Integrated Geography, Adam Mickiewicz University in Poznań, Poland*

[b] *Department of Geography, Humboldt-Universität zu Berlin, Germany*

[c] *School of Natural Sciences, Trinity College Dublin, Dublin 2, Ireland*

[*] Corresponding author.

E-mail address: iwona.zwierzchowska@amu.edu.pl (I. Zwierzchowska).