land

MDPI

Editorial

Editorial for Special Issue "Nature-Based Solutions (NBS) in Cities and Their Interactions with Urban Land, Ecosystems, Built Environments and People: Debating Societal Implications"

Diana Dushkova [1,2,*], Annegret Haase [1], Manuel Wolff [3] and Dagmar Haase [3,4]

[1] Department of Urban and Environmental Sociology, Helmholtz Centre for Environmental Research—UFZ, Permoser Str. 15, 04318 Leipzig, Germany; annegret.haase@ufz.de
[2] Landscape Design and Sustainable Ecosystems, Agrarian and Technological Institute, Peoples' Friendship University of Russia (RUDN), Miklukho-Maklaya Str. 8, 117198 Moscow, Russia
[3] Lab of Landscape Ecology, Department of Geography, Humboldt University Berlin, Rudower Chaussee 16, 12489 Berlin, Germany; manuel.wolff@geo.hu-berlin.de (M.W.); dagmar.haase@geo.hu-berlin.de or dagmar.haase@ufz.de (D.H.)
[4] Department of Computational Landscape Ecology, Helmholtz Centre for Environmental Research—UFZ, Permoser Str. 15, 04318 Leipzig, Germany
* Correspondence: diana.dushkova@ufz.de or kodiana@mail.ru

Citation: Dushkova, D.; Haase, A.; Wolff, M.; Haase, D. Editorial for Special Issue "Nature-Based Solutions (NBS) in Cities and Their Interactions with Urban Land, Ecosystems, Built Environments and People: Debating Societal Implications". *Land* **2021**, *10*, 937. https://doi.org/10.3390/land10090937

Received: 16 August 2021
Accepted: 30 August 2021
Published: 6 September 2021

Today's cities increasingly serve as the nexus between nature and people in times of strong urban growth and, in some cases, urban decline. There is no doubt that today's most major and urgent challenges occur in cities. Among them are challenges such as rapid climate and environmental change, complex water and waste management issues, adverse health and well-being as well as changes in social cohesion, land use and migration patterns. The increasing concentration of people in cities and the fact that cities are strongly tied to non-urban areas in relation to economics, consumption and power reveals the considerable significance of cities in terms of global challenges. This poses new tasks for the cities of the future, which should be designed as sustainable and liveable to serve the health and well-being of the population, on the one hand, and to support biodiversity and healthy ecosystems, on the other. In this regard, nature-based solutions (NBS) can provide an entry point for addressing these challenges, as they involve integrating the ecological dimension within spatial planning policies and practices in cities.

Defined by the European Commission as "actions [...] and solutions to societal challenges [...] which are inspired by, supported by, or copied from nature", NBS simultaneously provide multiple environmental, social and economic co-benefits [1]. For example, they can improve both air quality and a location's physical attractiveness and have positive impacts on public health and quality of life while also allowing for more biodiversity, or create green jobs through the greening of cities or planting of trees in former brownfields [2,3]. In comparison to ecosystem services aimed at the assessment and valuation of the immediate benefits to human well-being and the economy, NBS focus on the benefits to people and the environment itself. They allow for sustainable solutions that are able to respond to environmental changes and hazards both in the short and long term [4]. In this sense, NBS go beyond the traditional biodiversity conservation and management principles by "re-focusing" the debate on humans and specifically integrating societal factors such as human well-being, poverty reduction, socio-economic development and governance principles.

Nowadays, NBS are on their way to becoming mainstream in national and international policies. A great number of ongoing European research projects endeavour to explore how NBS work in different urban contexts in relation to the political, social, cultural, institutional, environmental and economic background, and how to successfully

implement NBS in Europe and worldwide. In most cases, these projects aim to analyse how the NBS concept could help link research and innovation in the areas of biodiversity, ecosystem services, economic demands and societal challenges. Researchers have explored what actions are needed to further support the knowledge base for NBS and presented key recommendations for identifying the drivers of NBS success and for overcoming barriers and bridging gaps to boost the promotion and uptake of NBS worldwide. This is reflected by an increasing number of relevant scientific publications [5–8].

Although scholarly work on NBS has since entered the transdisciplinary arena and urban practice reality, there are still many open questions and challenges awaiting a response. This includes, among others, methodological, planning and resilience issues, not to mention challenges related to the question of how NBS can respond to complex societal, political, economic and environmental challenges and how they may contribute to more socially sustainable and responsible futures. These questions are particularly relevant in cities because urban areas are often characterised by high inequality in terms of access to green space as well as demographic, socio-economic, environmental and power-related factors.

As a result, the notion of "nature-based" usually describes heterogeneous phenomena that operate differently according to different contexts, even when they are based on the same or a similar conceptual model.

It is acknowledged that when NBS are locally set up, they interact strongly with the local conditions such as the built environment, the local natural resources and ecosystems, the socio-demographic potential and the land use, in addition to the way urban policy and planning processes are organised and, not least, the makeup of the urban population, the society and its actors. Thus, by and large, if we want to better understand how NBS may operate successfully at the local level and which challenges have to be overcome, we require a great deal of knowledge about the interactions between the multiple contextual conditions and drivers of NBS and their impacts [3].

The interactions between NBS, cities and urban populations are complex and multidimensional. Conceptual knowledge is required to better understand urban transformations and their consequences for cities, which are, of course, highly complex systems. Models or principles are used to analyse the outcomes of different local responses, and tools serve to resolve specific problems. NBS implementation also enters the field of urban policymaking, governance and participation, for instance, when new models of cooperation are set up or when new local business associations or civic society groups are involved in strengthening sustainability or environmental stewardship [4,6,9–11]. The assessment report by Wild et al. [8] shows that the societal implications of NBS have become an increasingly important topic, and there are still many challenges for future research related to the acceptance of NBS, their methods of implementation and impacts or trade-offs with regard to social inequalities, diverging interests and conflicting goals.

At the same time, the urban green scholarly debate has become more attentive to topics such as the interaction between urban ecosystem services or NBS and the unequal distribution of their benefits and burdens in cities [10,12,13], as well as the impact of power relations and imbalances [14]. Furthermore, within recent years, the connections between greening programmes/policies and issues of inclusiveness, justice and inequalities have also come into focus [15–19].

Set against this background, this Special Issue seeks to provide an overview of the current state of knowledge about the interactions between NBS and urban land, built environments, ecosystems and people in cities. In particular, it looks at those interactions through the lens of societal challenges which NBS are aimed to address. With the help of a number of conceptual and empirical studies on NBS development and implementation in different cities, we discuss the interactions between NBS and their urban context, the resulting benefits and trade-offs, as well as the consequences for policy, planning, maintenance, stewardship and governance.

This Special Issue of *Land* brings together a collection of diverse papers that debate the societal implications of NBS in cities and their interactions with urban land, ecosystems, the built environment and people. In inviting papers, we were particularly interested in studies that could assist in answering some of the following questions:

- What types of NBS based on green and blue infrastructure (GBI) are being implemented in cities across the globe?
- Which properties of urban nature and/or urban ecosystems do they make use of, and how do NBS themselves influence urban ecosystems and ecosystem services flows in cities?
- What are the trade-offs of NBS compared to other ecosystem services and urban biodiversity?
- What are the typical types of land and land units where NBS are implemented?
- How do NBS and their implementation interrogate/interact with the social environment and issues of social cohesion and justice?
- What are land governance and policy schemes for NBS in cities? Do they differ from the prevailing land management and governance policies implemented so far in our cities?
- How does the implementation of NBS correspond to and interact with general directions and priorities of urban development?

We have compiled a range of articles from research undertaken in different countries, continents and hemispheres (Netherlands, Germany, USA, Bangladesh, India and Australia) to show that the interconnections between NBS and urban societies are a global challenge and how contextual factors can impact NBS design, implementation, acceptance and effects.

Looking more closely, we can see that a number of studies demonstrate the value of NBS from the perspective of urban GBI networks [3,20,21]. Several studies analysed linkages between urban green spaces, the ecosystem services they provide and public health and well-being through a range of benefits such as the mitigation of climate change, improvement of mental health and well-being through contact with nature, stormwater management and biodiversity conservation [20–22]. This Special Issue considers two sides of GBI development with NBS. On the one hand, we have included a range of papers that address the perspective of ecosystem services provision and its benefits, such as carbon storage and sequestration, pollution removal, food production, noise reduction and recreational and cultural values (see papers [21–23]), while other papers deal with the undesired effects and trade-offs of NBS implementation, such as green gentrification, negative effects on neighbourhoods/residential development and housing prices, as well as increases in social disparities and disintegration [24,25]. This underlines that, firstly, NBS are a complex response to the need for greener and more sustainable cities and include multiple impacts that bring about very different results for different actors, people, structures and spaces in the city. Secondly, the authors of most of these papers demand a more serious consideration of the multiple impacts of NBS (implementation), including existing trade-offs.

The role of NBS for spatial planning and landscape-based visions in Dutch cities was analysed by Van Roiij et al. (2021) [23]. They applied a landscape-based and co-creation-based planning approach to regional spatial policy challenges, paving the way for a paradigm shift towards a future land management system that is resilient to external pressures.

The value of co-creation in the process of successful NBS development and implementation is also highlighted in the paper by Dushkova and Haase (2020) [3]. The authors use the city of Leipzig (Germany) as an example to discuss the main drivers behind NBS, possible design options and the involved governance actors. By discussing these drivers and governance strategies, the authors introduce a framework for assessing the co-benefits, opportunities and challenges of NBS in urban areas. They also provide examples of best practices that demonstrate the multiple co-benefits provided by NBS.

The types and quality of GBI-based NBS implemented in cities were studied by Lahoti et al. (2020) [22] and Ahmed et al. (2019) [20]. They analysed the existing spatial morphology to understand the potential for GBI development and its challenges. Using

Dhaka (Bangladesh) as a case study, the paper by Ahmed et al. (2019) [20] explores how urban growth planning can be guided by a GBI network that combines blue, green and grey elements to provide a multifunctional urban form. The authors highlight the meaning of the spatial morphology for potential locations of NBS development and the types of solutions necessary for different typologies of urban densities. The proposed network takes on different forms at different scales and locations and offers different types of climate mitigation actions, controls and management options. The paper also provides some practical implications and challenges for implementing BGI at different urban scales.

Ahmed et al. (2019) [20] consider the challenges addressed by GBI, such as flood mitigation and water sensitive design, while Shade and Kremer (2019) [26] focus on green infrastructure implementation as one of the important measures for climate adaptation. Using a combination of cellular automata, machine learning and Markov chain analysis, the authors demonstrate that land use and land cover modelling (such as the modelling conducted for Philadelphia, USA) is an important tool for city officials planning future land usage.

The papers by Ali et al. (2020) [24] and Schwarz et al. (2021) [25] introduce green regeneration NBS as strategies for tackling land abandonment and improving the quality of life in disadvantaged neighbourhoods in shrinking cities. A public park was found to operate as a trigger for structural, social and symbolic upgrades in the formerly shrinking city of Leipzig, but only in combination with dynamic real estate market developments, which are the main drivers of change. Ali et al. (2020) [24] identify various facets of green gentrification. Schwarz et al. (2021) [25] critically examine the positive and negative immediate impacts of green space NBS on residents' well-being, residential location choice and housing and land markets. The paper directly addresses questions posed by this Special Issue, arguing that social settings, such as property constellation and real estate agents, benefit from higher income clients' preferences to live close to high-quality urban green spaces and thus foster the green gentrification process discussed in the Ali et al. (2020) [24] article. The paper by Rink and Schmidt (2021) [27] adds to this topic by describing the use of pocket forests and larger urban forests on inner-city brownfields as multifunctional NBS for shrinking cities. Even though urban forests do not constitute an independent or new type of NBS, they create new ecosystems from existing abandoned, brownfield or neglected areas. These forests were found to be multifunctional in terms of urban climate alleviation and air quality improvement, as they simultaneously enhance the value of adjacent neighbourhood areas while creating new recreational opportunities and supporting local biodiversity. Moreover, the afforestation of brownfields was revealed as the cheapest way to create greenery, which not only fulfils the main objectives but also was accepted and used by the local population.

Taken together, the articles in this Special Issue indicate that NBS provide clear benefits for urban societies responding to social–environmental challenges. NBS can help achieve strategic planning goals such as climate adaptation, biodiversity conservation and the improvement of recreational facilities and public health. In terms of costs, NBS such as lawns or afforestation were found to be the cheapest ways to create urban greenery. At the same time, the papers report that NBS often involve trade-offs. For instance, greening can cause changes and new imbalances in the real estate market that limit the aforementioned recreational benefits, particularly for low-income households. Thus, and in line with recent arguments in urban social–ecological–technological studies [28,29], the societal implications we are examining in this Special Issue are ambivalent in the best sense.

An interdisciplinary approach is vital for land-related studies, and the contributions to this Special Issue represent a robust and broad panorama of disciplines, approaches and research traditions. Perhaps this is the best evidence for the fact that NBS, both as real-world tools and an area of research, have become increasingly relevant for the transformation of cities towards greater sustainability. At the same time, their implementation is increasingly controversial and critically debated, for instance, with respect to issues of justice.

While this collection may not provide a definitive summary of the NBS phenomenon, we are convinced that it will at least contribute to a better understanding of all those processes and tendencies which take place in the urban environment when NBS are put into action.

Funding: This research was funded by the Horizon 2020 Framework Programme of the European Union, research and innovation project "—Regenerating ECOsystems with Nature-based solutions for hydro-meteorological risk rEduCTion", grant Agreement No. 776866.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. European Commission. Policy Topics: Nature-Based Solutions 2016. Available online: https://ec.europa.eu/research/environment/index.cfm?pg=nbs (accessed on 15 June 2021).
2. Albert, C.; Schröter, B.; Haase, D.; Brillinger, M.; Henze, J.; Herrmann, S.; Gottwald, S.; Guerrero, P.; Nicolas, C.; Matzdorf, B. Addressing societal challenges through nature-based solutions: How can landscape planning and governance research contribute? *Landsc. Urban Plan.* **2019**, *182*, 12–21. [CrossRef]
3. Dushkova, D.; Haase, D. Not Simply Green: Nature-Based Solutions as a Concept and Practical Approach for Sustainability Studies and Planning Agendas in Cities. *Land* **2020**, *9*, 19. [CrossRef]
4. Almenar, J.B.; Elliot, T.; Rugani, B.; Philippe, B.; Gutierrez, T.N.; Sonnemann, G.; Geneletti, D. Nexus between nature-based solutions, ecosystem services and urban challenges. *Land Use Policy* **2021**, *100*, 104898. [CrossRef]
5. Dushkova, D.; Haase, D. Methodology for development of a data and knowledge base for learning from existing nature-based solutions in Europe: The CONNECTING Nature project. *MethodsX* **2020**, *7*, 101096. [CrossRef] [PubMed]
6. Kabisch, N.; Korn, H.; Stadler, J.; Bonn, A. Nature-based Solutions to Climate change in Urban Areas–Linkages of science, policy and practice. In *Theory and Practice of Urban Sustainability Transitions*; Springer: Cham, Switzerland, 2017.
7. Raymond, C.M.; Berry, P.; Frantzeskaki, N.; Kabisch, N.; Breil, M.; Nita, M.R.; Geneletti, D.; Calfapietra, C. A framework for assessing and implementing the co-benefits of NBS in urban areas. *Environ. Sci. Policy* **2017**, *77*, 15–24. [CrossRef]
8. Wild, T. (Ed.) *Nature-Based Solutions Improving Water Quality & Waterbody Conditions. Analysis of EU-funded Projects (Report)*; Publications Office of the European Union: Luxembourg, 2020. [CrossRef]
9. Eggermont, H.; Balian, E.; Azevedo, J.M.N.; Beumer, V.; Brodin, T.; Claudet, J.; Fady, B.; Grube, M.; Keune, H. Nature-based Solutions: New Influence for Environmental Management and Research in Europe. *Gaia–Ecol. Perspect. Sci. Soc.* **2015**, *24*, 243–248. [CrossRef]
10. Kabisch, N.; Frantzeskaki, N.; Pauleit, S.; Naumann, S.; Davis, M.; Artmann, M.; Haase, D.; Knapp, S.; Korn, H.; Stadler, J.; et al. Nature-based solutions to climate change mitigation and adaptation in urban areas: Perspectives on indicators, knowledge gaps, barriers, and opportunities for action. *Ecol. Soc.* **2016**, *21*, 39. [CrossRef]
11. Scott, M.; Lennon, M.; Haase, D.; Kazmierczak, A.; Clabby, G.; Beatley, T. Nature-based solutions for the contemporary city. *Plan. Theory Pract.* **2016**, *17*, 267–300. [CrossRef]
12. Keeler, B.L.; Hamel, P.; McPhearson, T.; Hamann, M.H.; Donahue, M.L.; Meza Prado, K.A.; Arkema, K.K.; Bratman, G.N.; Brauman, K.A.; Finlay, J.C.; et al. Social-ecological and technological factors moderate the value of urban nature. *Nat. Sustain.* **2019**, *2*, 29–38. [CrossRef]
13. Neßhöver, C.; Vandewalle, M.; Wittmer, H.; Balian, E.V.; Carmen, E.; Geijzendorffer, I.R.; Görg, C.; Jongman, R.; Livoreil, B.; Santamaria, L.; et al. KNEU Project Team. The network of knowledge approach: Improving the science and society dialogue on biodiversity and ecosystem services in Europe. *Biodivers. Conserv.* **2016**, *25*, 1215–1234. [CrossRef]
14. Berbés-Blázquez, M.; González, J.A.; Pascual, U. Towards an ecosystem services approach that addresses social power relations. *Curr. Opin. Environ. Sustain.* **2016**, *19*, 134–143. [CrossRef]
15. Cousins, J.J. Justice in nature-based solutions: Research and pathways. *Ecol. Econ.* **2021**, *180*, 106874. [CrossRef]
16. Haase, D.; Kabisch, S.; Haase, A.; Andersson, E.; Banzhaf, E.; Baró, F.; Brenck, M.; Fischer, L.K.; Frantzeskaki, N.; Kabisch, N.; et al. Greening cities–To be socially inclusive? About the alleged paradox of society and ecology in cities. *Habitat Int.* **2017**, *64*, 41–48. [CrossRef]
17. Kremer, P.; Haase, A.; Haase, D. The future of urban sustainability: Smart, efficient, green or just? Introduction to the Special Issue. *Sustain. Cities Soc.* **2019**, *51*, 101761. [CrossRef]
18. Langemeyer, J.; Connolly, J.J.T. Weaving notions of justice into urban ecosystem services research and practice. *Environ. Sci. Policy* **2020**, *109*, 1–14. [CrossRef]
19. Pineda-Pinto, M.; Frantzeskaki, N.; Nygaard, C.A. The potential of nature-based solutions to deliver ecologically just cities: Lessons for research and urban planning from a systematic literature review. *Ambio* **2021**, in press. [CrossRef]
20. Ahmed, S.; Meenar, M.; Alam, A. Designing a Blue-Green Infrastructure (BGI) Network: Toward Water-Sensitive Urban Growth Planning in Dhaka, Bangladesh. *Land* **2019**, *8*, 138. [CrossRef]
21. Ignatieva, M.; Haase, D.; Dushkova, D.; Haase, A. Lawns in Cities: From a Globalised Urban Green Space Phenomenon to Sustainable Nature-Based Solutions. *Land* **2020**, *9*, 73. [CrossRef]

22. Lahoti, S.; Lahoti, A.; Kumar Joshi, R.; Saito, O. Vegetation Structure, Species Composition, and Carbon Sink Potential of Urban Green Spaces in Nagpur City, India. *Land* **2020**, *9*, 107. [CrossRef]
23. van Rooij, S.; Timmermans, W.; Roosenschoon, O.; Keesstra, S.; Sterk, M.; Pedroli, B. Landscape-Based Visions as Powerful Boundary Objects in Spatial Planning: Lessons from Three Dutch Projects. *Land* **2021**, *10*, 16. [CrossRef]
24. Ali, L.; Haase, A.; Heiland, S. Gentrification through Green Regeneration? Analyzing the Interaction between Inner-City Green Space Development and Neighborhood Change in the Context of Regrowth: The Case of Lene-Voigt-Park in Leipzig, Eastern Germany. *Land* **2020**, *9*, 24. [CrossRef]
25. Schwarz, N.; Haase, A.; Haase, D.; Kabisch, N.; Kabisch, S.; Liebelt, V.; Rink, D.; Strohbach, M.W.; Welz, J.; Wolff, M. How Are Urban Green Spaces and Residential Development Related? A Synopsis of Multi-Perspective Analyses for Leipzig, Germany. *Land* **2021**, *10*, 630. [CrossRef]
26. Shade, C.; Kremer, P. Predicting Land Use Changes in Philadelphia Following Green Infrastructure Policies. *Land* **2019**, *8*, 28. [CrossRef]
27. Rink, D.; Schmidt, C. Afforestation of Urban Brownfields as a Nature-Based Solution. Experiences from a Project in Leipzig (Germany). *Land* **2021**, *10*, 893. [CrossRef]
28. Lin, B.; Ossola, A.; Ripple, W.; Alberti, M.; Andersson, E.; Bai, X.; Dobbs, C.; Elmqvist, T.; Evans, K.L.; Frantzeskaki, N.; et al. Cities and the "new climate normal": Ways forward to address the growing climate challenge. *Lancet Planet. Health* **2021**, *5*, e479–e486. Available online: http://www.thelancet.com/planetary-health (accessed on 15 June 2021). [CrossRef]
29. Egerer, M.; Haase, D.; McPhearson, T.; Frantzeskaki, N.; Andersson, E.; Nagendra, H.; Ossola, A. Urban change as an untapped opportunity for climate adaptation. *NPJ Urban Sustain.* **2021**, *1*, 22. [CrossRef]