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Special Series

Introduction to the Special Series, "Incorporating Nature-based Solutions into the Built Environment"

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EDITOR'S NOTE:

This article is part of the special series "Incorporating Nature-based Solutions into the Built Environment." The series documents the way in which the United Nations Sustainable Development Goal (SDG) targets can be addressed when nature-based solutions (NBSs) are incorporated into the built environment. This series presents cutting-edge environmental research and policy solutions that promote sustainability from the perspective of how the science community contributes to SDG implementation through new technologies, assessment and monitoring methods, management best practices, and scientific research.

Abstract

Incorporating nature-based solutions (NBSs) into the built environment supports the ongoing sustainability challenge as emphasized in the United Nations' Sustainable Development Goals (SDGs) and has particular relevance for SDG Goal #11 (Sustainable cities and communities), which seeks greater efficiencies in urban planning and management practices that address aging infrastructure and ongoing air, water, and soil pollution. The short communications and research articles in this special series exemplify many of these aspects, highlighting the application of NBSs and showcasing the latest environmental research and policy solutions to support this. Nature-based solutions in the built environment aim to promote the understanding of the transdisciplinary nature of NBSs and enhance the global awareness of the value of NBSs by providing a diversity of solutions to illustrate the positive economic, social, and environmental benefits of NBSs in the built environment. *Integr Environ Assess Manag* 2022;18:39–41. © 2021 The Authors. *Integrated Environmental Assessment and Management* published by Wiley Periodicals LLC on behalf of Society of Environmental Toxicology & Chemistry (SETAC).

KEYWORDS: Biodiversity, Climate adaptation, Infrastructure, Nature-based solutions, Sustainability

INTRODUCTION

The 2020s will be a transformative decade for human interaction with the Earth's environment, largely inspired by the United Nations' call for global action through 17 Sustainable Development Goals (SDGs). Scientific research and environmental management practices can lead the way to sustainability in all sectors of our society. One SDG Goal #11 (Sustainable cities and communities) seeks greater efficiencies in urban planning and management practices that address aging infrastructure and ongoing air, water, and soil pollution.

Incorporating nature-based solutions (NBSs) into the built environment is one approach to address this ongoing sustainability challenge as recently emphasized in the UN Environment Program's report "Making Peace with Nature" (UNEP, 2021). The report specifies that the use of NBSs in cities and other settlements can be a cost-effective method to reduce pollution, ensure that settlements are more resilient to environmental degradation and to the impacts of climate change, and provide cobenefits, such as improved biodiversity and mental health. As such, several SDG #11 Goal Targets are addressed when NBSs are incorporated into the built environment, and this special series showcases the latest environmental research and policy solutions to support this.

Nature-based solutions are best understood as an umbrella concept that incorporates key concepts to include green infrastructure, ecosystem restoration, ecosystem engineering, and ecosystem-based adaptation, to name a few

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(Seddon et al., 2021). More recently, the use of NBSs has also been recognized to improve biodiversity and deliver meaningful environmental, social, and economic benefits. The selection of short communications and research articles in this special series presents topics that cover many of these aspects highlighting the application of NBSs to (i) address a diversity of challenges, such as protecting coastal communities, ensuring reliable water supplies with NBS watershed management strategies, and improving land management strategies; (ii) illustrate the use of frameworks and monitoring methods to assess the effectiveness of NBSs; (iii) emphasize the need for transdisciplinary collaborations to include the involvement of stakeholders; and (iv) share the lessons learned using case study sites from various geographical locations and representing different contexts.

For example, NBSs can make an important contribution toward protecting infrastructure from climate change impacts as highlighted by Polk et al. (2021) and their study to understand the capacity and quantify the resilience of living shorelines to provide storm protection by reducing erosion of fringing salt marshes. Another example of NBSs reducing the multihazards of flooding and the transport of legacy contaminants is provided by Hale et al. (2021). The authors explore potential NBSs in which the landscape is transformed to reduce the amount of water in contact with pollutants, thereby reducing the amount of pollutants spreading and remediating contaminated water.

Currently, monitoring and evaluation of NBSs are needed to provide a stronger evidence base to capture both the effectiveness of NBSs and the cobenefits associated with NBSs. Contributions that address this knowledge gap include Davis, Whitfield, et al. (2021) and Geisthardt et al. (2021). Davis, Whitfield, et al. (2021) present a project that is monitoring an island restored through beneficial sediment use to develop a model to predict island structural performance under a range of different system scenarios. The model will be used to inform adaptive management options and inform the design and construction of future projects that restore habitats and coastal protection, and the effects of sea level rise. Geisthardt et al. monitored a breakwater that was enhanced during a routine repair to determine whether such navigation structures can be modified cost-effectively during routine repairs. Such enhancements not only improve the habitat quality of the structure but also provide additional environmental, social, and economic benefits compared to conventional repair techniques.

Due to the transdisciplinary nature of NBSs, implementation of NBSs in the built environment must overcome traditional silo-based management processes. Diverse knowledge and skills need to be coordinated across sectors and organizations. Davis, Guertin, et al. (2021), King et al. (2021), and Holmes et al. (2021) are three examples that illustrate how this coordination is being implemented in practice. Davis, Guertin, et al. (2021) present three NBS case studies implemented across collaborating organizations that posed challenges when implemented within existing regulatory frameworks. Yet, these challenges were overcome using a combination of robust conservation science, tools and expertise, and thoughtful collaboration to foster the adoption of NBSs within a company and their regulating entities. King et al. present a collaborative process involving landscape architects, scientists, and engineers that is producing a complementary set of skills and expertise to advance the development of NBSs through meaningful communications. The partnership, collaborative techniques, and resulting products are fostering innovation as well as advocacy for more sustainable infrastructure. Holmes et al. show how this collaborative and interdisciplinary approach combined Engineering With Nature® strategies and landscape architecture techniques into a large costal storm risk management study. This project illustrates a method for expanding overall project value and producing infrastructure that benefits coastal communities.

Further to transdisciplinary collaboration, participatory approaches to include codesign and coproduction of NBSs have the potential to improve NBS implementation as well as maintenance. Brauman et al. (2021) assess the hydrologic impact of potential and existing NBSs using an evaluation framework of salience, credibility, and legitimacy of information from the viewpoint of three different types of stakeholders. The results provide insight into some of the most common assumptions in the hydrologic assessment of NBS projects, particularly the recognition that a narrow focus on hydrologic model performance that does not adequately consider the larger social, political, and environmental context of a project and decisions can reduce the legitimacy of projects.

Finally, several of the Special Issue articles highlight activities through the use of case study sites as compelling examples. Interesting cases are described by Suedel et al. (2021), Cohn et al. (2021), and Sella et al. (2021). Briefly, the Madeira River Navigation and Improvement Project provides a unique opportunity to incorporate NBSs into the built environment of one of the last free-flowing mega-rivers to promote sustainable communities and water resource infrastructure (Suedel et al., 2021). In this manner, the project seeks to create a safe, reliable, and sustainable navigation channel in the Madeira River through modeling, beneficial reuse of sediment, and use of local materials. Cohn et al. (2021) highlight the benefits of wave attenuation for coastal protection, living shorelines composed of ecotypic native plants, and managed retreat to restore coastal environments while supporting and maintaining natural habitats. Two case studies are presented to illustrate the value of incorporating these nature-based approaches into otherwise vulnerable coastal environments. Finally, Sella et al. (2021) present the principles of ecological engineering in active urban waterfronts using articulated concrete block mattresses (ACBMs) as coastal and marine infrastructure. The multiyear monitoring results indicate that ACBMs provide enhanced ecological benefits without compromising and even strengthening their structural performance.

Nature-based solutions as a tool not only align the SDGs with addressing the challenges of climate change but also

mainstream NBSs across sectoral decision-making. With this special series, we therefore aim to promote the understanding of the transdisciplinary nature of NBSs and enhance the global awareness of the value of NBSs by providing a diversity of solutions to illustrate the positive economic, social, and environmental benefits of NBSs in the built environment.

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This special series on "Incorporating Nature-based Solutions to the Built Environment" is dedicated to the memory of Dr. Shimrit Perkol-Finkel, a mother of three daughters, wife, sister, dear friend, talented marine biologist, innovator, and brilliant entrepreneur. Shimrit was a woman who changed the world.

Her love for the ocean led her to earn a doctorate in marine biology as a Marie Curie Fellow and drove her passion to make an impact for the sake of our oceans. In 2012, she and research-partner Ido Sella cofounded a startup, ECOncrete. Their mission was to transform destructive concrete infrastructure along our coasts into nature-inclusive infrastructure—protecting marine ecosystems, and fighting climate change.

In her work as CEO, opinion leader, and industry expert, Shimrit brought her creative, compassionate thinking to drive real change. She convinced conservative, male-dominated concrete giants that their construction would be made better with nature. She inspired thousands at countless conferences from the UN to NGO zoom panels. She deployed over 30 projects that create resilient waterfronts.

Author of over 20 peer-reviewed scientific papers, Shimrit was a revered scientist, and award-winning innovator, honored as 2020 Vital Voices Partner, quoted among 100 women using their power to empower; UN We Empower Awardee; *Forbes*—one of the top 50 women-led startups crushing Tech; 2019 Fast Company—Most Creative Business People; and more.

At the age of 45, she died in a tragic traffic accident.

DISCLAIMER

The peer review for this article was managed by the Editorial Board without the involvement of A. M. P. Oen or B. Suedel.

DATA AVAILABILITY STATEMENT

There are no data associated with this paper.

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REFERENCES

Brauman, K., Bremer, L., Hamel, P., Ochoa-Tocachi, B., Román-Dañobeytia, F., Bonnesoeur, V., Arapa, E., & Gammie, G. (2021). Producing valuable information from hydrologic models of nature-based solutions for water. *Integrated Environmental Assessment and Management,18,* 135-147. https://doi.org/10.1002/ieam.4511

Cohn, J., Copp Franz, S., Mandel, R., Nack, C., Brainard, A., Eallonardo, A., & Magar, V. (2021). Strategies to work towards long-term sustainability and resiliency of nature-based solutions in coastal environments: A review and case studies. *Integrated Environmental Assessment and Management, 18,* 123-134. https://doi.org/10.1002/ieam.4484

Davis, J., Guertin, F., Guidry, T., Rogers, M., Saunders, Z., & Uhl, M. (2021). Lessons learned from a corporate manufacturer on driving the adoption of nature-based solutions. *Integrated Environmental Assessment and Management, 18,* 74-81. https://doi.org/10.1002/ieam.4442

Davis, J., Whitfield, P., Szimanski, D., Raves Golden, B., Whitbeck, M., Gailani, J., Herman, B., Tritinger, A., Dillon, S. C., & King, J. K. (2021). A framework for evaluating island restoration performance: A case study from the Chesapeake Bay. *Integrated Environmental Assessment and Management, 18,* 42-48. https://doi.org/10.1002/ieam.4437

Geisthardt, E., Suedel, B., & Janssen, J. (2021). A hemimysis driven novel ecosystem at a modified rubble mound breakwater: An engineering with Nature® Demonstration Project. *Integrated Environmental Assessment and Management, 18,* 49-62. https://doi.org/10.1002/ieam.4427

Hale, S., Folde, M., Melby, U., Sjødahl, E., Smebye, A., & Oen, A. (2021). From landfills to landscapes—Nature based solutions for water management taking into account legacy contamination. *Integrated Environmental Assessment and Management, 18,* 99-107. https://doi.org/10.1002/ieam.4467

Holmes, R., Burkholder, S., Holzman, J., King, J. K., & Suedel, B. (2021). Integrating Engineering With Nature® (EWN®) strategies and landscape architecture (LA) techniques into the sabine to galveston (S2G) Coastal Storm Risk Management (CSRM) Project. *Integrated Environmental Assessment and Management, 18,* 63-73. https://doi.org/10.1002/ieam.4434

King, J. K., Holmes, R., Burkholder, S., Holzman, J., & Suedel, B. (2021). Advancing nature-based solutions by leveraging Engineering With Nature® (EWN®) strategies and landscape architectural practices in highly collaborative settings. *Integrated Environmental Assessment and Management, 18,* 108-114. https://doi.org/10.1002/ieam.4473

Polk, M., Gittman, R., Smith, C., & Eulie, D. (2021). Coastal resilience surges as living shorelines reduce lateral erosion of salt marshes. *Integrated Environmental Assessment and Management, 18,* 82-98. https://doi.org/10.1002/ieam.4447

Seddon, S., Smith, A., Smith, P., Key, I., Chausson, A., Girardin, C., House, J., Srivastava, S., & Turner, B. (2021). Getting the message right on nature-based solutions to climate change. *Global Change Biology, 27*(8), 1518–1546. https://doi.org/10.1111/gcb.15513

Sella, I., Hadary, T., Rella, A., Riegl, B., Swack, D., & Perkol-Finkel, S. (2021). Design, production, and validation of the biological and structural performance of an ecologically engineered concrete block mattress: A Nature-Inclusive Design for shoreline and offshore construction. *Integrated Environmental Assessment and Management, 18,* 148-162. https://doi.org/10.1002/ieam.4523

Suedel, B., Amorim, R., Lauth, T., & Creech, C. (2021). Nature-based solutions for improving navigation reliability on the Madeira River, Brazil. *Integrated Environmental Assessment and Management, 18,* 115-122. https://doi.org/10.1002/ieam.4478

UNEP. (2021). *Making Peace with Nature: A scientific blueprint to tackle the climate, biodiversity and pollution emergencies.* Nairobi. https://www.unep.org/resources/making-peace-nature

