The formation of a global center on urban nature-based solutions

La formation d'un centre mondial dédié aux solutions fondées sur la nature en milieu urbain

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RÉSUMÉ

Le Centre WUNDR a été créé afin de rassembler des chercheurs en hydrologie urbaine issus de disciplines diverses et de régions du monde variées, dans le but de répondre aux problématiques liées aux inondations urbaines et à la gestion des eaux pluviales. L'action du Centre s'attache à examiner de manière systématique la manière dont les résultats de la recherche sur les nature-based solutions (NbS) peuvent être mobilisés de façon plus efficace et efficiente par l'ensemble de la communauté de la gestion des eaux pluviales, afin de satisfaire des objectifs multiples. L'objectif du WUNDR est d'évaluer, de développer, de concevoir et de recommander, de manière exhaustive, des stratégies de gestion et d'exploitation des données pour la mise en œuvre des NbS, transférables à l'échelle mondiale et adaptées à une diversité de contextes physiographiques. Par la mise en place d'une plateforme dédiée au partage et à l'intégration des connaissances, le Centre favorise l'avancement des NbS, facilite la recherche interdisciplinaire et permet la synergie des idées à travers différentes régions du monde. Les travaux initiaux ont mis en évidence un décalage notable entre la littérature académique et les directives municipales relatives à la conception des NbS, décalage qui constitue un obstacle à leur planification et à leur conception en vue de répondre à des objectifs multiples. Une étude a ainsi été conduite afin d'analyser la manière dont ces objectifs sont intégrés dans les directives municipales de conception, ainsi que les recoupements et chevauchements existant entre ces différentes directives.

ABSTRACT

The Water in Urban Nature-based Design for Resilience (WUNDR) Center was formed to bring together urban water researchers from different disciplines and global areas to address urban flooding and stormwater management issues. The Center focuses on systematically examining how findings from nature-based solutions (NbS) research can be used more effectively and efficiently by the entire stormwater community to satisfy multiple objectives. WUNDR's goal is to comprehensively evaluate, develop, create, and recommend data management and data-informed strategies for NbS implementation that are transferable worldwide and across diverse physiographic regions. Through the creation of a platform for sharing and integrating knowledge for the advancements of NbS, research across fields can be facilitated and ideas can be synergized across different parts of the world. Initial work has identified the gap between academic literature and municipal guidance on NbS design that presents a barrier for NbS to be planned and designed for multiple objectives. A study was conducted that evaluated how multiple design objectives are included in municipal design guidance and how design guidance overlaps with each other.

KEYWORDS

Data-sharing, Multidisciplinary, Multi-objective function, Nature-based Solutions, Urban built environment

1 MOTIVATION AND DEVELOPMENT

Urban flooding and stormwater management are increasingly significant and costly issues globally. These challenges are exasperated due to climate change along with dynamic urban landscapes, which force shifts in approaches to maintaining and managing ecosystem health. Nature-based solutions (NbS) can be a primary method to sustainably and effectively meet these challenges, but that requires a multi-disciplinary approach. Researchers representing engineering, science, and planning from four different countries have come together to work together to provide a platform for these solutions. The Water in Urban Nature-based Design for Resilience (WUNDR) Center has the vision to combat these issues by providing globally relevant, sustainable, holistic, transferable, and community-driven approaches.

WUNDR's primary goal is to comprehensively evaluate, develop, create, and recommend data management and data-informed knowledge and strategies for NbS implementation that are transferable worldwide, across diverse physiographic regions. Through the creation of a platform for sharing and integrating knowledge for the advancements of nature-based solutions (NbS), research across fields can be facilitated and ideas can be synergized across different parts of the world.

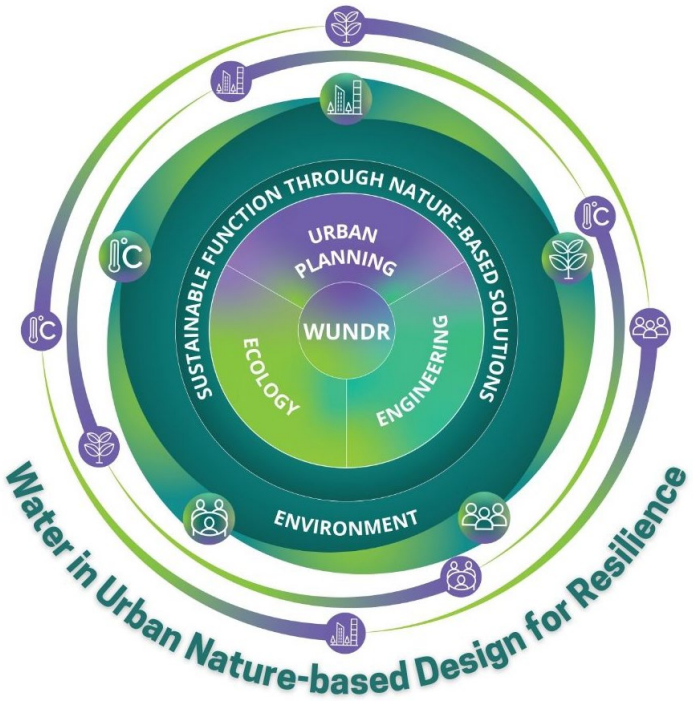

Figure 1. WUNDR logo representing the overarching guidance to identify sustainable function of NbS considering the built environment, community, ecosystem, and climate.

2 INITIAL WORK

Currently, there is no common data portal or controlled language around NbS. There is inconsistent terminology, differing design and performance goals, and challenges in scaling and transferring findings to inhibit widespread sharing of knowledge. A key outcome of WUNDR will be to create a data structure to leverage existing data and to easily share data and findings to advance modeling and analytical techniques to determine NbS and urban hydrology trends, commonalities, and differences based on climate, policy, design, and physiographic parameters.

The researchers of WUNDR identify research questions under assessing NbS design to advance water quality and co-benefits of these systems, evaluating system maintenance requirements under diverse environmental and economic conditions, and exploring the feedback loop of engaging more NbS on urban resilience. For all of these questions, the issue of appropriate metrics became evident. While metrics exist to measure design assessment, performance evaluation, and feedback, there was no common usage and often metrics were not transferable to

different disciplines.

While the research team identified that there is research on the multifunctionality of NbS that research has yet to be translated into practice (Cook et al. 2024). One reasoning they found was that potential synergies are assumed to be passive and are overlooked during planning and design. And therefore, the knowledge generated by researchers is not making it to municipal guidance manuals.

To demonstrate the gap between academic literature and municipal guidance on NbS design, a study to evaluate the coordination and material overlapping across regional design manuals was done for multiple design objectives beyond traditional engineering considerations. The review and evaluation focused on three United States design manuals (Pennsylvania BMP Manual (2006), Ohio Rainwater & Land Development (2025), Tennessee SCM Manual (2014/2016)), one manual from Canada (Toronto Stormwater Manual (2003)), and one manual from the United Kingdom (UK SuDS Manual (C753, 2015)). Through an AI-powered analysis, the degree of alignment among these manuals was assessed. Preliminary results (Figure 2) demonstrate that what design manuals include can drive multidisciplinary innovation of NbS, such as in the case of the UK. This preliminary review also confirms the need for WUNDR to develop a multi-scale, data-informed approach to harmonize NbS practices across regions to advance resilient urban design in a way that is accessible and usable by design BGI planners and designers.

Design Priority	Pennsylvania BMP Manual (2006)	Ohio Rainwater & Land Development (2025)	Tennessee SCM Manual (2014/2016)	Toronto Stormwater Manual (2003)	UK SuDS Manual (C753, 2015)
Flood / Peak Control	5	5	5	5	5
Water Quality	5	5	5	5	5
Erosion Control	5	5	5	5	5
Maintenance	3	4	4	3	5
Runoff Reduction	2	2	5	2	5
Climate Adaptation	2	2	3	5	5
Regulatory Strength	3	3	3	3	5

Figure 2. Sampling of results from AI comparison showing a heatmap of topics that are prevalent in each manual with 5 having very strong emphasis and 1having minimal emphasis.

3 NEXT STEPS

A key next step will be to identify and choose relevant research projects to advance metrics to include multifunctionality into NbS design in a way that is useful and accessible. For example, studies such as how to provide ecologically appropriate plant choice for urban planners and NbS engineers to increase biodiversity potential in bioretention systems (e.g., Myers et al. 2025), will be undertaken. Integrating perspectives from

researchers from different disciplines and global regions will enable more robust metrics to be identified and more actionable recommendations for inclusion in guidance documents. Through global collaboration, this project will broaden the community's understanding of NbS and urban hydrology, increase NbS ecosystem services and resilience, advance understanding of these systems to influence policy, and aid in improving the urban environment and social equity.

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