frontiers | Frontiers in Ecology and Evolution

EDITORIAL
published: 15 April 2022
doi: 10.3389/fevo.2022.882510

Editorial: Urban Trees in a Changing Climate: Science and Practice to Enhance Resilience

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Keywords: urban ecosystems, social-ecological systems, climate change vulnerability, climate change adaptation, ecosystem management

The Editorial on the Research Topic

Urban Trees in a Changing Climate: Science and Practice to Enhance Resilience

INTRODUCTION

Adapting cities to the possible effects of climate change is a priority (IPCC, 2014). This adaptation requires transforming cities in profound ways, such as creating and maintaining urban nature that thrives. Many cities are focusing attention on urban forests for undertaking these transformations (Frantzeskaki et al., 2019). Urban trees can increase heat and water resilience in cities (Livesley et al., 2016) and contribute to the livability of cities (Shanahan et al., 2015). As such, there is a current assumption in urban forestry: more and better-quality trees in cities result in more resilient cities to climate change.

However, an often-overlooked aspect is vulnerability of urban forests to climate change (Ordóñez and Duinker, 2015; Brandt et al., 2016). Temperature is one of the key drivers for global forest distribution and structure (Parmesan and Yohe, 2003). Changes in temperature and precipitation patterns—which are expected to be enhanced in cities due to the urban heat island effect (Huang et al., 2019)—can deeply impact tree growth, tree health, and overall forest ecological dynamics and performance (Woodall et al., 2010; Raquel et al., 2016; Dale and Frank, 2017; Gillner et al., 2017; Nitschke et al., 2017; Kendal et al., 2018). Therefore, understanding vulnerability of urban forests to climate change and addressing these vulnerabilities are key for increasing trees and enhancing canopy cover in cities.

Urban forest vulnerability to climate change has also been overlooked in professional practice and in the decisions that are required to address this vulnerability. Most research on urban forests and climate change focuses on selecting the correct tree species, planting good quality tree stock, and planting trees in environments where they are most likely to thrive (i.e., optimal soil volume and quality; optimal irrigation; damage reduction). However, since decisions about urban forests are connected to city planning, many social processes can also determine successful adaptation to climate change in urban forestry, such as coordination and communication between decision-makers, funding, staffing, regulatory frameworks, and community support, among others (Ordóñez and Duinker, 2015; Živojinović and Wolfslehner, 2015; Brandt et al., 2016; Derkzen et al., 2017; Lo et al., 2017).

The aim of this Research Topic is to fill, even if partly, these gaps in research and practice regarding urban forests and climate change. Here, we generate new scientific information and connect this knowledge with practitioner approaches to solve this problem. We do this from an

Edited and reviewed by:
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Specialty section:
This article was submitted to Urban Ecology, a section of the journal Frontiers in Ecology and Evolution

Received: *23 February 2022*
Accepted: *30 March 2022*
Published: *15 April 2022*

Citation:
Ordóñez Barona C and Trammell TLE (2022) Editorial: Urban Trees in a Changing Climate: Science and Practice to Enhance Resilience. Front. Ecol. Evol. 10:882510. doi: 10.3389/fevo.2022.882510

international perspective publishing studies from urban communities across the world that are committed to enhance urban forests in a changing climate.

THIS ISSUE

This Research Topic was conceptualized by Dr. Peter Duinker, Professor Emeritus at Dalhousie University, Canada, to advance research on urban forest vulnerability to climate change from both a research and practice perspective, and to stimulate a global discussion about climate resilience in urban forestry. Dr. Duinker then invited the two of us plus Dr. Cynnamon Dobbs (Universidad Mayor de Chile), Dr. James Steenberg (Nova Scotia Department of Natural Resources, Canada), and Dr. Tahia Devisscher (University of British Columbia, Canada) to join the guest editor team. We are deeply grateful for the contributions of these colleagues. The Research Topic provided a platform to generate new knowledge and enhance knowledge exchanges across diverse research fields on urban forests and climate change. A key theme was to provide practical insights on how to increase climate resilience in urban forestry through specific management interventions.

ARTICLE CONTENT

The article collection presents a wide range of research from physiological measurements that improve tree selection to approaches for co-production of knowledge between practitioners and researchers. Barradas and Esperón-Rodríguez present an innovative simulation modeling technique to understand the ecophysiological vulnerability of urban tree species to climate change. This technique will help optimize tree-species selection under future climate change. Similarly, Sousa-Silva et al. demonstrate a spatially explicit approach to prioritize street-tree planting locations to optimize benefits obtained from urban trees in Quebec, Canada. In a participatory research approach, Hilbert et al. combine field data on expected vulnerability of urban tree species to climate change with expert opinions about this vulnerability to develop a community-based process for selecting underutilized tree species. The goal of this work is to enhance the diversity of urban forests, increase climate resilience, and overcome professional biases in tree species selection.

Assessing the vulnerability of trees to climate change is a vital first step for creating resilient cities. Brandt et al. assess the vulnerability of 178 tree species to projected future climate change scenarios across 14 cities in the U.S. upper midwest. These tree species vulnerability indices combined with traditional species selections can enhance urban forest resilience to climate change. To address urban forested natural areas, Piana et al. convened urban forest practitioners and researchers across the eastern U.S. to co-produce climate-adapted urban silviculture techniques for urban forests. City participants assessed impact factors and adaptive capacity to generate a vulnerability assessment for urban forests. Despite current "good woods" conditions, vulnerability was ranked "high" in most cities, thus highlighting that those seemingly healthy forests are also very vulnerable to urban and climate impacts. To address this challenge, the workshop participants and researchers co-designed an experimental study to enhance climate resilience of urban forests. Finally, while climate change research in cities generally focuses on warming and flooding, Miron et al. present a compelling case for increased de-icing salt use under various climate change scenarios in certain cities around the world. The authors discuss the need to coordinate public safety issues with sustaining healthy urban street trees and present a toolbox to facilitate synchronized mitigation of tree exposure to de-icing salts while addressing needs for transportation safety during these climate scenarios.

FINAL REMARKS

We were fortunate to assemble a strong set of international studies and showcase research occurring in urban places not widely represented in the literature, such as mid-west U.S. cities, Canadian French-speaking urban communities, and Latin American cities, including Mexico City. The wide spectrum of perspectives brought by research and practitioners working in urban forests, climate change, management, and planning in these diverse contexts can advance urban forestry from a local issue to a global field of knowledge and research.

This Research Topic will make a lasting contribution to research and practice at the intersection of urban forestry and climate change. The interdisciplinary and trans-disciplinary research showcased demonstrates that without connecting science to professional practice, scientific findings will exist in isolation and be difficult to translate into management approaches and technical activities used by professional practitioners. If we can achieve this connection, as both scientists and professionals, then we can climate-proof our urban future.

AUTHOR CONTRIBUTIONS

CO led the writing of the article, with significant intellectual and writing contributions by TT. All authors contributed to the article and approved the submitted version.

ACKNOWLEDGMENTS

We would like to acknowledge the contributions made by the authors and all reviewers of the manuscripts in this *Urban Trees in a Changing Climate: Science and Practice to Enhance Resilience* Research Topic, as well as the support provided by the editors of Frontiers in Ecology and Evolution. Special thanks to Dr. Peter Duinker.

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