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Mark A. Elgar,
The University of Melbourne, Australia

*CORRESPONDENCE
Hua-Feng Wang
✉ hfwang@hainanu.edu.cn

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# Editorial: Distribution patterns, driving mechanisms and ecological service functions of urban plant biodiversity

Hua-Feng Wang[1,2]*, AJ Harris[3], Salman Qureshi[4] and Jing-Jiang Zhou[5,6]

[1]Hainan Yazhou Bay Seed Laboratory, Sanya Nanfan Research Institute of Hainan University, Hainan University, Sanya, China, [2]Key Laboratory for Sustainable Utilization of Tropical Bioresources, School of Life and Sciences, Hainan University, Haikou, China, [3]Key Laboratory of Plant Resources Conservation and Sustainable Utilization, South China Botanical Garden, Chinese Academy of Sciences, Guangzhou, China, [4]Department of Geography, Humboldt University of Berlin, Berlin, Germany, [5]College of Plant Protection, Gansu Agricultural University, Lanzhou, China, [6]State Key Laboratory Breeding Base of Green Pesticide and Agricultural Bioengineering, Guizhou University, Guiyang, China

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Editorial on the Research Topic
Distribution Patterns, driving mechanisms and ecological service functions of urban plant biodiversity

The greenspace and plant diversity within urban areas play invaluable roles in providing ecological services and in increasing the wellbeing of residents and environment. For example, urban green space can accommodate existing plant diversity that is vital to conservation efforts. Simultaneously, urban greenspace, which contains both native and non-native species, can serve as an important carbon sink and aid in creating cooler microclimates. However, society is undergoing rapid urbanization, and urban development sites are experiencing considerable ecological changes, such as loss of native species, urban heat island effects, and others. Urbanization leads to high fragmentation of vegetation cover. The loss of native biodiversity reduces the wellbeing of urban dwellers. It is urgent to investigate the distribution patterns, driving mechanisms, ecological service functions of urban plant biodiversity. Accordingly, our Research Topic in Frontiers in Ecology and Evolution aims to understand the mechanisms of maintaining urban plant diversity and the pattern variation of urban plant diversity. This special issue covers five Research Topics: 1. The distribution patterns and driving mechanisms of urban plant diversity. 2. The temporal and spatial variations of urban greenspace with rapid urbanization. 3. The relationships between urban plant diversity and above-ground biomass. 4. Plant-animal-fungal interactions in urbanized areas and 5. Ecological service functions (e.g., regulating the microclimate) of urban plant diversity and greenspace.

Guo et al. studied the diversity and distributional patterns of non-native plant species in the tropical island of Hainan, China and provided a working checklist of the non-native plants of Hainan as well as a theoretical framework and reference for the control of invasive plants. Among the natural environment variables, the authors found that the number of non-native species strongly correlated with the monthly temperature. Zhang et al. investigated 16 quadrats of *Hopea hainanensis* wild populations in Hainan Island and found that the

community where *H. hainanensis* occurred was relatively unstable. The fragile ecology of *H. hainanensis* was directly linked with the stability of the community structure and function of a suitable environment. The connection between *H. hainanensis* and related herbs was more complex than with trees and shrubs probably because of resource utilization. Li et al. carried out a time series analysis of Landsat-5 TM and Landsat-8 OLI images of Hefei city, China and found that the common characteristics of Urban Greening Space changes were the transfer-out of farmland and the transfer-in of built-up land. They revealed that the newer the region was, the more intense the changes occurred. But at the park level, the fishnet cell analysis revealed significant spatial heterogeneity in the landscape patterns as the location of the urban parks in Urban Greening Space changed from center to periphery. The type of the parks was dependent on different factors especially single to rich. He et al. explored the city variations among 439 Chinese cities based on enhanced vegetation index over the period of 2 decades and investigated the vegetation greening (VG) and its relationship to urban expansion. It was found that most of the vegetation was predominantly situated in central and eastern China, accounting for 60.47% of the total Chinese greening area. Among all the UG patches, northern areas exhibited better integrity than the central and southern areas of China. Moreover, the intensity of the area expansion was bearing a negative correlation with vegetation greening. Wheeler et al. conducted co-located ecological surveys of yards and social surveys of residents in four diverse neighborhoods of Phoenix, Arizona. They found that neighborhood age and other characteristics were important drivers of the ecological change. Residential plant communities made some changes in their yards, but the number of plant species were significantly different.

These papers provided evidence supporting four main hypotheses of the driving mechanisms for the variation of urban plant diversity patterns. The first is the land use hypothesis. Wealthy urban areas with less human input have smaller vegetation area and species number, while residential areas with high human input and strong management have larger vegetation area and species number (Wheeler et al.). The second is the luxury effect hypothesis. Urban rich areas have higher vegetation cover and species diversity. In other words, urban vegetation area is positively correlated with community income and population density (Li et al.). The third is the legacy effect hypothesis. The old city has more perennial herbaceous plants in vegetation area, but the new city has less vegetation area and species diversity (Zhang et al.). The fourth is the climate gradient hypothesis. Cold and rainy inland areas have higher tree cover, while warm and humid coastal areas have higher shrub and herbaceous coverage (Guo et al.).

Furthermore, the above four hypotheses may explain the mechanism of variation in plant diversity characteristics in some cities. The driving factors of the current spatial pattern of urban plant diversity can be classified into two categories: the factors of human activities dominated by social economy, including government decision-making, human preferences, socioeconomic level and urban greening management level, and the natural environmental factors, such as average temperature, rainfall, soil organic matter, soil water content. Cities have a hierarchical structure, and the coupling of human activities and nature at different levels may not be the same. Therefore, it is necessary to analyze the impact of the coupling between human activities and nature on urban plant diversity from different scales. The applicability of the coupling effect model of human activities with natural factors to different scales was tested, and the variation mechanism of urban plant diversity was explored (Guo et al.; Wheeler et al.).

The Research Topic demonstrates that plant communities in residential areas are dynamic over time. Several new drivers have been identified from urban agglomerations, free trade pilot zones (ports), and tropical rainforest national parks (Zhang et al.). There is also a coupling mechanism between plant diversity patterns and driving factors such as land use, socioeconomics, greening management, and the natural environment in urban ecosystems (Guo et al.). The plant species richness and genealogical diversity within urban ecosystems are closely related to human wellbeing (Wheeler et al.). The studies indicate the need for a greater attention to the regulation of the structure, function, and dynamics of urban plants. It is proposed to achieve carbon peaking and carbon neutrality goals in 2030. However, there are few studies related to sequestration capacity of urban ecosystems. The data from He et al. would be applied to estimate the carbon sequestration capacity of urban ecosystems based on the urban vegetation index. The improvement of the carbon sequestration capacity of urban ecosystems would provide a scientific basis for creating a more beautiful and livable urban ecological environment.

In future, multi-scale (intra-urban and inter-city), multi-angle (landscape pattern and species diversity), multi-factor (socio-economy, greening management, and natural environment, etc.) and multi-means (remote sensing interpretation, sample survey, socio-economic questionnaire, and observation experiment, etc.) should be included in the study to comprehensively analyze the variation of urban plant species diversity pattern. There should be the integration of sociological investigations with natural ecological science, and the establishment of urban agglomerations with different development models. It is necessary to recognize the obvious differences in socioeconomic level and unique urban environment.

## Author contributions

H-FW, AH, and SQ: conceive the ideas and wrote the draft. J-JZ: revise the manuscript. All authors contributed to the article and approved the submitted version.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Publisher's note