Review of the 2nd International Conference on Urban Ecology, 2016 (Post-Print)

Authors: Zhang Zhengkai, Tu Xingyue, Jiang Yaqiong, Huang Ganlin

Date: 2017-04-11T00:00:00+00:00

Abstract

The 2nd International Conference on Urban Ecology was held in Shanghai, China, from July 8-10, 2016, with the theme "Challenges for Urban Ecology in the Context of Rapid Urbanization and Global Environmental Change." The conference featured 16 special sessions, with main topics including urbanization dynamics, urban sustainability research, urban biodiversity assessment, and urban ecology education. Urban green space was one of the research hotspots of the conference, where important scientific issues in urban development were discussed, such as the close relationship between urban green space and urban biodiversity, the temperature regulation function and cultural services of urban green space, and the relationship between urban green space and compact cities. To promote the further development of urban green space and urban ecology research, this paper reviews and introduces research content related to urban green space at the SURE conference. This conference has important implications for future urban green space research: (1) strengthen research on ecosystem services of urban green space and sustainable science education; (2) strengthen research on the assessment, planning, and management of small-scale urban green space; (3) strengthen comprehensive research on the multifunctionality of urban green space.

Full Text

A Review of the Second International Congress of the Society for Urban Ecology, 2016

Jiang Yaqiong[1,2], Tu Xingyue[1,2], Huang Ganlin[1,2]
[1]State Key Laboratory of Earth Surface Processes and Resource Ecology, Faculty of Geographical Science, Beijing Normal University
[2]Center for Sustainable Human-Earth Systems, College of Resources Science and Technology, Beijing Normal University

Abstract

The Second International Congress of the Society for Urban Ecology (SURE) was held in Shanghai, China in July 2016, focusing on the challenges facing urban ecology under rapid urbanization and global environmental change. The conference featured three presentation formats: plenary talks, oral presentations, and poster sessions, with 34 oral presentations and 9 thematic discussion panels. Key themes included urbanization dynamics, urban infrastructure design and functional assessment, urban-rural ecological linkages, urban ecological education, and urban sustainability research. Urban green space emerged as a central research focus throughout the congress, with discussions covering its close relationship with urban biodiversity, temperature regulation effects, cultural services, and connections to compact urban development. This review synthesizes and introduces the research presented at the congress related to urban green space, which offers important insights for future research directions: (1) strengthening research on ecosystem services of urban green space and sustainable science education; (2) enhancing assessment, planning, and management studies of small-scale urban green spaces; and (3) promoting comprehensive research on the multifunctionality of urban green space.

Keywords: urban ecology, urban green space, urban biodiversity

1. Conference Overview

The Second International Congress of the Society for Urban Ecology (SURE) convened in Shanghai, China, addressing the challenges confronting urban ecology against the backdrop of rapid urbanization and global environmental change. The conference program consisted of plenary talks by distinguished scholars, oral presentations, and poster sessions. The nine thematic sessions encompassed urbanization dynamics, urban environmental remote sensing, urban biodiversity assessment, urban ecosystem planning, urban infrastructure design and functional evaluation, urban-rural ecological linkages and management, and urban ecological education. Urban green space consistently emerged as a prominent research theme, with discussions addressing critical scientific questions such as the relationship between urban green space and biodiversity, temperature regulation functions, cultural services, and the integration of green space within compact cities. To advance research on urban green space and urban ecology, this review synthesizes the relevant presentations from the congress.

2. Research Progress on Urban Green Space

Urban green space refers to land designated for improving ecology, providing recreational areas for residents, and beautifying the landscape, including parks, production green space, protective green space, and affiliated green spaces. These spaces provide vital ecosystem services, including climate regulation, biodiversity conservation, landscape integrity maintenance, and recreational and cultural venues for citizens. Compared with built-up areas, urban green spaces feature highly diverse habitats and serve as crucial components for urban biodiversity conservation and important nodes connecting habitat networks. The regulating and cultural services provided by urban green spaces play a significant role in enhancing urban residents' well-being and form the foundation for sustainable urban development. Research on urban green space has attracted widespread scholarly attention, and the congress presentations can be categorized into four main areas: the close relationship between urban green space and biodiversity, temperature regulation effects, cultural services, and the relationship with compact cities.

2.1 Urban Green Space and Biodiversity Biodiversity refers to the diversity and variability of living organisms and their ecological complexes. Urban biodiversity constitutes an important foundation for urban ecosystem services and holds positive significance for improving urban environments and maintaining sustainable development. Urbanization-induced habitat loss continuously threatens urban biodiversity, making green spaces valuable refuges. The importance of urban green space for biodiversity has been widely recognized. Research hotspots include the impacts of urbanization on biodiversity, relationships between green space environmental attributes and biodiversity, and biodiversity-oriented green space planning and design.

The congress featured studies on biodiversity homogenization and the relationship between green space characteristics and biodiversity levels. Researchers investigating tree and bird diversity changes across multiple green spaces in different periods found homogenization trends among cities in different geographical locations. Analyses of woody plant species in three major Chinese cities revealed converging species composition, with native species declining and exotic species increasing. Bird species composition changes were closely related to land use and land cover changes. Studies along the Yangtze River found higher similarity in plant communities between cities than between cities and surrounding natural vegetation, attributed to human species preferences and urban habitat filtering.

Research also examined relationships between environmental factors, human management activities, and biodiversity in urban green spaces. Comprehensive reviews of urban infrastructure impacts on bird diversity and distribution indicated that most such research focuses on urban green spaces and protected areas, where endangered species are gradually being replaced by widespread generalists. Bird richness and abundance correlate positively with vegetation characteristics,

tree diversity, shrub layer height, and coverage. Investigations of nearly 100 urban lakes and ponds in Switzerland identified key factors influencing species richness for different taxa. At the pond scale, species richness positively correlated with water area, shoreline vegetation cover, and substrate naturalness, while nearby buildings and roads negatively impacted all taxa. These findings suggest that creating new ponds with adequate area, embedding them within green space networks, and promoting diverse aquatic vegetation can enhance biodiversity.

Studies on landscape structure and biodiversity in high-density urban areas found that biotope diversity indices, saturation indices, and fragmentation indices correlate closely with biodiversity. Research along urban density gradients revealed that while bird species diversity showed no clear trend, green space area, spatial structure, and vegetation layering were important influencing factors. These studies provide recommendations for urban green space planning from a biodiversity conservation perspective, emphasizing the use of native plants, multi-layered habitat creation, biodiversity education, and controlled urban expansion.

2.2 Temperature Regulation Effects of Urban Green Space Urban expansion during urbanization processes reduces natural areas such as green spaces and water bodies, altering urban surface thermal properties. Combined with heat emissions from transportation, industry, and residential energy consumption, these factors create urban heat islands—phenomena where urban temperatures exceed those of surrounding suburbs. Urban heat islands significantly impact resident health and thermal comfort, drawing widespread attention to the regulatory role of urban green spaces. A key research challenge involves identifying which green space landscape patterns can effectively mitigate urban heat island effects.

Congress discussions focused on how green space landscape patterns affect surface temperature and how to maximize cooling effects through rational planning in limited spaces. Research revealed that both spatial composition (vegetation cover, tree cover) and spatial configuration (mean patch area, shape index, edge density, largest patch index) correlate negatively with surface temperature, with scale-dependent relationships. Spatial autocorrelation of indicators particularly affects these relationships at smaller analysis scales.

Studies using Minimum Cumulative Resistance (MCR) models analyzed green infrastructure network elements' impacts on urban heat islands, classifying patches by their importance to network connectivity into seven core types: core areas, branches, and non-green spaces. Cooling effects correlated positively with patch importance, with core areas showing the lowest average temperatures. Other research simulated various green infrastructure types—green roofs and building façade vegetation—to assess temperature changes, finding that evapotranspiration and shade provision were primary factors influencing cooling effectiveness. Under scenarios maximizing tree and façade vegetation propor-

tions, urban green infrastructure could effectively offset climate change-induced thermal effects. These studies recommend prioritizing tree planting, leveraging green infrastructure multifunctionality (such as biodiversity enhancement and stormwater retention), and increasing façade vegetation when space is limited.

2.3 Cultural Services of Urban Green Space Research on cultural services at the congress examined both internal park factors and external influences on visitor behavior. Studies analyzed relationships between park characteristics, landscape elements, and visitor preferences to identify important ecosystem services and social values, providing scientific foundations for green space planning and design.

Questionnaire surveys in four Beijing parks identified primary visitor activities as walking, resting, and socializing, with preferred locations near water bodies, areas with abundant vegetation, and lawns. Visitor motivations centered on fresh air, nature experience, and tranquility, with natural environment quality, management level, and facility configuration identified as important park characteristics. Research in a Shanghai wetland park using geotagged photographs and the Social Value for Ecosystem Services (SolVES) model found high aesthetic, biodiversity, and recreational values, with water bodies, pathways, and structures being the most popular landscape elements.

Studies on external factors investigated park accessibility and its relationship with residents' socioeconomic characteristics in Beijing, revealing a decreasing accessibility gradient from city center to periphery and weak correlations with socioeconomic factors. Comparisons between buffer analysis and road network analysis methods showed consistent results, though buffer methods tended to overestimate accessibility and its correlation with socioeconomic characteristics. Research on air quality impacts on park visitation in a Beijing community park found significant negative correlations between air quality and visitor numbers, with the strongest effects on walking activities and children. Analyses of cultural service mechanisms, mapping, and modeling identified current research status and challenges, calling for greater efforts in environmental justice and social health disparity research, strengthened international and interdisciplinary collaboration.

2.4 Urban Green Space and Compact Cities Under rapid urbanization, compact city development combined with rational green space planning represents an important pathway for adapting to climate change and addressing urban ecological challenges. Congress participants discussed challenges and proposed strategies and research frameworks for green space planning in compact cities.

Presentations identified challenges including global climate change, reduced green space area, declining green space quality, decreased quality of life, reduced social harmony, and environmental justice issues regarding uneven benefits from

green spaces among different social groups. Effective strategies should integrate green and gray infrastructure to enhance multifunctionality and connectivity while addressing environmental justice. Frameworks should seek balance between urban compactness and rational green space planning, coordinating high-density built-up area development with comprehensive green infrastructure utilization. Recommendations include ensuring daily activity facilities and green spaces remain within residents' accessible range, reserving space for green networks during concentrated urban development, and establishing stakeholder participation models for urban and green space planning. Long-term monitoring and management of potential development areas and green space quality should incorporate multi-scale, multi-functional planning perspectives. These studies remain at the theoretical and framework development stage, requiring further exploration of practical applicability across different regional and socioeconomic contexts.

---

3. Implications and Future Directions

The congress demonstrated that urban green space has gained significant attention in urban ecology, with substantial progress in four key areas: urban green space and biodiversity, temperature regulation, cultural services, and relationships with compact cities. These advances deepen our understanding and provide valuable insights for future research and green space planning and management.

3.1 Strengthening Ecosystem Services Education and Sustainable Science Education People often recognize ecosystem services' importance only after their dramatic decline or loss. Strengthening ecosystem services education is therefore urgent. The congress dedicated substantial attention to this theme, establishing a special session. Current research primarily targets students, analyzing cognitive changes before and after education and impacts on attitudes and behaviors. However, studies targeting urban residents remain limited. Urban green spaces provide rich ecosystem services, yet their planning, protection, and management depend on resident participation and support, which correlate with knowledge backgrounds and values. Enhancing urban residents' awareness of green space ecosystem services through environmental education to promote behavioral change represents an important future research direction.

3.2 Enhancing Small-Scale Urban Green Space Assessment, Planning, and Management Most ecosystem service assessments, biodiversity evaluations, and planning studies focus on city or local scales. A notable trend at the congress was research on small-scale green spaces such as community gardens and small ponds. These small-scale green spaces serve as fundamental units for biodiversity conservation and ecosystem service provision, closely linked to human well-being. Strengthening research on relationships between biodiversity,

ecosystem services, and social-environmental factors at small scales is necessary.

3.3 Promoting Comprehensive Multifunctional Research on Urban Green Space Urban green spaces provide multiple important functions including biodiversity conservation, temperature regulation, and recreational services. While in-depth research exists on each function individually, most studies focus on single functions from disciplinary perspectives. Future research should comprehensively consider multiple functions, quantifying relationships among them to support planning and design that promotes synergistic development and provides effective safeguards for sustainable urban development.

References

[1] Ministry of Construction of the People' s Republic of China. CJJ/T 85–2002 Standard for Classification of Urban Green Space. Beijing: China Architecture & Building Press, 2004.

[2] Goddard M A, Dougill A J, Benton T G. Scaling up from gardens: biodiversity conservation in urban environments. Trends in Ecology & Evolution, 2010, 25(2): 90-98.

[3] Wu J G. Landscape sustainability science: ecosystem services and human well-being in changing landscapes. Landscape Ecology, 2013, 28(6): 999-1023.

[4] Pejchar L, Reed S E, Bixler P, Ex L, Mockrin M H. Consequences of residential development for biodiversity and human well-being. Frontiers in Ecology and the Environment, 2015, 13(3): 146-153.

[5] Sandifer P A, Sutton-Grier A E, Ward B P. Exploring connections among nature, biodiversity, ecosystem services, and human health and well-being: Opportunities to enhance health and biodiversity conservation. Ecosystem Services, 2015, 12: 1-15.

[6] Odum E P. Fundamentals of Ecology. 3rd ed. Philadelphia: Saunders, 1971: 457-457.

[7] Wu J G. Changing perspectives on biodiversity conservation: from species protection to regional sustainability. Biodiversity Science, 2008, 16(3): 205-213.

[8] Fernández-Juricic E, Jokimäki J. A habitat island approach to conserving birds in urban landscapes: case studies from southern and northern Europe. Biodiversity and Conservation, 2001, 10(12): 2023-2043.

[9] Oke T R. The energetic basis of the urban heat island. Quarterly Journal of the Royal Meteorological Society, 1982, 108(455): 1-24.

[10] Arnfield A J. Two decades of urban climate research: a review of turbulence, exchanges of energy and water, and the urban heat island. International Journal of Climatology, 2003, 23(1): 1-26.

[11] Bowler D E, Buyung-Ali L, Knight T M, Pullin A S. Urban greening to cool towns and cities: A systematic review of the empirical evidence. Landscape and Urban Planning, 2010, 97(3): 147-155.

[12] Santamouris M, Cartalis C, Synneffa A, Kolokotsa D. On the impact of urban heat island and global warming on the power demand and electricity consumption of buildings-A review. Energy and Buildings, 2015, 98: 119-124.

[13] Zhou W Q, Huang G L, Cadenasso M L. Does spatial configuration matter? Understanding the effects of land cover pattern on land surface temperature in urban landscapes. Landscape and Urban Planning, 2011, 102(1): 54-63.

[14] Li J X, Song C H, Cao L, Zhu F G, Meng X L, Wu J G. Impacts of landscape structure on surface urban heat islands: A case study of Shanghai, China. Remote Sensing of Environment, 2011, 115(12): 3249-3263.

[15] Jokimäki J. Occurrence of breeding bird species in urban parks: effects of park structure and broad-scale variables. Urban Ecosystems, 1999, 3(1): 21-34.

Note: Figure translations are in progress. See original paper for figures.