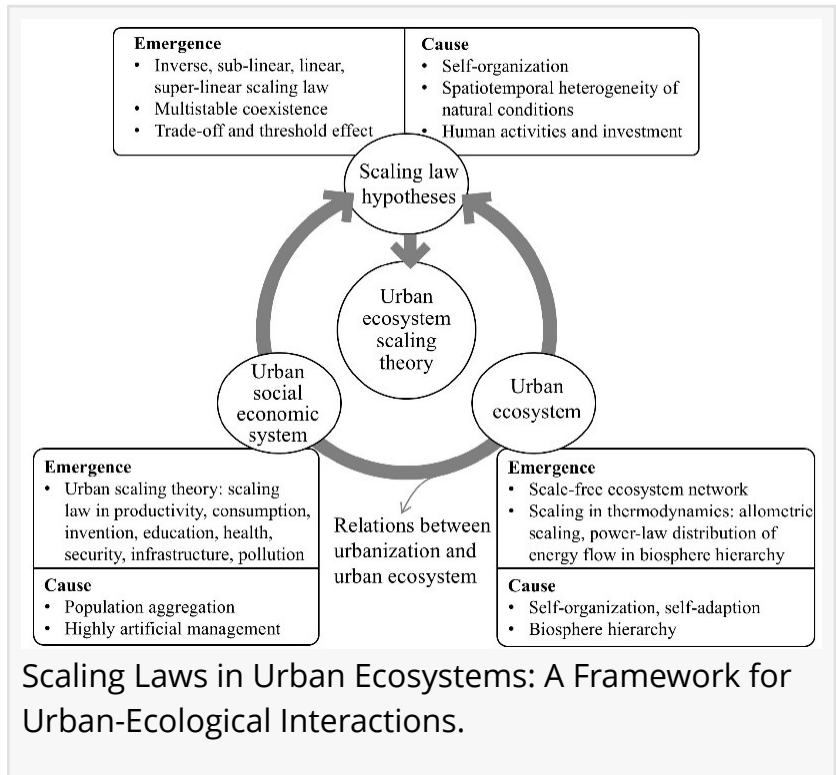


Scaling laws in urban ecosystems: a new perspective on city growth

GA, UNITED STATES, January 14, 2025 /EINPresswire.com/ -- A recent review has introduced the concept of scaling laws to urban ecosystems, offering a novel perspective on city growth and ecological balance. By merging thermodynamic principles with [urban metabolism](#), researchers have created a framework that not only predicts shifts in urban ecosystems but also provides insights for more sustainable urban planning. This approach illuminates the delicate balance between urban expansion and ecological sustainability, promising to reshape how we manage cities in an era of rapid growth and environmental change.



As urbanization accelerates, ecosystems are often pushed to the brink, leading to the degradation of ecological services and heightened environmental stress. Traditional urban planning has typically focused on economic and social factors, often sidelining the complex interactions within urban ecosystems. This oversight can result in unsustainable practices, threatening the long-term health of cities and their surrounding environments. In response to this challenge, there is an urgent need for a more integrated approach—one that incorporates ecological principles into the fabric of urban development. Such an approach is essential to safeguard urban resilience and sustainability, ensuring that cities thrive amid rapid growth and changing environmental conditions.

A team of researchers from Beijing Normal University has published a pioneering review (DOI: [10.1007/s11783-025-1924-8](https://doi.org/10.1007/s11783-025-1924-8)) in the October 2024 issue of *Frontiers of Environmental Science & Engineering*. This research explores the application of scaling laws in urban ecosystems, focusing on the thermodynamic processes that govern urban metabolism. Their goal is to uncover patterns that can help boost ecological resilience within cities, providing a scientific foundation

for more sustainable urban planning.

The study takes an innovative approach by applying scaling laws—typically used to describe biological systems—to urban environments. By analyzing energy flows and metabolic processes within cities, the researchers uncovered that urban ecosystems exhibit multistable states. These states reflect different equilibrium points where the demands of urban growth and the provision of ecological services can coexist, fostering a dynamic balance between the two. One of the study's most significant findings is the identification of threshold effects, where small changes in urban planning or environmental conditions can cause dramatic shifts in ecosystem stability. For example, expanding green spaces or implementing sustainable infrastructure can enhance the resilience of urban ecosystems, enabling them to better withstand challenges like climate change and pollution. The study also emphasizes the importance of maintaining ecological infrastructure—such as parks and green corridors—which are critical for supporting the multifunctional needs of urban environments. By optimizing resource use and adopting sustainable practices, cities can build more resilient ecosystems, ultimately improving the quality of life for urban residents.

Dr. Gengyuan Liu, a leading expert in urban metabolism and one of the study's principal researchers, commented, "Understanding the scaling laws of urban ecosystems is crucial for creating sustainable cities. This research lays the groundwork for predicting ecological tipping points, providing essential insights to guide urban planning toward more resilient and efficient systems."

The implications of these findings are profound, offering a new framework for urban planners and environmental policymakers. By integrating scaling laws into urban design, cities can better anticipate the ecological impacts of their growth and implement strategies to enhance ecosystem services. This approach has the potential to transform urban planning, fostering cities that are more sustainable, resilient, and adaptable to environmental challenges. In the long run, such strategies could improve not only the ecological health of cities but also the economic and social well-being of their residents, creating thriving urban environments for generations to come.

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