

Mapping Urban Spatial Resilience: First Steps Towards Spatially Adaptable Cities

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Urban Resilience, Spatial Resilience, Urban Morphology

BACKGROUND

Globally, urban areas are expected to triple by 2050. Current urban planning and design approaches often struggle to address the rapidly changing, increasingly complex, and uncertain environments that future cities must navigate. In contrast, urban resilience is a promising approach for planning and design as it embraces uncertainty and encourages planning with and for change.

METHOD

Drawing on the fields of urban science and complexity theory, 14 urban metrics were used to the case study of Manhattan (NYC, USA) to capture five key spatial characteristics of complex adaptive systems. The results of each stage were combined using a multi-criteria decision analysis process. The result is a *Spatial Adaptive Potential* score for every land parcel in Manhattan. This process as applied across three spatial scales, quantified as 10-, 20-, and 30-minute travel times.

Urban Metrics:

14 different network and access-based urban analytic metrics were applied to capture five spatial complex system characteristics of the urban form. The metrics are calculated using multiple sources and types of urban form data.

Spatial Complexity Characteristics:

Connectivity, diversity, urban potential (density), redundancy, and modularity are evaluated as directives for spatial adaptive potential.

Spatial Adaptive Potential:

A compound index built from the directives acting as a proxy for the potential adaptive capacity provided by the urban form of a city.

FINDINGS

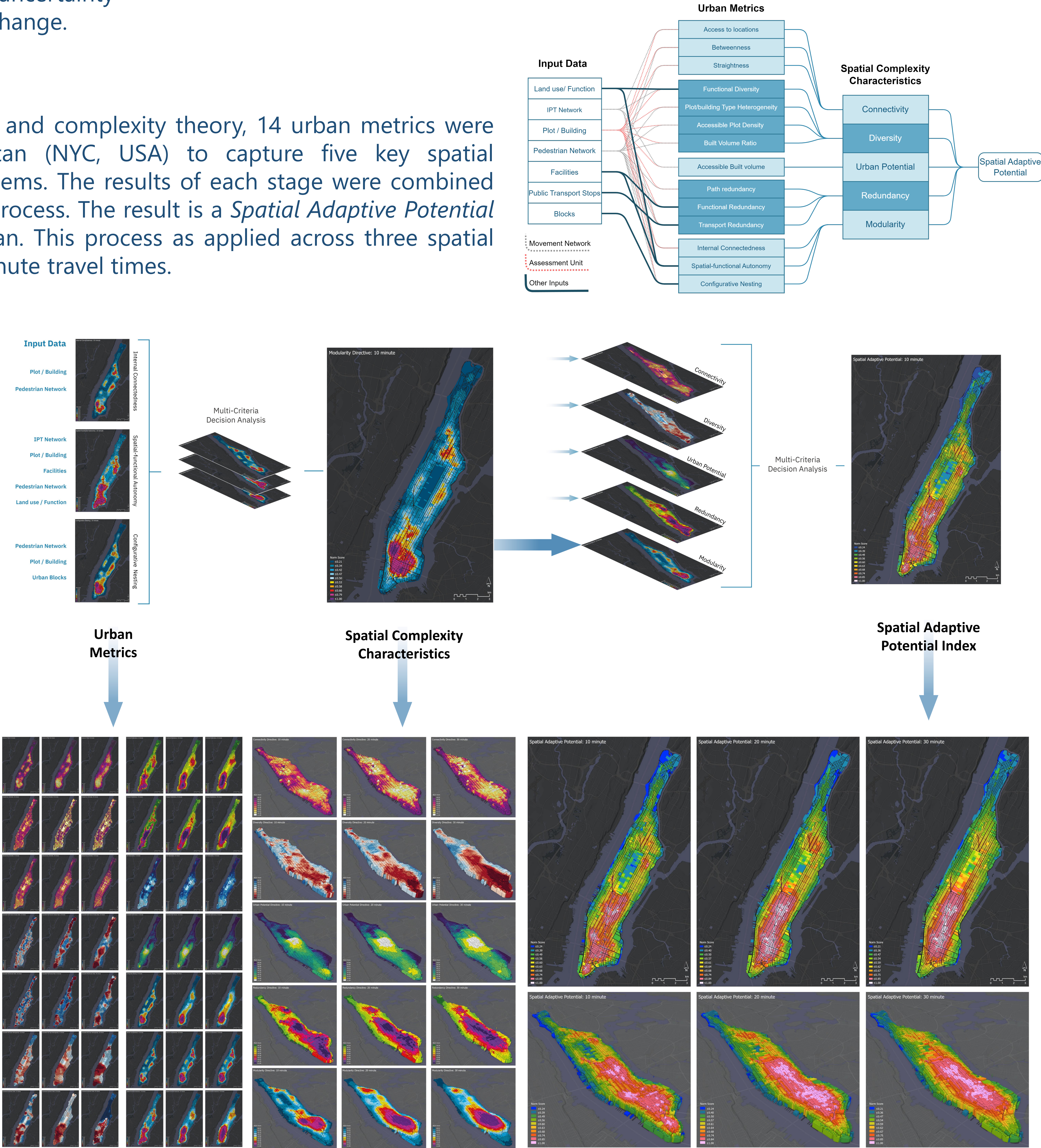
The study shows that spatial adaptive potential is strongly impacted by the spatial organization and urban form of an area. It is largely influenced by building, plot, and block size and density as well as street configuration. Additionally, the spatial distribution decentralization of functions and facilities is also critical.

RESEARCH GAP

Urban form is theorized to create the spatial and functional framework for resilience to emerge. Yet, urban resilience theory, increasingly recognized in urban discourse, lacks the methods and metrics to evaluate the spatial adaptive capacity of urban form within cities.

AIM

From a *general resilience* perspective, the aim is to develop a novel approach to assess the multiscale and urban form driven spatial adaptive potential of cities to help identify the urban forms and their qualities that promote spatial resilience.



CONCLUSION

This study highlights the importance of promoting the spatial qualities that build complexity and enable resilience by promoting urban form with high connectivity, diversity, density, redundancy, and modularity. These complex system traits amplify a city's spatial adaptive potential and its capacity to respond effectively to disruptions. The integration of adaptive

qualities into urban design, emphasizing flexibility and adaptability, is vital. The research advocates for innovative planning and design strategies that prepare urban spaces for dynamic conditions, ensuring that cities can sustain and flourish amidst diverse socio-economic and environmental challenges.