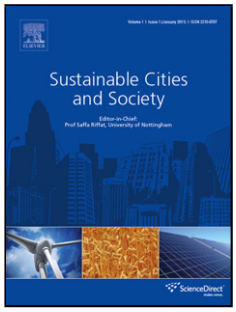

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Title Page

A theoretical framework of urban systems and their evolution: the GUSE theory and its simulation test

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Highlights

- A GUSE theory is developed to explain the urban system and its evolution
- The GUSE theory shown the mathematical description of urban system
- "Urban tree" is used to express the process of urban system evolution
- The theory and model are tested by numerical simulation
- The GUSE theory provides theoretical foundation for studies of urban system and urban planning

Abstract:

City, urban systems and their evolution are classical interdisciplinary issues in urban studies. Most traditional classical theories have different drawbacks because of the inherent limitations of their basic disciplines. Therefore, a general theoretical framework is urgently needed to interpret city, urban systems and their evolution. This study proposed a novel theoretical framework of urban systems and their evolution (the GUSE theory) to explain the processes and features of origin, spatial pattern and evolution of regional urban systems. We firstly proposed definitions of coverage, city and urban system based on Graph Theory method; then built models and indices to interpret and evaluate growth and evolution of urban system by combining the model of spatial interaction flow with the "urban tree (UT)" hypothesis. Numerical simulation is finally conducted to illustrate the GUSE theory and verify the stability of the proposed models. The GUSE theory in this study can provide significant theoretical basis for regional research, such as urban system study and planning.