



THEORETICAL ANALYSIS OF INTERACTIVE COUPLED EFFECTS BETWEEN URBANIZATION AND THE ECO ENVIRONMENT

¹MIRZA DANISH BEG

¹Assistant Professor, Department of Geography, NBGSM College Sohna Gurgaon

ABSTRACT

The development of mega-urban agglomerations has triggered the interactive coercion between resources and the eco-environment. The interactive coupled effects between urbanization and the eco-environment in mega-urban agglomerations represent frontier and high-priority research topics in the field of Earth system science over the next decade. In this paper, we carried out systematic theoretical analysis of the interactive coupling mechanisms and coercing effects between urbanization and the eco-environment in mega-urban agglomerations. In detail, we analyzed the nonlinear-coupled relationships and the coupling characteristics between natural and human elements in mega-urban agglomerations. We also investigated the interactive coercion intensities between internal and external elements, and the mechanisms and patterns of local couplings and telecouplings in mega-urban agglomeration systems, which are affected by key internal and external control elements. In addition, we proposed the interactive coupling theory on urbanization and the eco-environment in mega-urban agglomerations. Furthermore, we established a spatiotemporal dynamic coupling model with multi-element, multi-scale, multi-scenario, multi-module and multi-agent integrations, which can be used to develop an intelligent decision support system for sustainable development of mega-urban agglomerations.

INTRODUCTION

The development of mega-urban agglomerations has triggered the interactive coercion between resources and the eco-environment. The interactive coupled effects between urbanization and the eco-environment in mega-urban agglomerations represent frontier and high-priority research topics in the field of Earth system science over the next decade. In this paper, we carried out systematic theoretical analysis of the interactive coupling mechanisms and coercing effects between urbanization and the eco-environment in mega-urban agglomerations. In detail, we analyzed the nonlinear-coupled relationships and the coupling characteristics between natural and human elements in mega-urban agglomerations. We also investigated the interactive coercion intensities between internal and external elements, and the mechanisms and patterns of local couplings and telecouplings in mega-urban agglomeration systems, which are affected by key internal and external control elements. In addition, we proposed the interactive coupling theory on urbanization and the eco-environment in mega-urban agglomerations. Furthermore, we established a spatiotemporal dynamic coupling model with multi-element, multi-scale,

multi-scenario, multi-module and multi-agent integrations, which can be used to develop an intelligent decision support system for sustainable development of mega-urban agglomerations. The historical development of global urbanization shows that it is accelerating, causing actual or potential harm to the eco-environment. By 2014, 54% of the world was urbanized, and the United Nations predicts that 66% of the world's population will be living in urban areas by 2050. An extremely complex non-linear interactive coupling and coercing relationship exists between urbanization and the eco-environment, but the question of how to manage that relationship is a difficult and pressing one for academia and governments, and it is quickly becoming a strategic problem of global importance. Research on the interactive coupling relationship between urbanization and the eco-environment is set to become a popular area of study in international earth system science and sustainability science in the next 10 years. The process of urbanization is one of the most important manifestations of the evolution of human social development, while the eco-environment is the natural setting and support system that humans rely on for survival and to thrive. Both urbanization and the eco-environment are classic examples of complex systems, and an extremely complex non-linear interactive coupling and coercing relationship exists between them (Qiao and Fang, 2005). An interactive coupling relationship between urbanization and the eco-environment means a dynamic relationship of interdependence, inter-coordination and mutual promotion as well as coordinated development between elements of the urbanization system and elements (or subsystems) of, and movements in, the eco-environment system. This includes interactive coupling effects of various human elements within the urbanization system and interactive coupling effects of various natural elements within the eco-environment system, as well as non-linear interactive coupling effects involving one-to-one, one-to-many and many-to-many elements within the urbanization and eco-environment systems.

ANALYSIS

Types of coupling shows that interactive coupling effects between urbanization and the eco-environment include scale coupling effects, telecoupling effects, element coupling effects, function coupling effects, structure coupling effects and pattern coupling effects, with coupling periodicity, measurability and regularity observable between the different types of coupling effects. The coupling process also has open, non-linear, self-organizing, and fluctuating, multiple feedback and scale nesting characteristics. The International Human Dimensions Programme on Global Environmental Change formulated a scientific research program entitled Urbanization and Global Environmental Change, a core project on global environmental change, which proposes to strengthen research on the coupling relationship between urbanization and global environmental change using cross-temporal and cross-spatial scale approaches, parallel and comparative studies across regions, and research that provides effective communication to the public and policy makers. The core project seeks to develop a better understanding of the interactions and feedback between global environmental change and urbanization at the local, regional and global scales, with an emphasis on coupling humanities and natural sciences and using an interdisciplinary perspective to solve issues related to the coupling relationship between human activities and the environmental system. A Millennium Ecosystem Assessment report entitled "Ecosystems and Human Well-being" published in 2005 carried out a special assessment of urban systems and argued that rising urban populations and economic development were producing increased pressure on global ecosystems, thereby affecting ecosystem services. It particularly highlighted the vulnerability of urban ecosystems due to the effects of climate change. The Future Earth initiative announced in 2012 brings together four major existing projects on global environmental change, namely the World Climate Research Programme, the International Geosphere-Biosphere Programme, DIVERSITAS and the International Human Dimensions Programme on Global Environmental Change. It aims to strengthen ties between the natural and social sciences to provide needed scientific knowledge, technical methods and solutions to help the world, regions and individual countries respond to global environmental change. It also seeks to promote sustainable global and regional development and takes as its core objective the observation, analysis and

simulation of changes to natural and social systems, especially the dynamic characteristics of interactions between people and the environment. The program tries to understand the links between global environmental change and human wellbeing and development, with a focus on observing, explaining, understanding and projecting earth, environmental and societal system trends, drivers and processes and their interactions and anticipating global thresholds and risks. An urban agglomeration is a large, open, and complicated system encompassing the cross-couplings of internal and external elements. Of these, internal elements refer to all those factors that can improve urban socioeconomic development within the city, while external elements include all the imported factors from outside of the city that could promote socioeconomic activities. Following expansion of urban agglomeration and its increasing demands on resources, internal elements are gradually unable to fulfill the needs of sustainable development, resulting in continuous importation of large numbers of external elements and stresses on the agglomeration ecosystem.

CONCLUSION

The results reveal that economic urbanization and ecological pressure sub-systems contribute to the largest share to the urbanization and eco-environment. Comprehensive level of urbanization and eco-environment both show a trend of steady rise. In the coupling coordination degree and under three different share cases, the sub-systems of urbanization and eco-environment present the consistent coupling coordination degree which is of linear stability. But coupled coordination degree has diverse evolution character in different cities. In general, Yinchuan is in a phase of transitional development, and it is in the basically balanced development with eco-environment lagged. Shizuishan is in the transitional phase from basically balanced development with urbanization lagged to basically balanced development. In the transitional phase from unbalanced development to basically balanced development with urbanization lagged.

REFERENCES

- Chauvin J P, Glaeser E, Ma Y et al., 2017. What is different about urbanization in rich and poor countries? Cities in Brazil, China, India and the United States. *Journal of Urban Economics*, 98: 17–49.
- Clark W C, 2007. Sustainability science: A room of its own. *Proceedings of the National Academy of Sciences*, (104): 1737.
- Committee on New Research Opportunities in the Earth Sciences at the National Science Foundation (CNROES), 2014. *New Research Opportunities in the Earth Science*.
- Fang Chuanglin, 2014a. *China's New Urbanization Development Report*. Beijing: Science Press.
- Fang Chuanglin, 2014b. Progress and the future direction of research into urban agglomeration in China. *Acta Geographica Sinica*, 69(8): 1130–1144.
- Fang Chuanglin, 2015. Scientific selection and grading cultivation of China's urban agglomeration adaptive to new normal in China. *Bulletin of the Chinese Academy of Sciences*, 30(2): 127–136.
- Fang Chuanglin, Bao Chao, 2007. Management implications to water resources constraint force on socio-economic system in rapid urbanization: A case study of the Hexi Corridor. *Water Resources Management*, 21: 1613–1633.
- Fang Chuanglin, Bao Chao, Qiao Biao et al., 2008. *The Process of Urbanization and Ecological Environment Effect*. Beijing: Science Press.
- Fang Chuanglin, Guan Xingliang, 2011. Comprehensive measurement and spatial distinction of input-output efficiency of urban agglomerations in China. *Acta Geographica Sinica*, 66(8): 1011–1022.

- Fang C L, Liu H M, Li G D, 2016. International progress and evaluation on interactive coupling effects between urbanization and the eco-environment. *Journal of Geographical Sciences*, 26(8): 1081–1116.
- Fang Chuanglin, Liu Xiaoli, 2010. Comprehensive measurement of carrying degrees of resources and environment of the city clusters located in central China. *Chinese Geographical Science*, 20(3): 281–288.
- Fang Chuanglin, Mao Qizhi, 2015. The New Exploration of China's Urban Agglomeration Selection and Cultivation.
- Fang C L, Ren Y F, 2017. Analysis of energy-based metabolic efficiency and environmental pressure on the local coupling and telecoupling between urbanization and the eco-environment in the Beijing-Tianjin-Hebei urban agglomeration. *Science China Earth Sciences*, 60(6): 1083–1097.

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