

## Short Communication

# Cross-regional Nexus Perspective in Anthropocene

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## Abstract

In the context of global mobility, the traditional research framework based on a fixed location perspective is facing the need for adaptive innovation and change. In order to deepen the understanding of the evolution of the Anthropocene stratigraphic record and surface landscapes, this paper argues that the nexus approach and the systematic integration of spatial dimensions should be combined in the context of the Anthropocene to form a cross-regional nexus approach, to better cope with the complex issues and global challenges of the Anthropocene.

**Keywords:** *Nexus approach, Cross-regional nexus perspective, Telecoupling, Metacoupling, Spatially dimensional systems integration, Anthropocene*

Human beings are ever extending their activity space largely thanks to the technology progress in energy utilization, transport and information communication. The trajectory of human development since the 1760s indicated that the increasing enhancement of regional linkages and connectivity, and the growing higher human and resource mobility have become the prevailing trend and dominated pattern over the world. In these transformative changes, cities play a leading role as engine of the world technology advancement and the regional center for global production and consumption. The increasing connectivity and mobility have also gradually transformed the rural society based on local ecosystem services into the urban society based on non-ecosystem services and long-distance resource redistribution, and have profoundly changed the way humans interacting with nature. One of the most important changes in human-nature interrelationships, especially since the middle of the twentieth century, is the increasing interaction of coupled human and natural systems (CHANS) over long distances [1], and another is the fact that humans are influencing and modifying ecosystems to a greater extent than at any other time in history [2]. Over the past 70 years, human activities have greatly accelerated erosion and weathering on land; greenhouse gas emissions from agricultural, industrial and consumer activities are changing at an unprecedented rate, and the resulting fluctuations in the carbon cycle and climate change are threatening biodiversity and human survival. The changes taking place in the oceans are equally worrisome, and in addition to the widespread concerns about sea-level rise, ocean acidification and marine litter pollution, the recent release of nuclear-contaminated water from Fukushima, which was not sampled by scientists from neighboring countries, has created new uncertainties for marine ecosystems and human survival.

Given that these challenges cross the boundaries of culture, social governance and ecosystems, there is a need to re-examine human-environment interactions from a new perspective. The “Anthropocene”

is a geological concept based on the fact that human activities have had a global impact on climate and ecosystems. Since the introduction of the concept of the Anthropocene [3], the field has attracted a wide range of research interest, with recent attempts to establish an Anthropocene gold spike profile being particularly noteworthy [4]. It is worth noting that the anthropogenic factors driving the evolution of stratigraphic records and surface landscapes in Anthropocene have transcended the boundaries of specific regions in the context of evolving globalization and continuing urbanization, making the traditional research framework in the field of Earth sciences based on a fixed locational perspective is facing the need for adaptive innovation and change. In the last decade or so, a series of illuminating research work has been carried out in the nexus approach and spatially dimensional systems integration in order to better understand the interactions between coupled human and natural systems over distances and their resulting socio-economic and environmental impacts across regions. Hoff first introduced the concept of the water-energy-food (WEF) nexus at the Bonn Conference in 2011 [5] to better deals with the challenges posed by global changes from a multi-sectoral perspective. Subsequently, the nexus approach aroused widespread academic interest. In the same year, Liu Jianguo and others proposed the comprehensive concept of Telecoupling at the symposium on “Telecoupling of Human and Natural Systems” at the meeting of the American Association for the Advancement of Science [6]. This theoretical framework for describing socio-economic and environmental interactions at a distance between coupled human and natural systems was elaborated in the later paper “Framing sustainability in a telecoupled world” [7].

The theoretical idea reflected in telecoupling has attracted widespread academic attention, and a series of related theoretical models have emerged in the global academic community in the same period of time that the theory was put forward and thereafter, typically representing “interregional sustainability” [8,9], urban land

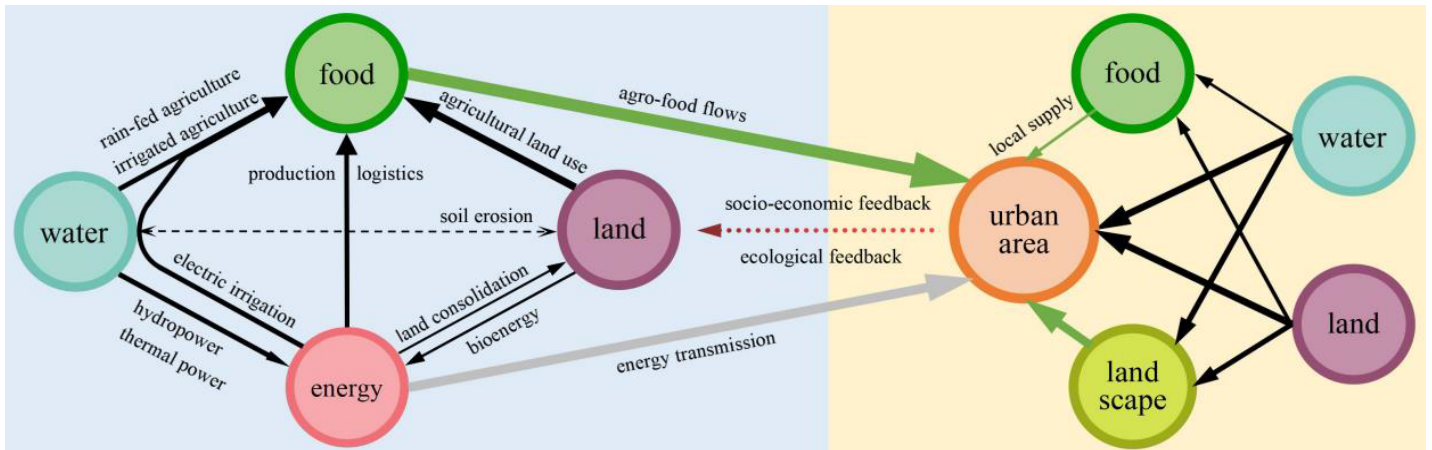


Figure 1: A typical case of cross regional nexus - urban food system.

teleconnections [10,11], local- and tele-coupling [12], metacoupling [13], as well as the Coupled Human and Natural Cube [14]. Among them, metacoupling is a natural extension to the study of telecoupling, and the theoretical framework is actually an integration of intracoupling, pericoupling and telecoupling [13]. It takes into account human-nature interactions within a given system and across spatial distances by incorporating all target coupled systems from near to far, essentially integrating the study of “flow space” and place space [15], and thus not only overcoming the inherent limitations of single-system studies in the classical propositions of human-nature relations, but also compensating for some of the shortcomings of the telecoupling framework [16]. Although many advances have been made in research on the Anthropocene, the nexus approach, and spatial dimensional systems integration, respectively, the combination of the three remains little discussed in the literature. In the context of the Anthropocene, the nexus approach extended to multiple regions - i.e., cross-regional nexus analysis can deepen the understanding of the evolution of the Anthropocene stratigraphic record and surface landscapes. For example, in the framework of the “water-land-food-energy” nexus, water is needed for irrigation and is consumed by energy production that provides electricity for irrigation, while the trend towards the energization of food creates tensions between bioenergy and food production over land resources [17].

These problems of factor clamping and conflict arising from the competitive use of resources affect the food security of distal regions, such as urban areas, through the food system. Conversely, in the process of urbanization, there is also competitive use of soil and water resources in urban areas between different uses. For example, more soil and water resources for urban development or ecological construction means less soil and water resources that can be used for agricultural production. The result is naturally a reduction in the self-sufficiency rate of food in urban areas and a shift in the resource and environmental pressure on food supply to other regions, thus creating a process of cross-regional nexus between natural and human elements [18] (Figure 1). In conclusion, the cross-regional nexus perspective in Anthropocene provides a concrete entry point for revealing the implicit connection and indirect feedback between human beings and the environment in the “flow space”, which is of great significance to the study of human-earth relationship

network system under the perspective of metacoupling, and its policy application is of great practical value in solving the many challenges of the Anthropocene and promoting sustainable development. Thus, theoretical and empirical research on cross-regional nexus in Anthropocene deserves the attention of scholars.

### Authorship Contribution Statement

Enpu Ma: Conceptualization, Writing original draft, Funding acquisition. Liuwen Liao: Conceptualization, Funding acquisition. Yiwen Ji and Sen Yu: Discussing, Drawing.

### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this original manuscript.

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