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## A Systematic Review of Linkages and Trends in Water-Food-Energy/Urban Nexus Research

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The water-food-energy (WFE) nexus are intertwined with urbanization, land use, and population growth and is rapidly expanding in scholarly literature and research projects as a novel way to address complex resource and development challenges. The nexus-related research aims to identify tradeoffs and synergies of water, energy, and food systems, internalize mutual impacts between the nexus and the urban systems, and guide the development of sustainable solutions. However, while the WFE nexus offers a promising conceptual approach, limited research focuses on systematically mapping the water, food, and energy interlinkages and evaluate the research trends and issues that we are facing in this field.

Water, food, and energy are the basis for human livelihoods and economic activities; they are also closely interrelated: Agriculture, forestry, and the energy sector simultaneously depend heavily on and affect water resources. Energy is essential for water management, but also agricultural production, processing, and marketing. Land is needed for the production of food, fodder, and renewable energy, as well as for water resource protection. Demographic trends – such as population growth, progressive urbanization, and globalization, changing lifestyles and consumer habits – are increasing pressure on already limited natural resources. A sustainable urban system requires the achievement of mitigating human impact on natural ecosystems while fulfilling our need for development.

Previous studies have discussed the research trends and nexus assessment tools (e.g., Endo et al. 2015;2017). Despite the increasing use of the WFE nexus in scholarly literature and research projects, few studies have systematically reviewed the broad range of linkages in the body of nexus literature. There is a need for a comprehensive review of, and critical reflection on, existing nexus linkages and issues to gain the big picture, improve clarity, and promote further advances in research for WFE nexus.

This paper reviews current WFE nexus linkages and issues to promote further development of tools and methods that align with nexus thinking and address the complexity of multi-sectoral resource interactions. As a conceptual framework, the nexus approach leverages an understanding of WEF linkages to promote coherence in policy-making and enhance sustainability. A summary of the most frequently used nexus linkages, issues, and keywords obtained from journal articles provides the clues to discover the current research emphases. Findings will provide a better understanding of trends in this line of research, which will serve as a useful reference for

future studies.