

# A three-phase developmental pathway for scaling up urban agriculture

We present an interdisciplinary conceptual framework of urban agriculture and synthesize its social–ecological effects across scales. Using those theoretical foundations, we proposed a multiphase developmental pathway for scaling up urban agriculture, including dynamics, processes, accelerators and feedback loops, which elucidated key considerations associated with achieving transformative change in urban regions.

## This is a summary of:

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## The question

Urban agriculture – growing, processing and distributing food products in urban regions – has been gaining increasing public and political traction internationally. Although urban agriculture has the potential to decentralize urban food supplies, to bolster ecosystem services (benefits people obtain from nature) and to mitigate transboundary environmental footprints (associated with obtaining resource supplies from outside urban regions), thus advancing urban resilience and sustainability<sup>1</sup>, small-scale implementation has largely constrained its impact.

Scaling up urban agriculture has been proposed as a transformative change in urban regions<sup>2</sup> that could meaningfully contribute to urban resilience and sustainability. Yet, current knowledge on scaling up urban agriculture remains fragmentary and siloed in disparate disciplines and sectors. Thus, the drivers, processes and pathways through which scaling up urban agriculture occurs and the factors that enable successful scaling up remain elusive. Such knowledge is critical for informing collective action and policy interventions to achieve resilient and sustainable urban futures.

## The discovery

To address these knowledge gaps in scaling up urban agriculture, we first developed a conceptual framework of urban agriculture in integrated socio-ecological urban regions. This involved identifying and synthesizing published studies in a systematic literature review to derive social–ecological implications of urban agriculture within and across urban region boundaries. We then derived theoretical foundations that represent individual-level and institutional-level factors as ‘bottom-up’ and ‘top-down’ influences, respectively, which underlie how and why urban agriculture might scale up and act as a transformative change in urban regions. Inspired by real-world socio-technical transitions (such as in human mobility or the green economy) and Rostow's theory of economic growth stages (encompassing predevelopment, take-off, acceleration and stabilization stages), we then proposed a multi-phase developmental pathway for scaling up urban agriculture using these theoretical foundations. We demonstrated dynamics, processes, factors (or ‘accelerators’) and feedback loops that drive transformative change and highlighted key considerations for future research, policymaking and implementation.

Within urban regions, urban agriculture can provide diverse ecosystem services (such as food production, heat mitigation,

carbon storage, water or nutrient flow regulation, biodiversity support and ecotourism)<sup>3</sup>. Across regions, urban agriculture effects can cascade along resource supply chains to lower transboundary environmental footprints<sup>4</sup>. Urban agriculture may also pose social–environmental risks, including pollution, injustice and inequality, which impact functioning and health of urban regions<sup>5</sup>.

Biophysical effects of urban agriculture may result in feedback loops affecting social systems, triggering individual, policy and governance changes. These feedbacks may be social–ecologically desirable (positive changes in ecosystem services and community development) and reinforce scaling up urban agriculture, or maladaptive (producing inequality, exclusion and oppression for vulnerable communities) that can hinder the upscaling process.

Our proposed developmental pathway for scaling up urban agriculture has three phases interconnected via feedback loops (Fig. 1), characterized by dynamics, processes and accelerators at the individual level (phase I), institutional level (phase II) and market-based economic level (phase III). We illustrated these phases with real-world examples of scaling up urban agriculture and highlighted diversity, heterogeneity, connectivity, spatial synergies and trade-offs, nonlinearity, scale and polycentricity as key considerations for driving transformative change in urban areas.

## The implications

Our scaling up urban agriculture framework provides a transdisciplinary policy and planning roadmap for collaborative engagement that can catalyse transformative change to achieve robust urban resilience and sustainability. We perceive our three-phase developmental pathway as working hypotheses for shaping scaling up urban agriculture dynamics and outcomes. They are likely nonlinear, context dependent and path dependent, with the specific phase configuration contingent upon socio-political, cultural and economic factors that operate in a co-productive manner at different scales (Fig. 1). Further investigation is needed to empirically test, examine and validate scaling up urban agriculture processes and theories using innovative approaches that analyse and contextualize real-world urban agriculture development cases experiencing such large-scale transformation.

## Jiangxiao Qiu

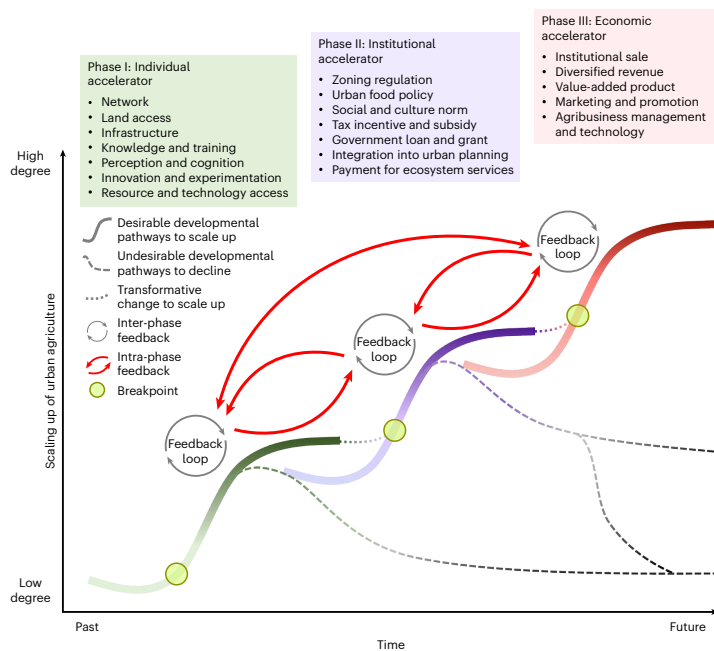
University of Florida's Institute of Food and Agricultural Sciences, Davie, FL, USA.

## EXPERT OPINION

“The article shows that with regard to several sustainability issues in cities (health, pollution, community building and so on), urban agriculture has the potential to provide solutions for establishing sustainable production and consumption systems and should further be investigated.

It further provides a framework showing three potential development phases of urban agriculture that can help as a reference point to cluster, assess and consult initiatives in this field.” **Manuel Bickel, Wuppertal Institut für Klima, Umwelt, Energie gGmbH, Wuppertal, Germany.**

## FIGURE



**Fig. 1 | Developmental pathway for scaling up urban agriculture over time.** Scaling up urban agriculture may follow a triple ‘S’ growth curve indicative of three dominant phases, each of which contains barriers, that when removed become accelerators (bulleted text). Each phase has four stages – predevelopment, take-off, acceleration and stabilization (denoted by the light-to-dark colour gradient of each ‘S’ growth curve). Towards the end of stabilization in each phase, transformative change needs to occur so that scaling up can continue into the next phase, or otherwise urban agriculture stagnates and declines. Positive or negative social–ecological inter-phase and intra-phase feedback loops occur that, in turn, affect the process and degree of scaling up urban agriculture over time. © 2024, Qiu, J. et al.

## BEHIND THE PAPER

This paper originates from the development of a research proposal that addresses social–ecological resilience and sustainability outcomes from scaling up urban agriculture as transformative food systems change. It also builds upon a project that developed technological integrations of the food–water–energy nexus to improve urban sustainability. Our paper provides the theoretical foundations for scaling up urban agriculture, but it has been challenging to secure funding to further empirically model, test and validate processes of urban agriculture upscaling

as our next research agenda, given its high complexity and transdisciplinarity. While this work is exciting, the challenges lie in the vast and heterogeneous literature and complex social–ecological dynamics and interdisciplinary nature of urban agriculture research and practices. We will continue seeking funding opportunities to expand this area and operationalize processes and pathways to scale up urban agriculture as nature-based solutions to forge more socially just and environmentally sustainable urban systems. **J.Q.**

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## FROM THE EDITOR

“The work by Jiangxiao Qiu et al. brings together emerging themes in urban agriculture development, assesses their synergies and presents a framework that policymakers and urban planners can use to develop the sector and bolster urban food systems.” **Annisa Chand, Senior Editor, Nature Food.**