

## Article

# Ecological Civilization in Practice: An Exploratory Study of Urban Agriculture in Four Chinese Cities

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**Abstract:** Chinese development priorities have, since 2012, been formally framed under the slogan “Ecological Civilization” (EC). Simultaneously, urban agriculture (UA) has emerged as a potential strategy to contribute to urban food security in China, in wake of the COVID-19 pandemic. In this paper, we interrogate EC as an approach to urban and agricultural development in China and explore how EC manifests in practical terms, through a case study of urban agriculture. Over four months, we conducted on-site interviews and surveys with UA practitioners in four Chinese cities to understand how their experiences are negotiated with the state, in the context of EC. We find through our case study that capital-intensive and peri-urban approaches to UA are favoured in the context of EC, while small-scale intra-urban initiatives are actively discouraged in policy but passively accepted in practice and enforcement. This is despite all forms of UA promoting key goals for EC, including beautifying urban areas, increasing the quality of life for urban residents, and reconnecting individuals with food growing culture. Despite novel developments in innovative agricultural practices in both rural and urban contexts, the EC pathway risks overlooking grassroots initiatives and meeting local residents’ needs.

**Keywords:** ecological civilization; urban agriculture; food policy; exploratory study; global development

**Citation:** Glaros, A.; Luehr, G.; Si, Z.; Scott, S. Ecological Civilization in Practice: An Exploratory Study of Urban Agriculture in Four Chinese Cities. *Land* **2022**, *11*, 1628. <https://doi.org/10.3390/land11101628>

Academic Editors: Piyush Tiwari and Jyoti Shukla

Received: 1 September 2022

Accepted: 20 September 2022

Published: 22 September 2022

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## 1. Introduction

China’s urban food system has undergone a series of rapid transformations in recent decades. These changes have occurred as urbanization, multiple food safety scandals, concerns over the state of the environment, diet change, and global market dynamics have placed stresses on food and agricultural resources. Urbanization has profoundly shaped food procurement channels in cities of the Global South, as supermarkets have become an increasingly significant component for meeting urban food security, complementing and competing with traditional wet markets and more informal distribution channels [1–3]. In Chinese cities specifically, a combination of public-private investment in food provisioning systems has created robust urban food provisioning [4]. Simultaneously, increased demand for urban accommodation has placed incredible stresses on peri-urban, arable land resources [5]. Regarding food safety, multiple scandals in recent years have fueled a rapidly growing ecological agricultural sector and generated increasing public engagement in alternative food networks that broadly emphasize alternative economic, social and ecological engagement with food production and consumption [6].

Urban agriculture is one potential approach through which to address food security issues in urban areas [7,8], including in China. Urban agriculture refers to a suite of tools and approaches to growing food within and peripheral to cities [9]. It has numerous

potential benefits including urban beautification, increased availability of local food products, employment and economic benefits for its practitioners, reconnection with food growing culture, and broader efforts to increase food system resilience [7,8,10]. Indeed, some argue that urban agriculture can serve as a vehicle through which to make food systems more just, accessible, and potentially address systemic barriers to food access [11].

Numerous case studies of urban agriculture in Chinese cities have emerged in recent years that have identified two key challenges remain for its implementation. First, UA in China is fragmented, lacks legal protection, and is generally neglected by food policy [12]. Without formal policy support and acceptance, the full economic and food security benefits in China have yet to be realized, as observed in case studies of Chongqing [13] and Wuhan [14]. Second, most urban agriculture initiatives in China that have been documented in the literature pursue more multi-functional forms of UA [15]. Multi-functionality prioritizes multiple goals for UA, including agritourism, food security, environmental education, among other benefits. However, multi-functional agriculture often occurs in peri-urban, not intra-urban, areas [16]. There is a need to examine UA as a potential food security strategy in wake of the COVID-19 pandemic, especially recognizing the need for greater civil society participation in emergency food provisioning [17].

The Chinese government now frames agricultural development and industrial development writ-large under the Ecological Civilization (EC) slogan: a term increasingly adopted in official policy documents and discourse over the past decade [18]. Understanding where and how UA fits into this overarching development framework is crucial. Similar to Ecological Modernization (EM), scholarship suggests this approach to development is highly technocentric, prioritizes strong public-private linkages, and criticizes it for overlooking grassroots participation [19,20]. However, several scholars suggest that EC marks a distinction from Western approaches to sustainable development, emphasizing China's unique Confucian environmental philosophy and emergence as a global leader on sustainability issues [21].

Scholars have written extensively regarding China's broad suite of economic development priorities under the slogan "Ecological Civilization" [18]. Informed by the adverse social and ecological impacts of China's rapid industrialization, the state approaches economic policy through a lens that increasingly considers the relationship between its citizens and the environment, in the context of its increasing leadership role at a global scale [22,23]. Regarding urban development, the EC slogan highlights the preoccupation of the municipal authorities with securing a global image of an 'eco-city' and fostering a 'harmonious' relationship between urban dwellers and the natural world [24].

## 2. Research Gap

In this paper we contribute to the body of research that explores urban agriculture in Chinese cities, focusing on its intersection with EC priorities. A suite of case studies has emerged in recent years that catalogues barriers and opportunities for UA in Chinese cities [15]. Absent from this literature is an in-depth examination for how and what barriers exist for urban agriculture to further the goals for Ecological Civilization. Indeed, how EC as a set of policies, ideas, and visions for China's future translate 'on-the-ground' and, in particular, within an urban food systems context, remain pertinent gaps in the literature. To address this gap, we undertook an exploratory case study of UA in four Chinese cities, that brings urban and agricultural development initiatives directly into conversation with one another. In undertaking a thematic content analysis of our interview and survey data, we draw from critical scholarship exploring the EC concept. We focus on answering the research question: to what extent are the goals and implementation of EC manifest across diverse forms of urban agriculture? We argue that EC policy priorities favour a specific form of agriculture in urban areas that is more technological, controlled, and public facing, at the expense of small-scale, more informal growing carried out by citizens. The objective of this paper is as follows: to understand if and how the goals and implementation of EC

are represented in practice, through an exploratory case study of UA in four different Chinese cities.

We begin this paper by discussing the myriad of changes and pressures experienced by the Chinese agricultural system. We define these challenges and the Chinese states' responses over time, from 'ecological modernization' to 'ecological civilization' development frameworks, including more critical commentaries of these approaches. We subsequently present the results of our data analysis: an exploratory case study of UA in four Chinese cities. We conclude the paper by discussing how many of the goals of EC are represented across diverse modes of UA, yet only more capital-intensive and peri-urban forms of UA are incentivized or allowed in practice.

### 3. From Ecological Modernization to Ecological Civilization

Urban agriculture, among other bottom-up approaches to food production, is born from decades of modernization in China's agricultural sector. The modernization of China's agricultural sector since the 1970s is distinct from other strategies pursued across the globe, comprised of unique processes, opportunities, and challenges. For example, Zhang and Donaldson [25] describe China's agricultural modernization in two 'leaps'. The first leap involved the de-collectivization of agriculture in the late 1970s, while the second leap from the 1990s onwards involved the institutionalization of agricultural modernization, with the goal:

"...to make the transition from traditional to modern agriculture and from uncoordinated and low-scale operation (*cufangshi jingying*) to coordinated and large-scale operation (*jiyueshi jingying*). The central government characterized a modernized agriculture as commercialized (*shangpin hua*), specialized (*zhuanye hua*), scaled up (*guimo hua*) standardized (*biaozhun hua*) and internationalized (*guoji hua*)." (p. 29)

The later twentieth century observed the prioritization of ecological goals, specifically, within China's economic development policies and priorities. Some scholars refer to this process as the development of 'ecological modernization' (EM) with Chinese characteristics, with the nation having achieved incredible environmental outcomes in a short period of time [26]. China's approach to EM varies from the Western context in which this theory was formed, described as highly technocratic and top-down steered [27]. Specifically, this process has been comprised of the rapid development of a large environmental regulatory bureaucracy at national and local levels, emphasis on 'clean' economic development, the rise of state-run agri-food business and limited but increasing civil-society participation [28–30]. For civil-society participation, specifically, environmental NGO's and civil society groups have grown in number in recent years, though these organizations operate outside the support and acknowledgement of the state [6,31,32]. As such, this approach to EM has been critiqued for emphasizing "...technological-economic dimensions of sustainable development, without entering too much into relations with equity, equality, citizen empowerment and the like..." Zhang & Donaldson [25] (p. 665). Alongside increased civil society participation, green consumerism has also emerged as a potential lever for supporting sustainable transitions of China's food system [33].

The term "Ecological Civilization" is China's most recent slogan for the state's economic development pathway. While initially debated and contested by diverse actors, the development narrative of 'Ecological Civilization' (EC) has now, under President Xi Jinping, been codified [18]. Specific policies and approaches involve the application of low-carbon technologies to existing and new 'green' industries, among others [18]. EC narratives are notable as compared to previous green development policies in their global-facing nature, as well as their incorporation of Chinese culture and ecological ethics into technological change regimes [34]. Simultaneously, this approach is optimistically suggested to serve as a model for green development pathways for various emerging economies [35]. Central to the EC slogan is placing China as a model sustainable society and

harnessing Chinese cultural tradition to create a harmonious state between society and nature [34,36]. Through EC, China aims to position itself as a global leader in sustainability and model for developing economies [37,38]. Marrying ecological considerations with social and economic development, EC aims to create socio-ecological ‘win-wins’ [39].

Others are more critical of the Ecological Civilization narrative, as presented in a review of the concept by Goron (2018) [40] who draws attention to the politics of its framing. First, some argue that the EC discourse is framed largely in anti-Western rhetoric, positioning western leaders as inadequate to tackle global environmental challenges; some scholars argue this is counterproductive to collaboration on those challenges [20]. Second, that it reinforces a global commitment to technocratic and green capitalist economic development, rather than a more “sustainable” (i.e., inclusive) alternative [19]. Third, that the discourse of EC constrains debate over the politics and economics of sustainability, though some scholars that promote EC (especially from the social sciences) are committed to global scientific discussions and critical perspectives on the EC approach [40]. Finally, echoing critiques of top-down governance mechanisms, EC policies have run into challenges ‘on-the-ground’, as evidenced by land-use schemes that fail to reflect local resource use practices or adapt to volatile agricultural commodity markets [39,41], or where resources are invested toward EC schemes that fail to address the real needs of local residents [24].

Echoing calls to modernize the agricultural sector from the late 20th and early 21st centuries, agricultural policy under an EC slogan aims to marry ecological goals with social and economic development priorities. Only a few studies have explored the EC concept as applied to agriculture in China, both in urban and rural spaces [42]. Zinda and He [39] discuss, through a case study of walnut production, how EC development pathways aim to prioritize ecological goals, cultural/traditional agricultural practices, and economic development priorities. Yet, the authors argue that EC outcomes may fall short, pending government capacity to adapt and be flexible in response to existing land management practices and market volatility. While not focused on agriculture explicitly, studies on EC translation into urban governance processes in China emphasizes the importance of aesthetics in land use planning and purpose. Planners center harmony between humans and nature in their land use planning and enforcement, creating an international “benchmark” for what cities “ought to look like”, but overlooking citizen engagement: particularly from lower-income individuals [24]. Such framings of urban land use planning have clear implications for the forms and types of urban agriculture that might take place.

As the EC concept continues to advance China’s approach to urban and agricultural development, it is critical to scrutinize how policies that incorporate EC as a slogan play out in practice. We ask how the goals and governance mechanisms of EC are manifest, in the context of urban agriculture. In our results section we describe results of our exploratory case study of urban agriculture policy and practice in four Chinese cities. We conclude by critically discussing how the EC slogan informs urban agricultural policy and practice on the ground. UA in China is prioritized in diverse and unique ways, as compared to common forms of UA pursued in North America, Europe, and Australia. We argue that EC as a slogan and set of policies have played a significant role in prioritizing capital-intensive (e.g., plant factories, vertical farms, intra-urban greenhouse production) and agritourism forms of UA at the expense of small-scale, informal forms.

#### 4. Methods

To address these questions, we undertook a deductive research approach to understand how EC manifests in UA practice in Chinese cities. Two of the authors undertook interviews with UA practitioners and policy makers from four cities in China, during May–August of 2017. The two authors each separately conducted interviews using a similar semi-structured approach: one focusing in Nanjing, and the other in Shanghai, Yangling, and Beijing. We define UA according to three broad forms, based on use of capital and location: capital-intensive intra-urban, peri-urban agritourism, and small-scale intra-

urban [43], and conducted interviews with individuals involved within each. Interviewees and respondents across all forms of UA were recruited through field observation and snowball sampling approaches. Interviews were conducted in Mandarin, Chinese and translated, before subsequently being analyzed by English-speaking authors. This study is exploratory in nature. Thus, we draw themes from a relatively small dataset of in-depth interviews rather than draw statistical inferences from a larger set of survey data.

#### 4.1. Study Area

Interviews and site observations for capital-intensive UA projects were conducted in three large cities: Nanjing, the capital of Jiangsu Province (located 300 km west of Shanghai); Shanghai; and Beijing. Interviews with peri-urban agri-tourism farms occurred within an ecotourism demonstration zone in Yangling, a small city in Shaanxi province (located 1500 km northwest of Shanghai). Interviews and questionnaires with small-scale UA practitioners took place in Nanjing, only. We selected these cities to explore UA for three primary reasons. First, we wanted to explore UA across an array of regions in China including northern, southern, eastern, and western areas. We selected Beijing and Shanghai as capital intensive intra-urban projects, at the time of this study, were mainly concentrated in these cities in China. Further, Yangling and Nanjing were, at the time of this study, as of yet unexplored cities in the context of UA.

#### 4.2. Analysis

We undertook a thematic content analysis of our interview and survey data to deduce if and how EC's key priorities and governance mechanisms are manifest in UA. To do this, we used a similar approach as other studies [44] and undertook a literature review to understand how literature frames the broad goals and governance of EC. We drew from a set of well-cited (>30 citations), English-written social scientific literature exploring EC. This set of literature included Goron [40], Pow [24], Hansen et al. [34,45], Marinelli [21], and Geall and Ely et al. [18] and our focus was on unpacking how these authors understood the goals of EC and its implementation. This led us to focus on the following five criteria to examine our interview and survey data:

1. Goals for EC
  - Creating beautiful landscapes
  - Constructing an ecological 'ethic'
  - Pursuing sustainable development
2. Governance
  - Demonstrating Chinese leadership across scales
  - Prioritizing top-down, technology-based projects

We subsequently coded our interview and survey data with these broad topics in mind, to observe if and how these EC goals and governance mechanisms characterized (from the literature) are reflected across diverse forms of UA practitioners.

We chose UA as a case study for a few key reasons. UA has played a relatively small role in Chinese food system policy development, neither actively promoted nor prohibited in practice by the state [14]. In practice, an array of UA initiatives currently exists in Chinese cities. These initiatives range in their formality (i.e., institutional support), policy support, and capital-intensity, from balcony gardens to state-supported vertical farming technologies (see Luehr 2019 [46] for in-depth discussion). In this research, we sought to understand the modes, motivations, and challenges for UA in the Chinese context. A full summary of the types and numbers of interviewees and respondents is presented in Table 1.

Further, UA is a unique case study to observe how EC operates in practice. UA contributes to similar goals for urban environments as EC, spanning urban, ecological, social, and cultural development domains [7,8,47]. Yet, UA is diverse in its forms, motivations,

and indeed its governance in the Chinese context [14,43]. Mapping these overlapping and potentially contradictory goals between EC and UA is thus an important area of contribution to scholarship exploring UA in the Chinese context. Furthermore, agricultural development and green urban planning are key dimensions for EC policy, respectively [24,39]. We would suggest that this makes UA an exemplar for how EC is implemented in practice, as it combines the states' respective attitudes toward agriculture and urban planning.

**Table 1.** Number of interviewees for each form of UA considered. An additional 56 questionnaires were answered by small-scale intra-urban practitioners.

	Type of Individuals and Operations Interviewed	Total Number of Interviewees
Capital-Intensive Intra-Urban: vertical farming, zero-acreage building, indoor grow-units directly in cities	Private Enterprise	2
	State-Owned Private Enterprise	2
	Academics	1
	Researchers and Developers	4
Peri-Urban Agritourism: ecological farming immediately outside cities, include experiential tourism component	Farm Managers and Farmers	9
Small-Scale Intra-Urban: informal cultivation by citizens directly in the city, on public or private property	Urban Farmers	13
	Government Officials	3
	Neighbourhood Committee Members	2
	Academics	1

We acknowledge that, due to language barriers, our small number of interviews and survey respondents, as well as our available data sources, some potential context for understanding EC is lost. Government documents and academic papers written in Mandarin likely provide important information to understand the key goals and governance of EC. However, we suggest that English language academic papers regarding EC provide a unique lens through which to assess its goals and methods of governance. In contrast to government documents, English-language peer-reviewed academic publications, particularly from the social sciences, provide important critical discussion of EC and its outcomes. We also acknowledge that given that our interviews were conducted in Mandarin and subsequently transcribed and translated into English, some detail may be lost. Moreover, our positionality as Western researchers may have affected our interviewee's participation in this study [48]. To attempt to mitigate these challenges, the two interviewers worked with research assistants and translators prior to, during, and immediately following interviews to introduce our research project and to verify the accuracy of interview notes and recordings. While our interviewee numbers are small in the context of four large Chinese cities, we note that this study is exploratory in nature. Rather than aim to present statistical inferences regarding UA in these specific city contexts, we use this data to present themes for future empirical examination.

We also acknowledge that the prevailing attitude toward urban green space (including for urban agriculture) as well as urban food security has shifted in the context of the pandemic, since the time our interviews and surveys were undertaken. Demand for urban green space has grown in several Chinese cities [49] and there is increasing recognition for the role that grassroots and voluntary citizen organizations can play in emergency food provisioning [17]. This increased public demand for green space may translate into increased numbers of citizens practicing UA, or potential Chinese policies to increase green space access (including potentially UA).

## 5. Results: An Exploration of UA in Four Chinese Cities

“[Urban modern agriculture] places emphasis on the combination of three concepts, namely: production, lifestyle, and ecology, which include new ideas such as (1) cater to the need of urban civilians for leisure and sightseeing; (2) cater to the ecological need to build a greener environment; (3) decrease pollution, lower the use of pesticide and chemical fertilizers in the production of food.” (Key Informant 2, 28 June 2017).

This quote, taken from an interview with a state official, highlights a prevailing attitude toward UA observed through our exploratory case study. Namely, UA in the Chinese context is about quality: increasing the quality of urban life, the quality of the urban environment, and the quality of food commodities themselves. In what follows, we use the themes deduced through our literature review to analyze our discussions and questionnaires with UA practitioners. Overall, we found that each of the three modes of UA practiced within Chinese cities explicitly articulates EC goals, but in different ways. Generally, the attitude of city officials is more favourable toward ‘higher-tech’ approaches to UA and UA that is practiced outside the city, as opposed to directly within.

Four capital-intensive operations were private enterprises that developed small and large-scale technologies for peri-urban production and large-scale vertical farming [46]. Two of these operations were state-owned. Five additional interviews were conducted with one urban planner and four vertical farming technologies researchers. Nine interviews were conducted with peri-urban farmers in an agri-tourism demonstration zone. A majority of capital-intensive and peri-urban interviews (N = 16) were conducted in Mandarin, Chinese, and subsequently translated to English by research assistants in China. A total of thirteen (N = 13) small-scale intra-urban growers were interviewed, and a total of fifty six (N = 56) participated in our questionnaire that explored their motivations for growing food in the city. An additional six (N = 6) interviews were conducted with state officials, neighbourhood committee members, and one academic regarding small-scale growing in Chinese cities.

## 6. UA Goals and Implementation—Crossovers with EC

### 6.1. *Creating Beautiful Landscapes*

For capital-intensive interviewees, vertical farming technologies allow for the introduction of greenery into buildings and business parks. Interviewees suggest that this greenery contributes to more naturalized and thus more welcoming environments. As one urban planner stated, the goal of their vertical farming operation was to “increase the quality of life (July 2017)” for residents. For small-scale intra-urban growers, participants believed that greening (through growing flowers and plants) made the environment more beautiful and would generate positive mental health benefits. Yet, in discussions with city officials, it was clear that do-it-yourself, guerrilla gardening, or otherwise small-scale informal forms of UA are either actively prohibited or passively accepted in practice. Only particular plants (inedible plants and flowers) are formally allowed to be grown outside households or, in some limited capacity, in public spaces. Officials were skeptical of the ‘optics’ of small-scale and other informal forms of UA, citing it in opposition to efforts to ‘beautify’ urban areas:

“People could grow flowers and plants around their own households, they could even grow some on the public green space, but in principle it is not allowed to grow vegetables. Even if growing some small-scale vegetables is permitted, one cannot influence other households, nor could they take up public space or parking lots, or cause any sort of inconvenience to other people, especially foul smell.” (Neighborhood Committee Member, June 2017).

In practice, however, we found that vegetable growing initiatives are ‘tucked away’ out-of-sight, and either passively allowed or actively removed with compensation. We observed a common refrain from city officials as well as peri-urban farmers that food

growing should take place in the countryside. We found that these individuals considered ‘traditional’ forms of cultivation as more appropriate for outside urban areas. Interestingly, peri-urban agri-tourism interviewees stressed the importance of connecting urban and rural areas, yet keeping land use patterns (i.e., where agriculture takes place) spatially distinct:

“Leisure agriculture should be in the rural areas...This kind of development is consistent with the policy of ‘unifying urban and rural areas’ proposed by the country.” (Agritourism Researcher, 2017).

## 6.2. Constructing an Ecological “Ethic”

Across all forms of UA here analyzed, reconnecting previous farmers and non-farmers with food production in and around cities was deemed a major goal and opportunity for UA. Individuals involved in capital-intensive and agritourism based projects catered to middle- or upper-class consumers as means to re-engage with food growing heritage, either through visiting farms outside the city or observing food production in controlled environments within business parks and public edifices. Despite using novel production techniques, capital-intensive UA practitioners highlighted the importance of their operations in sharing important cultural traditions around food. Grow-at-home units and vertical farming demonstration projects were attempting to engage members of the public—perceived as disconnected from food-growing heritage—in food growing practices: “[vertical farming] creates unexpected outcomes, having consumers, who have never had a chance or are disconnected from the whole [food growing] process, be part of it (Urban Planner, July 2017)”. Such projects sought to serve as models for what a ‘healthy’ or ‘ecological’ (treated synonymously) lifestyle looks like, for more ‘modern’ citizens. Peri-urban agritourism operations echoed similar goals, serving to reconnect urban consumers with ecological food growing practices outside the city.

With respect to small-scale growers, food growing was an integral part of their lifestyle and agricultural heritage, as growers took pride in their land and strategies to utilize resources (e.g., land, water, fertilizer) efficiently and effectively. Sixty-seven percent of small-scale UA practitioners that took part in this study had been farmers or farmed at some point. Producing food was thus a significant component of natural heritage, tradition, and reconnection within urban environments for many of these individuals. Simultaneously, over eighty percent of study participants believed that growing food is a significant part of their traditions and culture. Finally, participants shared food with extended family, friends, and neighbours (in addition to selling produce), indicating that producing food and sharing it, key cultural traditions, were a way to maintain or build new relationships.

Another important dimension of constructing an ecological ethic, for all forms of UA here analyzed, was creating higher quality food products. More specifically, we found that all forms emphasize trust, transparency, and ecological modes of food production processes to some degree. Yet, trust may take multiple forms within UA, from increased access to information around production process all the way to direct consumer participation within food production practices. For small-scale informal growers, trust was fostered by knowing how their food was produced (and for those receiving produce, trusting that producer to produce healthy food). Yet, it is important to note that state officials lack trust in citizens to independently produce food without generating public ills (poor smells, sanitation challenges, lack of structural integrity for growing fixtures, etc.). Capital-intensive growers, engineers, and urban planners echoed similar reasons for their growing. Interviewees suggested that capital-intensive approaches to UA further food system transparency by allowing consumers to grow food directly themselves, at home (e.g., home-scale vertical farm systems); emphasized making production information readily accessible via QR codes; and having consumers directly observe growing processes through public demonstration of vertical farming projects. For agritourism projects



it was further to do with directly observing food production or being able to access accurate product information through QR codes and other schemes, such as surveillance cameras on farms. Moreover, most peri-urban agritourism operations produced ecologically or organically, though only two were certified.

### 6.3. Pursuing Sustainable Development

Much discussion around capital-intensive and peri-urban UA centered around their potential environmental and economic benefits. Interviewees identified closing resource loops, increasing production efficiencies, and achieving simultaneous economic and environmental outcomes as key goals for their operations, echoing several of the key goals for EC. All capital-intensive growers identified China's loss of arable land as a major reason for increasing food production in urban areas, through greenhouse growing or vertical farming. To interviewees, vertical farming and indoor growing technologies allow food to be grown without the use of arable land and are thus an attractive opportunity to provide fresh food to cities without the requirement for long-distance transportation. For all agritourism farms, growing food ecologically was an important priority, both for increasing the quality and marketability of their produce, as well as for perceived increases in the quality of the local environment (air quality, in particular).

Making food production more efficient was a key lever to achieve the environmental and economic benefits listed above, as identified by intra-urban capital-intensive, or peri-urban agro-tourism entrepreneurs, researchers and the one interviewed state official. These individuals defined efficiency as the broad practice of reducing agricultural inputs and maximizing outputs through the use of technology. As an urban planner described: "I think technology is the key. As technology really, changes the productivity; that's one way to talk about vertical farming... (Urban Planner, June 2017)." Intra-urban capital-intensive researchers and businesses emphasized the opportunity for their systems to optimally apply water, nutrients and other inputs, as their systems provide total control over agricultural inputs (sun, light, water, etc.). Agritourism farms also noted that closed-loop, efficient nutrient systems were the main ecological benefit to their forms of production, as they prioritized waste recycling to maintain their ecological standards. Moreover, most agritourism farms and capital-intensive enterprises were actively attempting to lengthen industry chains, promoting tourism services, marketing their social benefits, and processing goods in addition to selling raw agricultural products (pursuing multi-functional agriculture). All these agritourism operations utilized ecological production methods, considering their multi-functional schemes as a means to reduce the ecological impacts of agriculture while achieving economic development goals.

Another key dimensions of sustainable development to consider is food security, and how UA is or is not perceived to increase food availability, access, and utilization at the city-level and beyond. All participants except one did not view capital-intensive or peri-urban agritourism operations as sufficient strategies to bolster Chinese food security. These participants stressed comparative advantage as a guiding principle to pursue food security goals, rather than localization through UA. This was argued by one vertical farm researcher:

"Different kinds of foods have different features. Those not suitable for long-distant transportation or preservation are mainly grown locally. Also, Chinese really care about the taste of food, and they think different foods belong to different places." (Vertical Farm Researcher, July 2017)

To these interviewees, the specific place in which food is grown contains intrinsic efficiencies or advantages. Capital-intensive and/or peri-urban operations are ideally suited more for quality and freshness rather than for bulk carbohydrate production.

Similar to the capital-intensive intra-urban and peri-urban practitioners above, small-scale producers did not grow necessarily for increased food security, instead emphasizing environmental and resource-saving motivations for growing. Small-scale intra-urban

agriculture practitioners identified similar environmental benefits as those from capital-intensive and agritourism UA. The most commonly listed environmental benefit to UA was improved air quality, as emphasized by one participant who was motivated to grow more plants in order to: “emit fresh oxygen and [remove] carbon dioxide” from the environment (Small-Scale UA Practitioner, May 2017), highlighting concerns over air pollution in the city. Participants also prioritized reusing materials to fertilize grow beds and engineer planting areas, for both economic and environmental reasons. To overcome soil nutrient limits, many participants dug additional mud from the surrounding areas: riverbanks, sewage drainage spots in the city and construction sites. Additionally, cultivators utilized household human waste (night soil), ash and food scraps to enhance the soil quality. For water access, participants often would place various types of vessels to capture rainfall, recycle several types of greywater from various household tasks, or dug wells and small streams. Food was not typically grown in soil, instead in various forms of urban waste (e.g., sinks, toilets, tubs) and vertical structures within residential neighborhoods, whereas those growing on areas of ceased development utilized raised beds, greenhouse structures, and various vertical structures. Plots were observed in an array of locations, such as along sidewalks or on sites of previous but ceased development (see Luehr, 2019). Finally, most small-scale intra-urban agriculture practitioners grew many diverse, indigenous crops, thereby increasing local biodiversity. Importantly, all these practices for small-scale UA growers involved developing more cyclical resource loops: a key goal for sustainable development.

#### *6.4. Demonstrating Chinese Leadership across Scales*

Largely, UA was not considered as a method for cities or regions to achieve recognition by the state or the international community. This was true across most interviewees and survey respondents with some notable exceptions. For three (N = 3) of the capital-intensive intra-urban stakeholders, their operations were viewed as an important means to demonstrate to other cities and nations what vertical farming technologies could do. One vertical farming technology designer was optimistic regarding Chinese vertical farming potential, describing with pride their yearly international conferences that showcased Chinese vertical farming innovation to countries such as Japan, the Netherlands, and Israel. This interviewee stressed that China was a leader in UA technology development. Another urban planner was similarly optimistic, stating that their vertical farming system could serve “at least for some cities to model” (Urban Planner, 2017). This was echoed by another government official involved with a vertical farming project outside of Beijing, who noted that their system could be replicated and spread to other major urban regions in China.

Small-scale intra-urban stakeholders did not discuss their operations or the role of UA, generally, in acting as a model for other cities or countries. This might have partially been due to the questions that we asked stakeholders, which primarily considered their motivations and practices rather than their broad perceptions of UA. However, we would also suggest that this was due to a generally negative (or at least neutral) attitude of state officials toward this form of UA practice. City officials were keen for more ‘modern’ forms of UA to be practiced, such as rooftop gardening, small-scale greenhouse growing, and other more capital-intensive modes.

#### *6.5. Prioritizing Top-Down, Technology-Based Projects*

The capital-intensive and peri-urban agritourism UA operations that were interviewed in this study were often directly incentivized by the state, through their promotion in demonstration zones, as demonstration projects, or in academic research facilities. This is similar to other projects outside of this study that have similarly been sanctioned by the government<sup>1</sup>. Capital-intensive projects are reliant on municipal discretion and in some cases, as described by an urban planner, municipalities were reluctant to engage with the project thereby resulting in delays: “It is unclear what the position of the government is

on the project, especially vertical farming” (Urban Planner, 2017). In other words, capital-intensive UA projects, though permitted and in many cases developed by the state, are reliant on seemingly ‘lukewarm’ acceptance by local and national authorities. Peri-urban agritourism farms that partook in this study observed more consistent levels of support from the government. In contrast to these other two forms of UA, small-scale UA practitioners faced multiple instances of conflict with city/enforcement officials. At the time and in the city (Nanjing) in which we undertook our interviews, small-scale UA was prohibited within city bylaws. In practice, however, growing food was more strongly discouraged when carried outside individual citizens’ household properties. Yet, despite preventing informal cultivation in writing, the state recognizes informal forms of UA as evidenced through compensation programs or ‘turning a blind eye’ to existing operations.

## 7. Discussion

In this paper we contribute to scholarship that explores UA in the Chinese context by advancing a typology of three forms of UA, and considering how the goals and implementation of EC, a unique set of development priorities, are manifest in urban and agriculture initiatives. Specifically, we undertook an exploratory case study analysis of UA in four Chinese cities to observe if and how these dimensions of EC are represented across three different forms of UA in practice: small-scale intra-urban, capital-intensive intra-urban, and peri-urban agritourism. In this section we argue that all forms of UA prioritize key EC goals, but in very different ways. The attitude of state officials and planners toward UA reflects some of the key findings for EC implementation described in the literature. Importantly, official prioritization of technology-intensive and peri-urban approaches to growing food in the city risks overlooking the practices of small-scale intra-urban growers and pursuing what some scholars are arguing for: an inclusive, just EC pathway [41].

We highlight that our study is exploratory in nature. We do not aim to generalize our findings to the four cities within which we worked, or across China more generally. However, the themes we found through our in-depth interviews can serve as a springboard for future empirical examination. One important contribution of this study lies in its typology of UA (distinct from other studies that explore UA in China, most often focusing only on multi-function initiatives and neglecting capital intensive and smaller-scale forms) [15]. Further, our analysis of UA’s intersection with EC reveals its potential as a method to achieve EC goals, and is among few studies [24] to have explored these intersections in qualitative, empirical detail. Further exploration of UA is particularly important in China, in the context of post-pandemic efforts to bolster urban food security and green space. Further, our research augments global efforts to better understand UA. Specifically, we focus on the governance mechanisms and institutions that may lead to (or detract from) its potential food security goals [8]. This is particularly important in the context of exploring UA as a form of civil-society participation and an exercise of public agency over urban areas [11].

The literature exploring EC in Chinese cities contends that urban planning favours a specific aesthetic of nature that is meticulously manicured and managed, complete with high technology and with world class mega-structures and architectural demonstrations [24,50]. In our study we found that stakeholders across all forms of UA view their operations as a means to beautify urban areas and contribute to greening the city; yet, it was clear through our interviews that capital-intensive and peri-urban forms of agriculture are aestheticized over small-intra urban farming. There is an implication here that agriculture (in its traditional form) should be away from the city, unless in a ‘modern’ high-tech form. Indeed, this echoes the results of other studies of UA in Asia, where most UA gardens are found on the periphery of cities [51]. Small-scale growers viewed their growing as a means to beautify their surrounding environment; however, state officials were more skeptical and framed the potential challenges for small-scale growing in terms of its smell or unsightliness. Moreover, the continued functioning of small-scale intra-urban growing

operations was subject to the whims of city officials who could either leave them operating or evict, compensate (or not compensate), and prohibit cultivation. This echoes the findings of similar studies [24] regarding EC in urban areas, where local greening practices were observed to conflict with the aesthetic appearance sought after by city officials:

“Ironically, many of the indigenous green practices are also deemed to be at odds with the eco-aesthetic regime in [the case study]. For instance, many respondents were told not to install their own solar panels due to their ‘unsightly’ appearance” (Pow, 2018, p. 878).

These aesthetic goals for EC are tangential to goals for increasing the quality of life for citizens living in cities. According to the literature, EC aims to reconnect Chinese citizens with culture and remold the perceived separation of humans from nature through China’s rapid industrialization processes over the past seventy years [52]. In our study, we found that all UA operations articulate similar aspirations for contributing to increased quality of life for practitioners. Interviews from capital-intensive operations regarded their growing as a means to create more beautified work environments and increase opportunities for socialization. For peri-urban agri-tourism farms, reconnecting urban citizens with food growing practices (in the countryside) and higher quality food were key goals. For small-scale UA, food growing was an important tool for participants to reconnect with their food growing heritage; share food with friends, neighbours, and family; and to contribute to their mental and physical well-being.

Developing policy for a ‘higher quality of life’ is an inherently normative goal. To critical EC scholars it is thus crucial to evaluate EC’s aim to increase quality of life: who gets to define what is an increased quality of life and who is left out? Some academics critique this prioritization and planning for a particular lifestyle, defined by the state, as overlooking social concerns or desires in practice [53]. We found that in practice, each form of UA favours a particular ‘type’ of reconnection for specific classes of individuals. In the case of capital-intensive and peri-urban agri-tourism agriculture, the beneficiaries of these operations were relatively affluent consumers who either worked in business parks in the city or could afford leisure time to visit the countryside. In the case of one vertical farming project, farmers currently on the land were to be relocated and older buildings demolished. The new town, replete with a vertical farm and new amenities, was explicitly designed for white-collar commuters travelling for work to major metropolitan areas. In contrast, small-scale intra-urban agriculture stakeholders were all of lower-income status, with a majority having previously farmed during their life. To summarize, all forms of UA emphasize reconnection and higher quality of life but for very diverse classes of individuals, respectively. These findings echo that of literature from Europe that found that stakeholders perceived a lack of social inclusion as a key challenge facing capital intensive forms of UA [54].

The EC slogan further emphasizes twin goals of economic and ecological development, drawing on appeals to harmony between society and nature found within traditional Chinese philosophical heritage [34]. Moreover, through the pursuit of EC China aims to position itself as a global leader in ecological and economic development, promoted through a material symbolic presentation of its version of eco-cities. Such narratives center the city or demonstration projects as a ‘model’ or a suite of ‘best practices’ for other cities across the globe [55]. All forms of UA promote their operations as a means to achieve ecological goals. Through pursuing closed-looped, efficient systems, interviewees from all forms of UA suggest their operations can minimize resource waste and maximize output. Yet, only capital-intense UA and peri-urban agritourism projects received direct state support or were developed as models of best-practice to be replicated across the country, despite the potential for small-scale intra-urban agriculture to contribute to local environments and utilize waste resources. Interestingly, across all forms of UA very few stakeholders consider UA as an economically viable food security solution. Moreover, only a handful of capital-intensive growers suggest their operations could be modelled

across the country. This suggests that participants do not consider UA as a key goal or model for sustainable development (a key goal for EC), nor as a viable food security strategy. Instead, practitioners consider UA as a means to produce a higher quality of (urban) life, through beautifying the environment, producing higher quality food, and reconnecting urban citizens with food and food production practices. These findings echo global research on UA, where UA has observed socio-cultural benefits, but its potential contributions to urban food security remain unclear [7,8]. Indeed, many of our findings regarding well-being, economic opportunities, and education, are key benefits observed in the reviews of UA across diverse geographic contexts [47].

The EC slogan intimates much more than a new ‘ecological way’ for economic development. It aims to reconcile economic and ecological goals with cultural values around harmony and balanced socio-environmental relations. Martindale [56] argues that it emphasizes the importance of trust between citizens and government: “In practice, the slogan of Ecological Civilization prompts a form of trust, as it legitimises Chinese society to promote ‘green’ development through a state provided lexicon” (p. 201).” For small-scale intra-urban actors interviewed in our study (and others [14]) trust in the state (that their grow beds won’t be removed, plants uprooted, etc.) is difficult and uncertain to form, and growers must often conform to local officials’ definitions of ‘quality’ or ‘beauty’. Simultaneously, the interplay between Chinese state and local state officials is complex and often asymmetrical [39]. With EC goals imposed from the top-down, local city officials often struggle to balance priorities between goals for the economy and the environment as well as, in this case of UA, the needs of practitioners on-the-ground. Yet, small-scale intra-urban practitioners maintained agency in face of these pressures, through continuing to operate and work around/with officials in complex ways. This echoes other literature exploring the impacts of EC on local resource users, where agency is negotiated with the market and the state [57].

Overall, our interviews with local state officials in addition to planning authorities suggest that UA is implemented by the state in top-down, technology intensive modes. Small-scale intra-urban agriculture: a grassroots and non capital-intensive approach to UA, is not actively incentivized by the state, but passively accepted or prohibited in practice. This is despite the fact that all forms of UA echo similar goals, including many defined in the academic literature for EC around improved quality of life, beautifying diverse landscapes, and reconnecting diverse individuals to the food system and to Chinese food growing heritage. Crucially, the state reinforces capital-intensive and peri-urban agritourism modes of UA that cater to higher income individuals with time and money to enjoy those operations. Without considering the needs of small-scale growers, state officials risk overlooking mostly lower-income individuals and their activities that, though less aligned with state-held ideals of ‘quality life’ and ‘beauty’, are nevertheless important for those growers themselves.

Future empirical work is required to test the qualitative themes we have found through our exploratory thematic analysis of interview data. These themes likely vary within and between cities in China that express diversity in policies supporting (or hindering) UA [16]. A large-N survey that adapts measures and indices to assess individual perceptions of UA’s contribution to EC goals is one potential strategy to address this research gap. Recognizing the array of EC indices in the literature [58], future work that examines how those metrics relate to UA practices and outcomes would strengthen understandings for how UA can contribute to the goals for EC. Further, recognizing that EC is but one set of policies and approaches to development in China, further work is required to assess UA in the context of policies such as the vegetable basket project.

## 8. Conclusions

In this paper, we sought to understand what goals and governance mechanisms of EC underwrite urban planning and agricultural development initiatives in a Chinese context. Moreover, in this paper, we examined what dimensions of EC are reflected in UA initiatives on the ground. From our literature review, we found five respective goals and methods of implementation for EC in Chinese urban planning and agricultural development contexts. The EC goals we directly consider in our analysis of urban agriculture span a range of dimensions, including a desire to beautify landscapes, construct an ecological ethic, pursue sustainable models of development, and highlight Chinese leadership in addressing environmental issues. We further consider if the broad implementation of EC described in the literature (often top-down, technology-centered), is similarly enacted with respect to urban agriculture.

From our exploratory case study of UA in four Chinese cities, it was clear that in actively promoting capital-intensive and peri-urban agritourism forms of UA is clear that the state prioritizes a more technological approach to growing food directly inside cities. This is at the expense of small-scale growers in urban areas who are often lower-income and come from farming backgrounds. Capital-intensive projects are often very public-facing and present a highly technocratic and bourgeois aesthetic of UA and its demonstrative role as eco-city models to other Chinese urban areas (and the world). It is also clear, through supporting peri-urban agritourism and prohibiting small-scale intra-urban cultivation, that state officials believe more ‘traditional’ approaches to food production ought to be relegated outside urban areas. Yet, all forms of UA, including small-scale intra-urban agriculture, prioritize many of the same goals for EC, as defined in the literature. These goals include beautifying landscapes, reconnecting citizens in urban areas with nature, and increasing the quality of life for the public. In prohibiting and/or neglecting small-scale forms of UA, policies actively promote a particular conceptualization of an ‘appropriate’ lifestyle that is inherently non-agrarian and focused on specific middle to upper middle classes of individuals. If EC policies are to be inclusive of all classes of individuals, they ought to work with all forms of UA, including small-scale intra-urban forms of agriculture.

Future empirical work that evaluates potential contributions of UA to EC using novel indices is important to test the validity of the qualitative themes we present in this study. Such work might focus on only one city, rather than exploring multiple city contexts, to contribute more in-depth, context-specific findings. Further examination of EC indices and their applicability to the goals and practices of UA would also be a fruitful approach to test how EC intersects with urban food production.

**Author Contributions:** Research design and conceptualization, A.G., G.L., Z.S. and S.S.; Methodology, A.G., G.L., Z.S. and S.S.; Data collection was conducted by A.G. and G.L.; Data analysis was conducted by A.G., G.L., Z.S. and S.S.; Writing—original draft, A.G. and G.L.; Review and editing, A.G., Z.S. and S.S. All authors have read and agreed to the published version of the manuscript.

**Funding:** This work received funding from the Ontario-Jiangsu Summer Research Program, the Social Sciences and Humanities Research Council, and the Mitacs Globalink Research Award (Funding Ref: 21090).

**Institutional Review Board Statement:** This research received ethics review and clearance from the University of Waterloo Office of Research Ethics.

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Conflicts of Interest:** The authors declare no conflict of interest.

## Note

- <sup>1</sup> See the COFCO demonstration zone in Beijing, China, completed in 2013 in partnership with researchers and engineers from Wageningen University, Netherlands (<https://niekroozenlandscape.com/beijing-cofco/> (accessed on 21 September 2022)).

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