

Article

Comprehensive Review of Ecosystem Services of Community Gardens in English- and Chinese-Language Literature

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Abstract: Community gardens are regarded as important green spaces that promote sustainable cities. Some studies have explored the ecosystem services of community gardens in different areas. However, existing studies lack a systematic review of research on community garden ecosystem services, and there is no comparative study of English- and Chinese-language literature. This paper comprehensively reviewed key English- and Chinese-language literature on the ecosystem services of community gardens from the Web of Science and CNKI and analyzed publication years, numbers, research locations, and research topics. The results showed that the number of studies in English and Chinese has increased significantly since 2015, with a consistent upward trend. Research locations are concentrated in urban areas of Europe, America, and eastern China. Both English- and Chinese-language literature focuses on “food supply (quantity)” in the provisioning services, as well as “learning and education” and “social cohesion and integration” in cultural services. The above results are related to the governance frameworks, the management systems, the climatic conditions, and the sustainable development needs of local cities and planning strategies. Given that most of the existing research focuses on the classification and mechanisms of community garden ecosystem services, it is proposed that future research deeply explore the design factors affecting community garden ecosystem services and pay attention to the links between different ecosystem services. The main findings of this review emphasize the correlation between community garden ecosystem services and contextual factors, and point out future research directions.

Keywords: community garden; ecosystem service; comprehensive review; comparative analysis



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1. Introduction

The global urbanization process is irreversible, and the global population will increase by another 2.2 billion people by 2050 [1]. In developing countries, it is expected that the urbanization rate will maintain a rapid growth trend from 2021 to 2050, and the urbanization rate in China will reach 76% [2]. Rapid urbanization has not only caused increasing hunger and food security problems, but has also led to global warming and the urban heat island effect, affecting people’s social and cultural lives [3–5].

Urban green spaces are essential for providing healthy, sustainable and resilient urban living environments [6,7]. As one kind of urban green space, community gardens are gaining popularity in many countries, and their ecosystem service value is widely recognized by scholars. Community gardens are collectively managed open spaces where

members of the local community grow plants, typically focusing on food production, education, or social interaction [8–11]. Unlike urban parks designed primarily for recreation or commercial urban agriculture focused on profit-driven production, community gardens emphasize community participation and non-commercial goals [12–15]. In this study, we adopt this definition and exclude large-scale urban farms and public parks. Community gardens traditionally manifest as discrete ground-level planting plots. Due to the shortage of land resources in high-density cities, innovative typologies have emerged through technological advancements in community gardens, including open-air rooftop gardens, rooftop greenhouse systems, and balcony cultivation spaces [16–19]. These building-integrated garden systems demonstrate enhanced ecosystem services. Rooftop gardens can reduce the urban heat island effect [20], while vertical garden facades contribute to improved building thermal regulation and neighborhood microclimate modification [21].

In recent years, the growth rate of community gardens worldwide has been continuously increasing. According to research by Schoen et al. [22], in countries and cities with a long history of community gardens, such as Poland, France, Germany, the United Kingdom, and the United States, community gardens have shown a continuous growth trend [22]. In China, rapid urbanization has resulted in an insufficient provision of urban ecosystem services. Consequently, establishing community gardens to enhance their ecosystem service functions has emerged as a crucial strategy for promoting sustainable urban development. In 2020, China had established 416 community gardens, with development primarily concentrated in eastern coastal regions [23]. By 2024, these initiatives had expanded to encompass all provinces, including high-altitude regions with harsh climatic conditions, such as Tibet and Qinghai [24,25]. Notably, major metropolitan areas, including Shanghai, Beijing, and Shenzhen, have demonstrated particularly rapid growth, with annual increases exceeding 100 community gardens [26–28]. The Chinese government has recently integrated community gardens into its urban policy framework as an implementation mechanism for urban renewal initiatives and refined governance strategies. This institutionalization is evidenced by concrete policy instruments. For example, the Shanghai Landscape and City Appearance Administrative Bureau has formulated the “Construction and Management Specifications for Community Gardens in Shanghai” [29], and the Beijing Municipal Forestry and Parks Bureau has launched the “Special Plan for Garden City of Beijing (2023–2035)”, promoting the construction of demonstration scenarios for community gardens [30]. Given this policy momentum, community gardens are poised to become a fundamental component of China’s urban design paradigm in the coming decades.

To date, a considerable number of studies have explored the diverse values of community gardens from the ecosystem service perspective. Ecosystem services, defined as the benefits humans derive from ecosystems and ecological processes, encompass four main categories: regulating, supporting, provisioning, and cultural services [31]. Recent studies have explored the specific types of ecosystem services provided by community gardens [32,33]. For instance, Janine and Monika highlighted that community gardens contribute to provisioning services by supplying medicinal plants and food, supporting services by enhancing species diversity, regulating services by mitigating urban heat island effects, and cultural services by offering recreational spaces, fostering social interaction, and serving as educational venues [34]. Cilliers et al.’s findings aligned with Janine and Monika’s perspective. They believed that the paths through which community gardens provide provisioning and supporting services are similar to the results of Janine and Monika’s research, and further elaborated that community gardens deliver regulating services by improving soil conditions, and cultural services are the most important benefits of community gardens, including aesthetic value, empowerment of women, strengthened social ties, and community cohesion [35]. To assess public perceptions, Zhao et al. conducted a survey on

the ecosystem services of community gardens. The results revealed that cultural services were more highly valued than regulating, supporting, or provisioning services. This preference may stem from respondents prioritizing social benefits over purely environmental functions, as well as the fact that recognizing cultural services requires less ecological expertise compared to other categories [36]. However, Evans et al. noted that while community gardens can deliver over 16 distinct ecosystem services across the four categories, their capacity to regulate local climate and air quality remains limited relative to urban parks [37].

Meanwhile, existing studies have focused on the ecosystem services of community gardens in different regions. Caneva et al. [38] analyzed the ecosystem services of community gardens in Rome, Italy, and developed corresponding planning indicators. Lin and Egerer [39] examined the impact of global social and environmental changes on the ecosystem services of community gardens in California's Central Coast. Langemeyer et al. [40] identified ecosystem services generated by community gardens in Barcelona, such as recreational value, place creation and social cohesion. Furthermore, some scholars have studied the ecosystem services of community gardens perceived by different stakeholders. Song et al. [41] analyzed the perceptions of community garden leaders and non-gardeners on food provisioning services. Hashimoto et al. [42] found that there were differences in the ecosystem services provided by public and private land based on a questionnaire survey of land managers, and the results showed that public-private cooperation was more conducive to improving ecosystem services. Ciftcioglu [43] showed that community garden participants were able to perceive 21 ecosystem services, and the social values of these ESs had a positive influence on human well-being.

Although the research on community garden ecosystem services has received more and more attention, the existing research lacks a systematic analysis of trends in community garden ecosystem services. While several review studies have examined community gardens as a form of edible landscaping or urban agriculture [44–46], no review has yet specifically and systematically analyzed research trends on the ecosystem services provided by community gardens. Key gaps remain in understanding temporal publication patterns, the geographical distribution of study sites, and the predominant types of ecosystem services investigated.

On the other hand, previous English-language studies on the ecosystem services of community gardens mainly focused on Europe and the United States [47,48]. In contrast, there is only one article that conducted an overall analysis of the current situation of community garden practices in China [23], and a few papers analyzed typical cases in specific regions of China [49,50]. No macro-scale comparative analysis has been conducted between the Chinese- and English-language literature on this topic. Addressing this gap is critical for elucidating regional disparities in the ecosystem service benefits of community gardens, thereby enriching global discourse. Furthermore, it could reveal implementation mechanisms and inform context-specific garden planning to mitigate pressing ecological challenges. China, as an emerging testing ground for community gardens, presents significant developmental potential but also requires evidence-based insights from international precedents. A systematic comparison of Chinese- and English-language research could thus offer valuable guidance for optimizing community garden strategies in China.

Our study aims to fill the aforementioned knowledge gap by conducting a systematic comparison of Chinese- and English-language literature on community garden ecosystem services. Specifically, we compared the publication time and quantity of Chinese- and English-language literature, analyzed geographic distributions of study locations, explored

the similarities and differences in research topics between the two bodies of literature, and focused on the following objectives:

Summarizing the publication time and quantity of Chinese- and English-language literature on community garden ecosystem services, and analyzing their relationship with the governance frameworks of community gardens;

Exploring the key study locations highlighted in English- and Chinese-language literature, and analyzing the potential reasons for the prevalence of these locations, such as local management systems or climatic conditions;

Identifying the similarities and differences in the research topics of community garden ecosystem services in Chinese- and English-language literature, investigating the linkage between urban sustainability imperatives and research topics, and proposing planning strategies for future development.

Our study contributes to the literature through three key innovations. First, it conducts a comparative analysis of community garden ecosystem services research between publications in English and Chinese, addressing a critical gap in existing scholarship that predominantly draws on Europe and America. Second, it systematically examines the evolution of community garden ecosystem services studies from the years of literature publication, research locations, and research topics. Finally, it elucidates the complex relationships between contextual factors (including governance frameworks, local management systems, climatic conditions, and urban sustainability imperatives) and the ecosystem services provided by community gardens, and points out adaptive planning strategies for community gardens under different ecosystem service orientations.

2. Methods

We identified the quality and limitations of current research and answered our research questions based on the research methodology of Piper's Systematic Review [51,52]. Although community gardens are recognized for their ecological and socio-cultural benefits [53], this review concentrates specifically on their ecosystem services. Previous systematic reviews have thoroughly examined their social aspects [54,55], yet a comprehensive synthesis of their ecological contributions remains lacking. Moreover, urban sustainability agendas increasingly emphasize quantifiable ecological outcomes. Within this scope, community gardens provide critical ecosystem services—such as food production and air quality regulation—that directly support the achievement of SDG2 (Zero Hunger), SDG11 (Sustainable Cities and Communities), and SDG13 (Climate Action).

In this study, we systematically reviewed existing papers related to community garden ecosystem services using the protocols of the Preferred Reporting Items for Systematic Review Recommendations (PRISMA) Statement [56]. PRISMA has demonstrated significant advantages in systematic literature reviews due to its comprehensive analytical framework and rigorous evidence hierarchy system [44]. Its application has gained substantial traction across multiple research domains, particularly in studies examining community gardens, edible landscapes, and urban agriculture, where it has made noteworthy scholarly contributions [45,46].

2.1. Search Resources

Currently, research involving literature reviews in Chinese and English publications often uses the Web of Science (WOS) and China National Knowledge Infrastructure (CNKI) databases as literature sources [57–59], especially in the fields related to this paper, such as urban agriculture and ecosystem services. For example, Jiang Yichen et al. extracted relevant literature from the WOS and CNKI to conduct a comparative analysis of urban agriculture characteristics in Europe and China [60]. Similarly, Li Xiaoyu et al. used these

two databases to review the research history and methodologies of ecosystem services [61]. WOS is globally recognized as the most authoritative core journal citation index database, covering over 10,000 disciplines and 21,000 high-impact journals [62–64]. Meanwhile, CNKI is the largest Chinese academic resource database, encompassing 95% of China's core academic journals [65], effectively capturing research by Chinese scholars on local contexts in China [52,66,67]. Since this paper aims to systematically compare research progress on ecosystem services of community gardens in English- and Chinese-language literature, relying solely on WOS for literature retrieval would lead to the significant omission of potentially significant studies published in Chinese journals, particularly those focusing on local Chinese contexts and regional applications, which are primarily indexed in CNKI and may not appear in WOS [68]. Therefore, we used the WOS database to retrieve English publications and the CNKI database to search for Chinese-language literature. The search string terms include “community garden”, “ecosystem service” and related synonyms. The full search string term is “community garden” AND (“ecosystem service” OR “ecosystem benefit” OR “ecosystem function”). Additionally, only peer-reviewed literature was searched. At this stage, 910 English publications and 169 Chinese publications were obtained.

2.2. Inclusion and Exclusion Criteria

In the first stage of screening, 656 English publications and 157 Chinese publications remained after excluding duplicate records and grey literature. In the second stage of screening, the three authors screened the full texts of these publications using three criteria. Firstly, our study focused on urban and periurban community gardens, excluding rural community gardens, which emphasize agricultural production over multifunctional ecosystem services. Suburban community gardens were included due to their urban-influenced socio-ecological characteristics. Secondly, studies were included only if they explicitly described the site as a community garden. Spaces labeled as urban parks or commercial farms were excluded, even if they contained gardening elements. Research focused on allotment gardens primarily for individual use was also excluded. However, allotment gardens that were uniformly managed by governments or associations and fostered informal social networks—such as gardeners exchanging seeds or tools or even organizing spontaneous activities—were considered for inclusion. Thirdly, the entire text must explicitly mention one or more ecosystem services of community gardens. In the second stage, a total of 119 English publications and 73 Chinese publications were screened.

2.3. Data Analysis

We summarized the screened publications by publication year, publication numbers and study locations. In order to clearly show the differences between English- and Chinese-language publications on community garden ecosystem services, we recorded the types of ecosystem services mentioned in these publications. We used the disaggregated ES valuation data from Camps-Calvet et al. [69] and Cilliers et al. [35], which divided ecosystem services into four categories: supporting services, provisioning services, regulating services, and cultural services, with a total of 20 ES sub-items [40]. We numbered these 20 ES sub-items (Figure 1). Three authors recorded ecosystem service types involved in different papers through intensive reading of the abstracts and full texts of 119 English publications and 73 Chinese publications (see Supplementary Materials Files S1 and S2). Data were manually extracted from each paper. If there was any ambiguous data, it was independently assessed by another member of the author team and then discussed collectively.

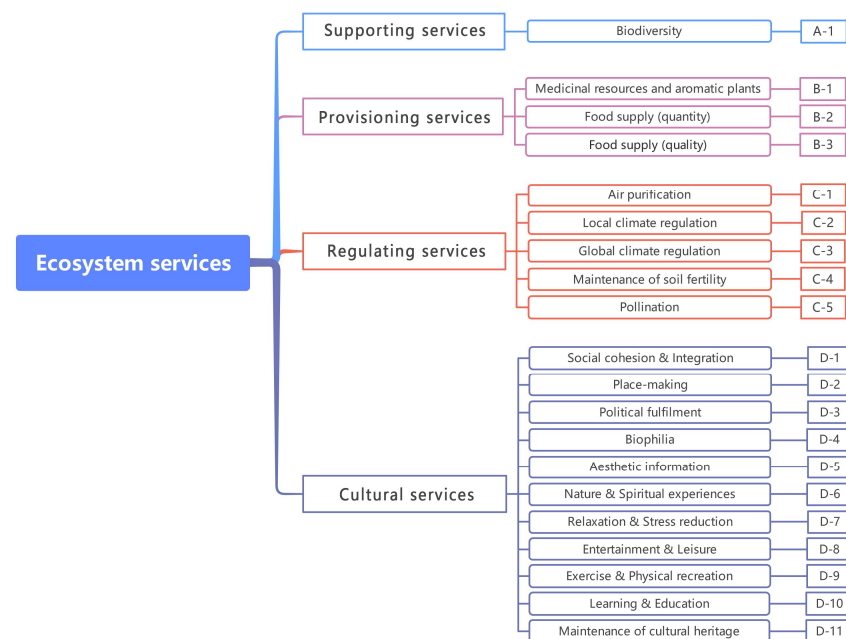


Figure 1. Ecosystem service framework diagram.

3. Result

3.1. Publication Years and Numbers

English papers: According to the Web of Science, there are 119 English publications that include content in community garden ecosystem services. The first paper was published in 2010. There were more than 10 papers published every year from 2018 to 2024, accounting for 82.35% of the total number of publications.

Chinese papers: According to CNKI, there are 73 Chinese publications that include content on community garden ecosystem services. The first paper was published in 2016. The highest number of publications is 22 in 2023. The number of Chinese publications has gradually increased since 2019.

Figure 2 shows that English papers were published earlier than Chinese papers. The number of English publications was higher than that of Chinese publications. There was an increasing trend in the number of publications in both languages.

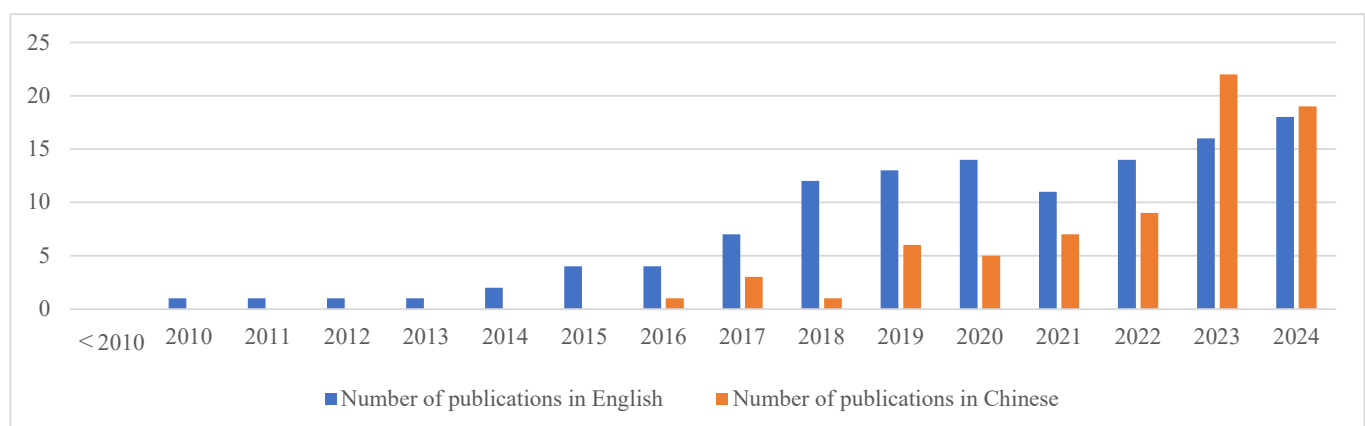


Figure 2. Number of publications in English and Chinese.

3.2. Study Locations

English papers: Most of the study locations focused on Europe and America (Table 1). Research on community garden ecosystem services has been predominantly conducted

in the United States (33), followed by Germany (21) and Italy (15). In Asia, studies were primarily concentrated in Japan (4), China (3), and Iran (3), while Oceania's research was limited to Australia (7) and New Zealand (2). African studies exclusively focused on South Africa (5).

Table 1. Number of English publications according to study location.

Country	English Publications City/Town	Number
USA	Seattle, Phoenix, New York, Chicago, Baltimore, Monterey, Santa Clara, Santa Cruz, Los Angeles, Laramie, Carbondale, Akron, Cleveland, Miami-Dade County, Denver, Appleton, Boulder, Washington	33
Germany	Karlsruhe, Leipzig, Dortmund, Aachen, Düsseldorf, Essen, Hannover, Kassel, Berlin, Kassel, Ruhr Area, Braunschweig, Munich	21
Italy	Parma, Milan, Bologna, Padua, Naples, Rome, Gallipoli	15
UK	Manchester, London, West Midlands, Ayr, Greenock	13
France	Grand Nancy, Marseilles, Nantes, Paris, Montreuil, Pré-Saint-Gervais, Bordeaux	10
Spain	Sevilla, Barcelona, Murcia, Cartagena, Valencia, Sant Feliu de Llobregat	9
Poland	Poznan, Warsaw, Gorzów Wlkp, Wrocław, Katowice, Krakow	9
Australia	Perth, Melbourne, Brisbane, Tasmania, Sydney, Hobart	7
South Africa	Rustenburg, Madibeng, Moretele, Moses Kotane, Elundini, Mbhashe, Mbizana, Ntabankulu, Raymond Mhlaba, Umzimvubu, Potchefstroom	5
Japan	Osaka, Tokyo	4
Canada	Winnipeg, Toronto	4
Austria	Salzburg	3
China	Changsha, Hangzhou	3
Iran		3
Portugal	Lisbon	2
New Zealand	Christchurch	2
Switzerland	Zurich	2
Czech Republic	Prague	2
Sweden	Stockholm	2
Mexico		1
Belgium		1
Slovenia	Ljubljana	1
Denmark	Arhus	1
Hungary	Budapest	1
Estonia	Paide, Marseille	1
Norway	Oslo	1
Singapore		1

Chinese papers: Chinese-language literature predominantly examined studies conducted in Asia, specifically focusing on China (62), Singapore (2), and Israel (1), followed by North America (10) and Europe (10). As for the specific study locations in China, Shanghai (23) was the most extensively studied city, followed by Beijing, Shenzhen and Foshan. These investigations were primarily concentrated in eastern China (Table 2).

Table 2. Numbers of Chinese Publications according to Study Location.

Country	Chinese Publications		Number
	Province	City	
China	Shanghai		23
	Beijing		10
	Guangdong	Shenzhen, Foshan	5
	Hunan	Changsha	4
	Tianjin		3
	Shandong	Weifang, Yantai	2
	Zhejiang	Shaoxing	2
	Chongqing		2
	Fujian	Fuzhou	2
	Hainan	Haikou	2
	Sichuan	Leshan	1
	Xinjiang	Wulumuqi	1
	Guangxi	Nanning	1
	Henan		1
	Wuhan		1
		Nanjing	1
		Chongqing	1
USA			10
Germany			6
England			4
Australia			3
Singapore			2
Israel			1

3.3. Research Topics

We extracted community garden ecosystem services mentioned in 119 English publications and 73 Chinese publications (Figure 3) and generated word clouds, as shown in Figures 4 and 5. In general, both English- and Chinese-language publications discussed supporting services, provisioning services, regulating services and cultural services of community gardens. English publications focused on supporting services, provisioning services and cultural services. Chinese publications concentrated on cultural services.

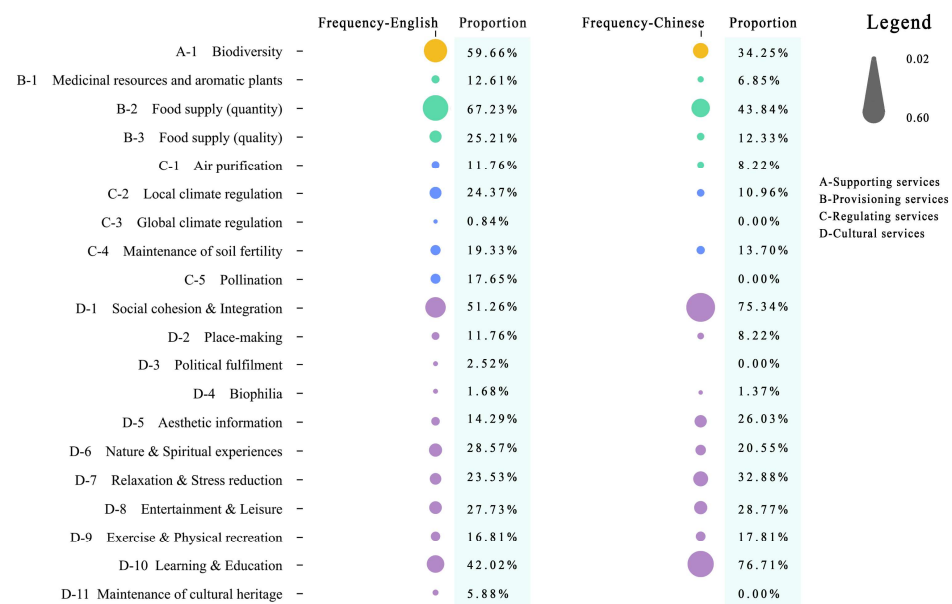
**Figure 3.** The frequency of each ecosystem service in English and Chinese publications.



Figure 4. Word cloud of the frequency of each ecosystem service based on 119 papers in English.



Figure 5. Word cloud of the frequency of each ecosystem service based on 73 papers in Chinese.

The ecosystem service sub-item “B-2 food supply (quantity)” in English publications topped the list with 80 papers, followed by “A-1 biodiversity” with 71 papers. “D-1 social cohesion and integration” and “D-10 learning and education” ranked third and fourth, with 61 and 50 papers, respectively. The remaining sub-items were mentioned in fewer than 40 papers. There were only a few papers that explored “D-11 maintenance of cultural heritage”, “D-3 political fulfillment” and “D-4 biophilia”, and it is worth noting that only one publication on “C-3 global climate regulation” was identified.

As for Chinese publications, the two most frequently mentioned ecosystem service sub-items belonged to cultural service. “D-10 learning and education” and “D-1 social cohesion and integration” ranked first and second, with 56 and 55 papers, respectively. Followed by “B-2 food supply (quantity)” with 32 papers. The remaining sub-items were mentioned in fewer than 30 papers. In addition, Chinese publications have not yet covered the study of ecosystem services, such as “C-3”, “C-5”, “D-3” and “D-11”.

3.3.1. Provisioning Services

In the English publications, B-2 “food supply (quantity)” was the most frequently mentioned among the three ecosystem service sub-items in provisioning services, followed by B-3 “food supply (quality)” (Figure 6). The researchers quantified the agricultural production potential of community gardens and assessed the food supply capacity of

community gardens within a household, region, or urban area [47,70–73]. Albaladejo-García et al. [74] and Glavan et al. [47] explained the relationship between permaculture, organic farming and B-3 “food supply (quality)”. For B-1, a few papers only mentioned this benefit without an in-depth analysis [35,75,76].

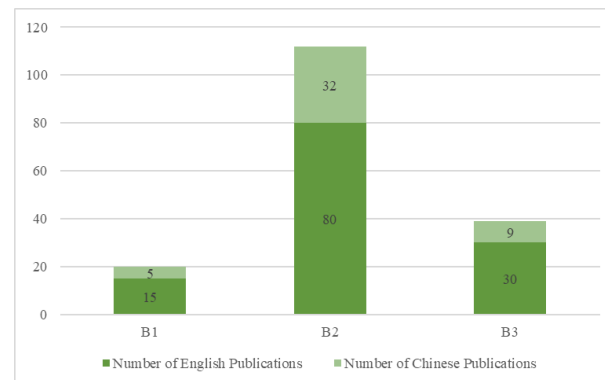


Figure 6. The number of Chinese and English publications on the provisioning services of community gardens.

The order of the frequency of B-1, B-2, and B-3 in the Chinese publications was the same as that in the English publications (Figure 6). He et al. [77] and Pei et al. [78] pointed out that community gardens can ensure that urban dwellers have access to nearby food sources and provide a self-sufficient and healthy choice for balancing the family food supply and demand. Liu et al. [79] proposed a suitable selection of fruit and vegetable varieties for community gardens in Shanghai. A few papers described the productive potential of community gardens in other countries [80,81]. As for B-3, most scholars believed that, compared with the assembly line food production, community gardens follow ecological principles and environmental protection concepts and emphasize the use of organic fertilizers, which is conducive to ensuring food safety [82,83]. In addition, He et al. [77] explored the healing properties of medicinal edible landscapes in community gardens.

3.3.2. Supporting Services

Community gardens were regarded as the most important self-sustaining ecosystems for biodiversity [35,84–86]. Most papers recorded the types of flora and fauna as evidence of the contribution of community gardens to biodiversity [87–90]. Some authors analyzed the unique types of organisms grown on community gardens, such as the traditional Indian crops mentioned by Porter [73]. Meanwhile, scholars also analyzed the reasons and influencing factors for the high biodiversity of community gardens. The ponds and uncultivated land in community gardens provided habitats for wild species [90,91]. Clarke and Jenerette [92] examined the impact of household income, plot size, and ethnic culture on biodiversity in community gardens. Anderson et al. [93] explored the relationship between biodiversity and tree cover in community gardens. Related studies also included comparative studies on the roles of community gardens in different types of locations. Speak et al. [75] found that the species richness of spontaneous flora in allotment gardens is higher than that in parks, while the species richness of tree species is lower in community gardens. Similarly, Cabral et al. [94] pointed out that suburban allotment gardens have higher levels of biodiversity than urban allotment gardens.

The authors of the Chinese publications also agreed that community gardens can achieve diversity by constructing a reasonable ecosystem environment (Figure 7) [95,96]. The research includes two aspects. Some researchers evaluated the impact of community gardens on urban species diversity and believed that community gardens provide habitats

and breeding places for insects and birds [78,83,97]. Other scholars proposed ways to increase the biodiversity of community gardens, such as setting up insect boxes and rainwater collection ponds [79,98] and planting different varieties of vegetables and ornamental plants [99].

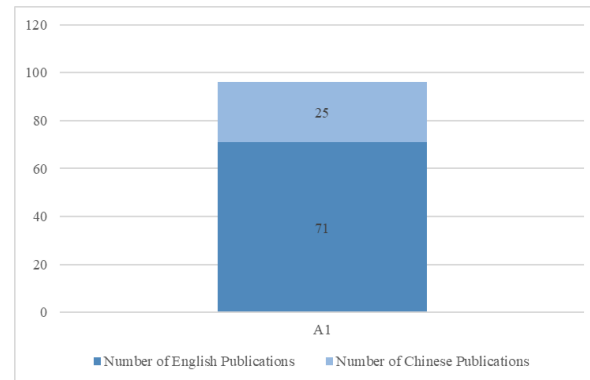


Figure 7. The number of Chinese and English publications on the supporting services of community gardens.

3.3.3. Regulating Services

Compared with C-3 “global climate regulation”, scholars generally agreed that community gardens can regulate the local climate [86,100–102]. Most of the papers described this ecosystem service benefit. Only Rost et al. [103] confirmed that community gardens have the function of regulating microclimate by measuring and comparing the nighttime climate of community gardens and densely built-up urban areas. In regulating services, scholars also focused on the role of community gardens in C-4 “maintenance of soil fertility” [84,90,104]. Gregory et al. [48] explained the specific practices of community gardens to improve soil through cover cropping. Tapia et al. [102] mentioned the use of organic farming methods, such as crop rotation and the use of animal manure, to enhance soil vitality in community gardens. In terms of C-5 “pollination”, Speak et al. [75] and Walters and Midden [90] pointed out that community gardens attract pollinators for pollination, enabling plants to set seeds of the fruits that develop. Cilliers et al. [35] observed that some specific elements in the garden, such as “naga”, are conducive to the realization of the pollination function. For C-1, scholars only described the ecosystem service function, and there was no in-depth or quantitative research (Figure 8).

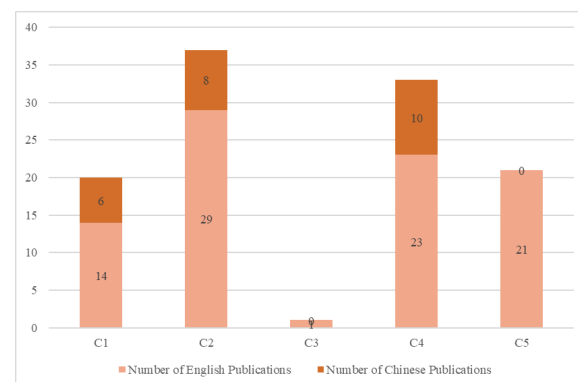


Figure 8. The number of Chinese and English publications on the regulating services of community gardens.

Chinese publications paid more attention to C-4 “maintenance of soil fertility” (Figure 8). Studies have shown that the use of ecological measures, such as plant mulching, ecological engineering technology, and organic composting, in community gardens can restore soil activity [77,83,99]. This was followed by C-2 and C-1, plant transpiration and land cover in community gardens, which can purify the air, adjust the temperature and humidity of the surrounding environment, and reduce the urban heat island effect [77,83,96]. There were no Chinese papers that mentioned C-3 and C-5.

3.3.4. Cultural Services

Both English and Chinese publications identified the role of community gardens in D-1 and D-10 (Figure 9). Furthermore, these two ES sub-items have been referenced in 50 or more academic papers across both language corpora.

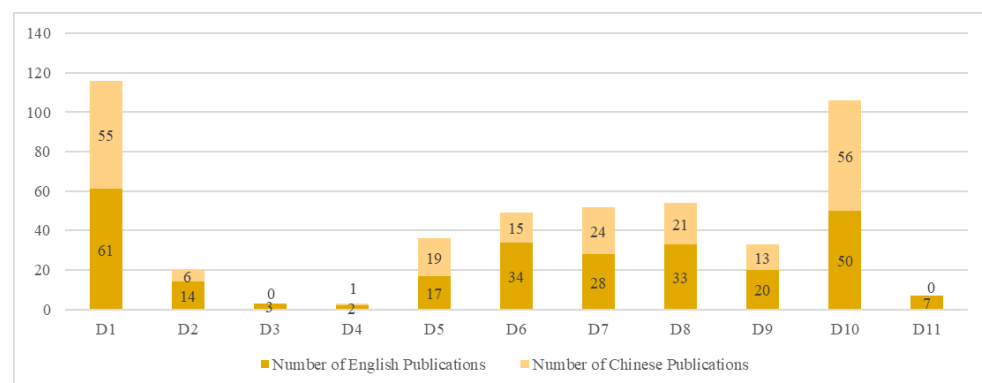


Figure 9. The number of Chinese and English publications on the cultural services of community gardens.

In English publications, nearly half of the researchers believed that community gardens provide a positive and supportive network, which helps people develop interpersonal and social relationships, and build D-1 “social cohesion and integration” [38,75,105–107]. Some scholars discussed the reasons for the formation of social cohesion. Scott et al. [108] pointed out that visual communication, social and exchanging activities among gardeners, and distant viewing between gardeners and non-gardeners are the reasons for the formation of community garden cohesion. Porter [73] and Riolo [87] also confirmed that the role of diverse activities (cultivating plants, sharing food, exchanging knowledge, etc.) in community gardens for interpersonal interaction and social cohesion. Palau-Salvador et al. [109] divided these diverse collective activities into collective learning activities, collective resource management, collective or common political attitudes, and elaborated on their contributions to the fostering of social cohesion in community gardens. The interpretation of community garden social cohesion is another research focus. Middle et al. [110], Menconi et al. [111] and Colding and Barthel [112] analyzed several types of social cohesion formed in community gardens, including family interaction, community interaction, and interaction between people of different races and cultural backgrounds. Schram-Bijkerk et al. [113] explained community garden social cohesion based on the social capital theory. It is worth noting that the social cohesion generated by community gardens contributed to strengthening unity and promoting consensus in special periods, such as post-disaster reconstruction and economic crises [69,114].

The research content and research focus on D-1 “social cohesion and integration” in the Chinese publications were the same as those in English publications. The causes of community garden social cohesion mainly include proximity to residents’ living environment [95] and diverse participatory activities [82,97,115]. Zhao [116] divided the

participatory activities of community gardens into profitable activities (rental activities, parent-child activities, summer camps, etc.), public welfare activities (daily maintenance activities, environmental protection activities, handicraft activities, etc.), and regional activities (community-based activities). In terms of the interpretation of community garden social cohesion, the Chinese publications emphasized the role of community gardens in strengthening the social relations of neighbors, and there was less research on the social relations between different ethnic groups and marginalized groups [50,78,117].

In terms of D-10, the educational content of community gardens consisted of ecological knowledge, such as natural heritage and biodiversity, maintenance knowledge, such as planting and pollination, management knowledge, such as communication and organization, and disaster resistance knowledge [69,114,118,119]. Colding and Barthel [112] supplemented that gardeners can also learn about spatial politics and social entrepreneurship through Public Access Community Gardens (PACs). Notably, Diduck et al. [120] divided the learning outcomes obtained in community gardens into normative outcomes, cognitive/behavioral outcomes, and relational outcomes, and the three outcomes interact with each other. The education forms carried out in community gardens can be classified into five categories, including non-formal forms such as seminars, courses, meetings, resource materials, and informal forms such as hands-on practice, communication with gardeners, and observation [48,120]. In addition, Cilliers et al. [35] used the theory of “social ecological memory” to explore how horticultural knowledge in community gardens is transmitted through oral teaching, collective imitation, and various sharing activities.

Chinese scholars also expressed great recognition of the D-10 “learning and education” provided by community gardens. Except for the ecological knowledge, maintenance knowledge, management knowledge and disaster resistance knowledge mentioned in English publications [98,121], the Chinese publications also emphasized the cultivation of willpower, hands-on ability, practical ability, cooperation ability and professional spirit and social service spirit for residents [78,99]. Zhou et al. [99] pointed out that community gardens can promote the development of children’s subjective initiative and self-creation ability, because there are more natural elements and non-fixed facilities. Yin [122] summarized the types of education content in community gardens into cognitive education, intellectual education, social education, emotional education, environmental education, and labor education. With regard to the education forms, Chinese researchers pointed out that gardening labor, teaching courses and training, resource recycling and reuse actions, and explanatory signs are beneficial for low-carbon ecological education [77,115,123].

In English publications, D-6, D-8, D-7, D-9, D-5, D-2 are mentioned in some papers, while D-11, D-3, D-4 are mentioned in fewer than 10 papers. In Chinese publications, D-7, D-8, D-5, D-6, D-9 are mentioned in more than 10 papers, while D-2 and D-4 are mentioned in a few papers. No papers mention D-3 and D-11.

With regard to D-6 “nature and spiritual experiences”, community gardens were considered to be able to provide spaces that are safer and more accessible to the natural environment in English publications [76,110,124]. Ponizy et al. [125] pointed out that the natural experience space provided by allotments is restorative and conducive to relieving stress. Egerer et al. [126] believed that community gardens serve as urban green spaces and provide residents with opportunities to connect with nature, thereby generating health benefits. In Chinese publications, most researchers found that community gardens can lead people to understand plants, observe animals, listen to birds and insects, be in touch with natural factors such as soil and water, and feel the natural material environment [77,82,96], which enriches people’s vision, tactile, and auditory sensations [83,99,127].

In recent years, since the function of community gardens has shifted from production to entertainment and leisure [94,118,125], the research on D-8 “entertainment and leisure”

has gradually increased. Breuste and Artmann [118] revealed that many entertainment facilities, such as barbecue grills and playgrounds, have been added to community gardens and they meet the entertainment needs of different age groups. Porter [73] believed that garden activities, such as digging, watering, and caring for bees, add to the enjoyment of gardeners, while the Chinese publications only briefly described D-8.

In English publications, most scholars briefly described D-7 “relaxation and stress reduction”. Schram-Bijkerk et al. [113] analyzed two formation mechanisms for D-7 in community gardens. One is that community garden enhances people’s opportunities to contact nature and transfer people to a more relaxed state; the other is that a community garden is a kind of restorative environment that helps to improve people’s physical condition. In Chinese publications, researchers pointed out that people reduce negative psychological problems by actively participating in horticultural work and passively getting close to the horticultural landscape [77,80]. Activities such as walking and exercising in the garden also help people reduce stress, anxiety and fatigue [96,127].

About one-sixth of the English publications discussed D-9 “exercise and physical recreation” [75,108,124,128]. Lampert et al. [129] argued that community gardens provide low- to moderate-intensity labor tasks, and the regular physical activity in community gardens promotes health. Middle et al. [110] identified the advantages of the sports provided by community gardens, including being close to nature, offering long-lasting exercise time, and being suitable for walking. In Chinese publications, researchers further pointed out that although not all residents can directly participate in work, community gardens could attract more residents to spontaneously take a walk or walk their dogs in gardens, which indirectly promotes residents’ exercise [82,98].

In terms of D-5 “aesthetic information”, Lindemann-Matthies and Brieger [130] argued that community gardens are more attractive than lawns, but need to be kept tidy. Menconi et al. [111] pointed out that the personalized design of the gardener can increase the aesthetic value and recognizability of the garden. Zhou et al. [49] showed that the design of landscape, public art pieces and signage in community gardens can stimulate people’s perception of beauty.

Regarding D-2 “place-making”, scholars explored the relationship between place-making spirit and resilience [111], and the factors affecting the formation of place-making spirit in community gardens [114,131].

With regard to D-11 “maintenance of cultural heritage”, community gardens were also considered to provide a place to share and disseminate traditional agronomic heritage knowledge. In addition, taking ethnic groups in southern Africa as an example, Cilliers et al. [35] pointed out that the culture of ethnic groups could be reflected through the selection of plants and agronomic activities in community gardens. For example, plants in specific locations in a garden can display ritual and charm [132].

There are five English publications and one Chinese publication that mention D-3 “political fulfillment” and D-4 “biophilia”. Tapia et al. [102] argued that the licensing of community gardens in urban land use plans represents a kind of political fulfillment. Palau-Salvador et al. [109] pointed out that gardeners in rental gardens, municipal gardens and associate gardens in Spain formed a common political consciousness by participating in political activities involving local producers and food sovereignty. Chan et al. [114] showed the role of the biophilicity of community gardens in post-disaster (hurricane) reconstruction.

4. Discussion

4.1. The Publication Timeline and Quantity Are Related to Governance Frameworks for Community Gardens

This systematic review has focused specifically on community garden ecosystem services in English and Chinese publications. It is shown that the research on ecosystem services of community gardens in English publications was conducted earlier than that in the Chinese publications, and the number of English publications was higher than that of the Chinese publications. Furthermore, the number of research papers in both languages increased significantly after 2015. In recent years, the rapid global urbanization process has led to a sharp decrease in green spaces in many countries and cities, and urban dwellers' demand for ecosystem services of community gardens has become urgent [69,133–135]. The New Urban Agenda, adopted in 2016, signifies that countries around the world are working together to build sustainable cities. Against this background, many countries and cities have integrated community gardens into their urban development planning or green infrastructure planning. For instance, the city of Lisbon has incorporated allotment planning into the “Lisbon Strategy for 2010–2024” [136]. The “Social Sustainability Policy and Action Plan 2018–2028” of Sydney highlighted the use of community gardens to improve environmental quality and reduce space and light pollution [137]. The “Chapter 8 Green Infrastructure” of “The London Planning 2021” proposed expanding community garden projects [138]. Scholars have also acknowledged the role of community garden ecosystem services in creating livable and high-quality urban environments, leading to increased research on community garden ecosystem services [92,139]. In China, the 2015 Central City Work Conference proposed that it was necessary to control the intensity of urban development, scientifically delineate the boundaries of urban development, and transform urban development from extensional expansion to connotation improvement [140]. In the same year, the Fifth Plenary Session of the Eighteenth Central Committee of the Communist Party of China emphasized the concept of urban green development. In this context, as one of the urban green ecosystems, community gardens have been valued and promoted by Chinese urban planners and scholars due to their advantages of easy construction and low cost [141]. They regarded community garden as an acupuncture renewal method, using community garden to improve the function of urban dilapidated small and micro spaces, and restore urban texture [50,142].

The number of Chinese publications in 2023 was significantly higher than in other years, which is closely related to the public health emergency caused by COVID-19. The outbreak of COVID-19 heightened public awareness of food and health crises. During the peak impact period of the coronavirus in China (2019–2022), the role of community gardens in food supply, natural and spiritual experiences, and relaxation and stress relief attracted widespread attention [143,144]. For example, the SEEDING Community Garden Neighborhood Mutual Aid Initiative in Shanghai used contactless methods to share seeds, plants, and knowledge, thereby strengthening connections among people and conveying love and trust [145]. Correspondingly, in 2023, nearly 60% of the Chinese-language literature discussed the ESs of community gardens in ensuring food security, fostering community emotional well-being, and alleviating individual negative emotions during the pandemic [143,144,146].

4.2. Study Locations Are Influenced by the Local Management System and Climatic Conditions

The research on community garden ecosystem services is geographically limited. The research locations are mainly in Europe and America. In China, most of the case studies are conducted in eastern cities. The practice of community gardening in Europe and the United States dates back further. Early forms of community gardens, such as the War

Garden and the Victory Garden, emerged during the Second World War [147]. Therefore, research locations are concentrated in Europe and the United States. Another explanation is that these areas have implemented a relatively clear management system for community gardens, involving a series of measures such as community garden management norms, financial subsidies, and educational support, which can guide the more orderly and rapid development of community gardens [23,148,149]. Taking the United States, Germany, and Shanghai, with a concentrated volume of publications, as examples, in Seattle, the Department of Neighborhoods has established space management regulations, garden use guidance, and participant rules for P-Patch gardens on the government website [150]. In Andernach, Germany, the municipal government provided employment security and financial support for community garden participants through network cooperation relationships established with other cities and scientific workers [151]. In Shanghai, China, although there is no top-down management system, social organizations, such as the Clover Nature School, composed of university researchers, volunteers, and design companies, actively promote the construction of community gardens. They have published books such as “Theory and Practice of Community Gardens for Building Beautiful Homes” to guide the operation of gardens. The number of community gardens created by Clover Nature School exceeds 1200 [152].

Climatic conditions also have an impact on the distribution of study locations. In English publications, studies conducted in the United States predominantly focus on two climatic regions: temperate continental (e.g., New York, Chicago) and Mediterranean (e.g., California). In temperate continental climates characterized by warm summers and abundant precipitation, researchers emphasize community gardens’ role in regulating rainwater runoff. For instance, Gittleman (2017) demonstrated that New York City community gardens significantly reduce rainwater runoff rates compared to conventional urban open spaces, confirming their effectiveness as green infrastructure for urban flood mitigation [153]. Conversely, Mediterranean climates with hot, dry summers have prompted investigations into thermal regulation benefits. Shalene Jha et al. proved in their study of the synergistic effects of multiple ecosystem services in 28 urban community gardens in the central coast of California, USA, that community farms have microclimate-regulating effects [154]. Chinese research exhibits a distinct geographical pattern, with most studies concentrated in subtropical monsoon climate regions of eastern and southern China (e.g., Shanghai, Shenzhen, Hunan). These areas benefit from concurrent rainfall and warmth during growing seasons, coupled with mild winters, creating optimal conditions for year-round community gardening. The favorable hydrothermal conditions in these regions also support greater plant diversity. As Liu Yuelai et al. mentioned in their research on Shanghai KIC Garden, various plants in community gardens are planted according to different seasonal rhythms and plant growth habits to ensure that there are suitable plants growing throughout the year [79]. Research in the northern temperate continental climate regions (such as Gansu, Xin-jiang) is relatively scarce, possibly related to high irrigation costs in arid areas.

4.3. Research Topics Respond to the Need for Urban Sustainable Development and Human Well-Being

A large number of studies have confirmed that community gardens contribute to the development of the three sustainable dimensions of urban economy, society and ecology [149,155]. Our research further shows that the type of community garden ecosystem services that are concerned is no longer just the food supply in the provisioning service; its various contributions in supporting services, regulating services and cultural services are closely related to the challenges faced by urban sustainable development (Figure 10). It is worth noting that the ecosystem services of community gardens to promote urban

sustainable development are contextualized, which is reflected in the fact that the types of ecosystem services of the community gardens that are highlighted vary according to the needs of urban sustainable development. Generally, in high-income environments, the supporting services, regulating services and cultural services that cater to higher-level needs, such as personal socialization, self-improvement, and environmental enhancement, are widely recognized [156,157]; provisioning services are more likely to be a priority in areas with low income or a shortage of arable land [41,102].

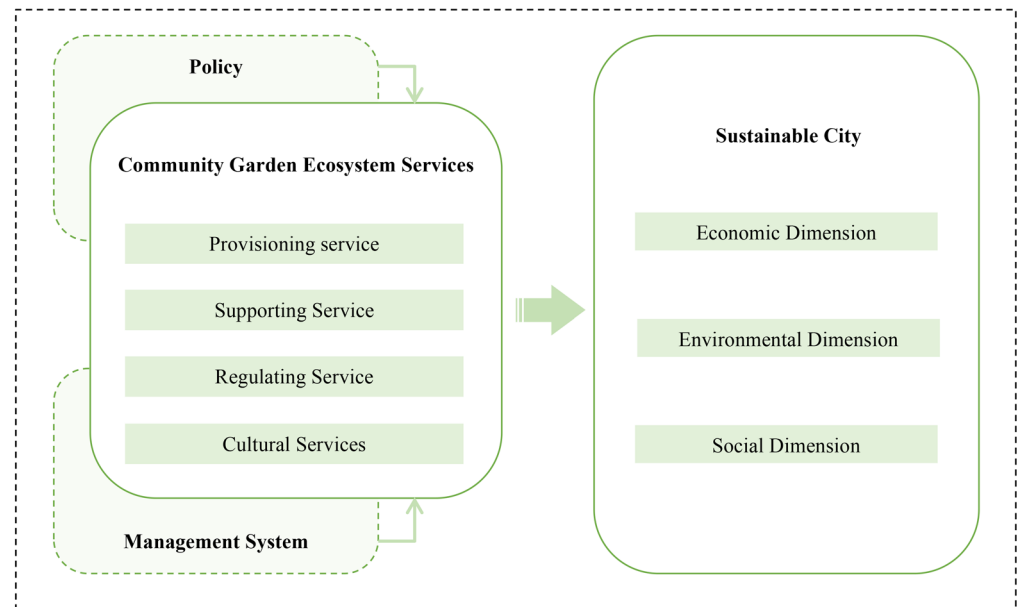


Figure 10. The relationship between community garden ecosystem services and sustainable city development.

In terms of the ecosystem services, B-2 “food supply (quantity)” was the most frequently mentioned item in English publications. Because productive function has always been the unique feature that distinguishes community gardens from other green ecosystems, the food supply potential of community gardens has received extensive attention [72,90], especially in areas where arable land is limited and where hunger and malnutrition are prevalent. For example, Song et al. [41] evaluated the proportion of food crops of community gardens, the tendency to share agricultural products with non-gardeners, and the self-sufficiency rate in Singapore. Mwakiwa et al. [148] analyzed the feasibility of using community gardens in Zimbabwe to address the issue of landless farmers. However, Chinese community gardens generally exist in cities with high population density. The size of Chinese community gardens is between 100 m² and 500 m², and the average number of Chinese community gardens in each province is 12 [23]. It is difficult for Chinese community gardens to solve the problem of the food supply, compared with the huge urban populations and urban food supply demand in China. Thus, there are few Chinese studies related to B-2. It is worth noting that a small number of Chinese scholars agreed with the flexible supply function of community gardens and pointed out that community gardens can alleviate the tension of food supply in times of public health emergencies or wars, and serve as a vegetable supply buffer [77,95,158].

D-10 “learning and education” is the most frequently mentioned item in Chinese publications. The rapid urbanization in China has led to a continuous decrease in the number and area of natural areas closely related to the activities of children and adolescents. As a result, the physical connection between children, adolescents, and nature has been severed, leading to a serious nature deficiency among children in China [159]. Community

gardens-based food education and environmental education have been gradually promoted in primary and secondary schools and kindergartens in China [49], enabling children and adolescents to better perceive nature, learn social collaboration, and improve their physical and mental health. In 2020, the State Council issued suggestions on comprehensively strengthening labor education in universities and middle and primary schools in the new era, stating that various methods can be adopted to carry out labor education [160]. The Ministry of Education of the People's Republic of China promulgated the "Compulsory Education Curriculum Plan" and "Compulsory Education Labor Curriculum Standards 2022 Edition", proposing that students' fully understand the importance of agriculture and fully master labor skills, such as planting, breeding, and handicraft [161]. In this context, community gardens related to learning and education have been established in various cities [49,123,158]. These community gardens have created a good environment for children to learn natural knowledge and master planting skills by combining with school courses or community-organized education and training activities [82]. Taking the Kid's Garden in Hunan Agricultural University as an example, college students majoring in landscape architecture explored the construction methods of community gardens and spread knowledge about plants and ecology. Meanwhile, the surrounding elementary schools and kindergartens used Kids' Garden as a science education base to provide children with outdoor classrooms and help children build a view of nature [49].

D-1 "social cohesion and integration" has also been recognized by many researchers in English publications and Chinese publications. China's urbanization has led to the breakdown of neighborhood relations and the lack of a platform for residents to communicate [162]. Community gardens provided residents with opportunities for communication and interaction [69,107,108], increased the sense of belonging, and created a harmonious community atmosphere [77,82,127]. The English publications highlighted the role of community gardens in promoting racial or ethnic integration and cultural identity [163]. Ethnic diversity is a prominent feature in Europe and the United States. Community gardens can strengthen the understanding and connection between different ethnic groups through collaboration, interaction, and shared activities in the process of work [164].

It was found that studies on community garden ecosystem services also focused on topics such as public health and public engagement, which were not included in the ES valuation data identified by Camps-Calvet et al. [69]. Joshi and Wende [165] pointed out that community gardens can build healthy and equitable connections for residents in a pandemic, and proposed to integrate community gardens into pandemic-sensitive urban planning strategies. Chinese researchers proposed that community gardens have the effect of relieving residents' anxiety caused by staying at home for too long during COVID-19 [96,166]. Meanwhile, a large number of Chinese and English publications discussed the positive impact of community gardens in promoting public participation in community building and citizen empowerment [116,119,167].

We also found that all four categories of community garden ecosystem services have been studied in English and Chinese publications, but some specific services received less attention, such as regulating services and supporting services. One possible reason is that these ecosystem services were not unique to community gardens, and other green spaces, such as urban parks and pocket parks, can yield higher ecological benefits in terms of these ecosystem services [168,169]. Hu et al. [170] pointed out that biodiversity was the most important urban park attribute. Studies by Evans et al. [37] also showed that parks and green spaces play a better role in local climate and air quality regulation than community gardens.

In general, policies and management systems provide a supportive environment for the development of community garden ecosystem services. The ecosystem services of

community gardens promote multiple levels of urban sustainable development. In the future, decision makers should play a top-down role and pay attention to the role of policies and management systems in promoting the construction of community gardens. For the types of community garden ecosystem services with high perception, they can be preferentially integrated into urban planning or special planning, and their impact on urban sustainable development can be considered, for example by incorporating the food supply (quantity) service of community gardens into resilient city and agricultural development strategies, integrating learning and education service of community gardens into children's education planning, and emphasizing social cohesion and integration service of community gardens in community development planning or health strategies.

4.4. Adaptive Planning Strategies for Community Gardens Under Different Ecosystem Service Orientations

The current community garden planning strategies mainly include three types: government-led planning, participatory planning, and informal planning [124,147]. Different planning strategies affect the supply of ecosystem services from community gardens. Government-led planning can ensure a more efficient food security supply during wars or disasters, promoting provisioning services [171,172]. For example, New York State utilized community gardens to support local food and nutrition supply through the SNAP-ed Community Growers Grant Program (Agriculture and Markets, 2023). Participatory planning demonstrates distinct advantages in delivering comprehensive ecosystem services through its multi-stakeholder governance model. By prioritizing environmental stewardship, social equity, and inclusiveness in its implementation, community gardens can provide a wider range of ecosystem services, including biodiversity conservation, natural education, fostering social cohesion, and mitigating the heat island effect [42,121]. Community gardens established through bottom-up informal planning are more likely to fulfill the functions of social cohesion [173]. For example, guerrilla practices in Salford demonstrated that informal planning emphasizes human agency throughout the process, encourages the formation of extensive social networks and enhances a sense of social belonging [174]. For planners, suitable community garden planning strategies can be sought based on local ecosystem service needs to achieve a matching of supply and demand. Of course, participatory planning is currently the most effective way to unlock the full range of ecosystem services from community gardens.

4.5. Knowledge Gaps and Research Directions

The existing research on ecosystem services of community gardens mainly focuses on the classification of ecosystem service types and the analysis of the mechanisms of ecosystem services generated by community gardens. There is a lack of research on how to apply these ecosystem services to the practice of community gardens. In the future, we can further study the design factors that affect the implementation effect of community garden ecosystem services, and try to improve these ecosystem services through reasonable designs so as to give full play to the role of community gardens in promoting sustainable urban development. In addition, different ecosystem services are linked to each other. For example, community gardens provide a green and fresh environment for urban dwellers, increase people's access to nature, and relieve the pressure in the process of establishing links with nature. Therefore, in the future, it is also necessary to study the relationship between different ecosystem services and explore how to stimulate the multiple benefits of community gardens through the interaction between different ecosystem services.

5. Conclusions

This paper systematically reviewed and compared 119 English publications and 73 Chinese publications on community garden ecosystem services, and analyzed the years and numbers of publications, study locations, and research topics. The main findings of this paper are as follows:

Publication trends: The number of both English and Chinese publications on community garden ecosystem services has increased in recent years, and the number of English publications was higher than that of Chinese publications.

Geographic distribution: The study areas of English publications are mainly located in Europe and America, and Chinese community gardens are mainly located in the eastern regions.

Ecosystem service focus: Both English and Chinese publications have discussed the four types of ecosystem services. The majority of English publications explored the B-2 “food supply (quantity)”, most Chinese publications identified D-10 “learning and education”, and both Chinese and English publications focused on D-1 “social cohesion and integration”.

Underlying influencing factors: These observed similarities and variations of English and Chinese publications are related to the governance frameworks, the management systems and climatic conditions in different areas, locally specific sustainable development objectives and planning strategies.

The research gaps indicate that future research can explore in depth the design factors that affect the ecosystem services of community gardens, and pay attention to the links between different ecosystem services, which will guide the development of community gardens more scientifically and rationally and contribute to promoting sustainable urban development through community gardens.

Supplementary Materials Files S1 and S2 are in Supplementary Data.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/buildings15122137/s1>, File S1: List of Selected English Publications; File S2: List of Selected Chinese Publications.

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