



Review

Past results and future directions in urban community gardens research

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ABSTRACT

Globally, rapid urbanisation has substantially reduced the amount of viable agricultural land – a food security issue. Food security is bringing a renewed scholarly interest in community gardens. This paper reviews the extent of English academic literature on community gardens, including: who has undertaken the research, where it has been published, the geographical location of the gardens studied, and the various methods used to undertake the research. The characteristics of the community gardens are summarised, including what types of plants are grown, who is involved in the gardens, and who owns the land. The motivations, benefits and limitations of community gardening are also examined. Finally, potential directions for research into community gardens are highlighted. Academic literature on community gardens is dominated by studies investigating gardens in low-income areas with diverse cultural backgrounds. Research based in cities in the USA also dominates the literature. Scholars from a wide diversity of disciplines have examined community gardens but research is mostly concentrated in the social sciences. The natural sciences are notably under-represented, yet they have much to offer including assessing gardening practices to better understand the agro-biodiversity conservation potential of community gardens.

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Introduction

Rapid urbanisation is a major issue confronting many countries, with over half of the world's population now living in urban environments (UNFPA, 2007). When people move from rural to urban environments, they are less likely to produce or even see food being grown, and more likely to consume food that has been transported long distances, including processed foods (Campbell, 2004; Clement, 2010). Growing concerns about the quality and cost of food, and food insecurity have increased interest in growing food locally in cities including in community gardens (Twiss et al., 2003; Corrigan, 2011; Evers, 2011). Community gardens are growing in popularity and can involve a wide range of groups such as schools, prisons, youth, elderly, hospitals, and local residents of neighbourhoods (Pudup, 2008; Teig et al., 2009). They are not only a source of food but provide other benefits, such as community building, education, and promoting health (Bodel and Anda, 1996; Kurtz, 2001; Mundel and Chapman, 2010; Beilin and Hunter, 2011; Turner, 2011).

Generally the term 'community garden' refers to 'open spaces which are managed and operated by members of the local community in which food or flowers are cultivated' (Holland, 2004; Pudup, 2008; Kingsley et al., 2009). We use this broad definition because it is clear, reflects other studies and captures the variety of community gardens in the literature. Community gardens are similar to, but not synonymous with urban agriculture, but differ from backyard gardens that are privately managed by a family.

Reflecting the growing interest in community gardens is an increasing literature on these types of gardens, including books, guides, evaluations, reports, manuals, conference papers, theses and academic literature (Nettle, 2010). Within the academic literature, there is considerable diversity in research on community gardens, with papers published in journals ranging from geography and planning to health. Despite, or perhaps because of the breadth of interest in community gardens, this literature has not been comprehensively reviewed until now. Employing a well-established quantitative review technique (Petticrew and Roberts, 2005), this paper assesses the extent of academic literature on community gardens including: (i) who has undertaken the research; (ii) where it was published; (iii) the geographical location of the gardens studied; and (iv) the types of methods used to undertake the research. Using this data, characteristics of community gardens are summarised including: what is grown, who is involved in the gardens, and land ownership. The motivations, benefits and limitations associated with community gardens are also examined. The paper concludes by highlighting future directions for research into

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community gardens. This paper makes a critical contribution to the field by mapping the current status of the literature on the topic, including identifying major gaps in the research.

Methods

A systematic quantitative literature review was performed using a methodology which has been used in a range of reviews (Petticrew, 2001; Ogilvie et al., 2004; Tucker and Gilliland, 2007; Dunton et al., 2009; Gentin, 2011; Steven et al., 2011). By using systematic methods to search and categorise the literature, these types of reviews provide reproducible, reliable assessments of the current status of a field of research. The ways in which papers were found, selected and categorised are clearly articulated, minimising potential biases that occur in some narrative style reviews (Petticrew, 2001; Collins and Fauser, 2005). The resulting quantitative assessment documents the geographical spread of the literature, the types of methods used, and the types of results obtained. Thus it can highlight if reliable conclusions can be drawn from the literature, or if biases produce weaknesses (e.g. areas that have been under researched), and hence can mobilise future research agendas (i.e. to fill knowledge gaps).

Original research papers in English language journals about community gardens were obtained from searches of electronic database including: Google Scholar, Geo Base, ISI Web of Knowledge, Pro Quest and Bio Med from December 2010 to December 2011. Keywords used for the searches were 'community garden' and a combination of terms including: 'space', 'green', 'gardening', 'school', 'urban', 'food production', 'land use', 'place', 'planning', 'agriculture' and 'people'. The papers found were triangulated against a recent annotated bibliography about community gardens (Nettle, 2010).

Only papers describing the results of original research using the term 'community garden(s)', and published in academic journals were included. Review papers and other reports such as conference proceedings or theses were not included. Since the first articles that appeared in many of the databases were the most frequently cited and recently published articles, the reference lists of the articles examined were also used to find additional papers.

Papers about community gardens and legal aspects of gardening appeared in the search results, however they were excluded since they were either review papers or commentaries (Borrelli, 2008; Irazabal and Punja, 2009; Dunn, 2010). Research articles about backyard or home gardening (Head et al., 2004; Ghosh et al., 2008; Galluzzi et al., 2010) and rural community gardens (Freidberg, 2001; Bharwani et al., 2005) were also excluded since they did not match the criteria for urban community gardens. From each research paper, the following information was recorded in a database: author(s), their affiliation, journal name, year of publication, location of the gardens studied, whether the term 'community garden' was defined, general focus of the paper (e.g. health, social, environment and planning, policy, economics, cultural issues, education), methods used in the research (e.g. method for collecting data, group segment and type of data), information about the gardens studied (e.g. food producing, land tenure, property value effect, average yield), and characteristics of people involved in them (e.g. type of community group, cultural backgrounds, poverty, motivations, challenges, benefits) as well as the overall effect of community gardens. Some of these categories had to be broadly based to deal with the diversity in the community garden literature.

The methods used for data collection were divided into natural and social science methods. Social science methods included: observation, surveys, interviews, focus groups, case studies and archival research. Wherever relevant, the source of information (e.g. gardeners, garden managers, etc.), the number of people

Table 1

The number of journal papers examining community gardens in different countries and the number of countries authors of papers are from (based on author affiliations).

Country	Community gardens	Authors
USA	51	119
Australia	12	26
Canada	5	17
UK	8	18
South Africa	2	3
Netherlands	1	3
Singapore	1	2
Spain	1	2
Cuba	2	1
Mexico	1	1
Portugal		1
Sweden	1	1
Israel		1
Brazil	1	
Other African countries	2	
Philippines	1	
Total	89	195

^aAlthough there were 87 papers, one paper examined gardens in three different countries (Wade, 1987 looked at gardens in Philippines, Zambia and Mexico).

involved in the research, and the number of gardens examined were recorded. The type of data collected was recorded as either qualitative, quantitative or both.

The motivations (e.g. access to fresh food, cultural or spiritual practices, to save money, to socialise, for education, etc.), benefits and challenges (e.g. future land access, soil contamination, waiting lists to obtain plots, funding, etc.) of community gardeners were also recorded. Benefits were classified as either 'discussed' or 'demonstrated' depending on whether they were only mentioned as the authors' opinion and/or findings in previous literature, or whether they were confirmed as a result of the research. These included access to fresh and safe foods, mental and physical health, reduced crime or increased safety, environmental sustainability, social, economic, cultural heritage, life satisfaction, education and increased biodiversity. Finally, the overall effect(s) community gardens had on the issues discussed were recorded as positive, negative, mixed, or neutral.

By only using peer reviewed research, the methods and conclusions of each paper assessed had already been evaluated within its discipline as of a suitable standard for publication in the academic literature. We did not explicitly assess/weight different studies as more or less reliable based on their methodology. To do so in a consistent and reliable way raises epistemological issues about the appropriateness of different research paradigms, particularly in situations such as that for the community gardens literature, where research has been conducted by diverse disciplines.

The database of papers was analysed to detect patterns in the literature. There were three aspects of the findings: the nature of the research and who conducted it, the gardens described in the literature, and the people involved in those gardens.

Results

Characteristics of current literature on community gardens

In this section, the nature of the authors, geographic and disciplinary scope and the methods used in the literature on community gardens are presented.

Authorship

Eighty-seven academic papers on community gardens were published between 1985 and 2011, the majority between 2000 and 2011 (Appendix 1). The research was predominantly about gardens in North America (66%), specifically the USA (57%) (Table 1). There

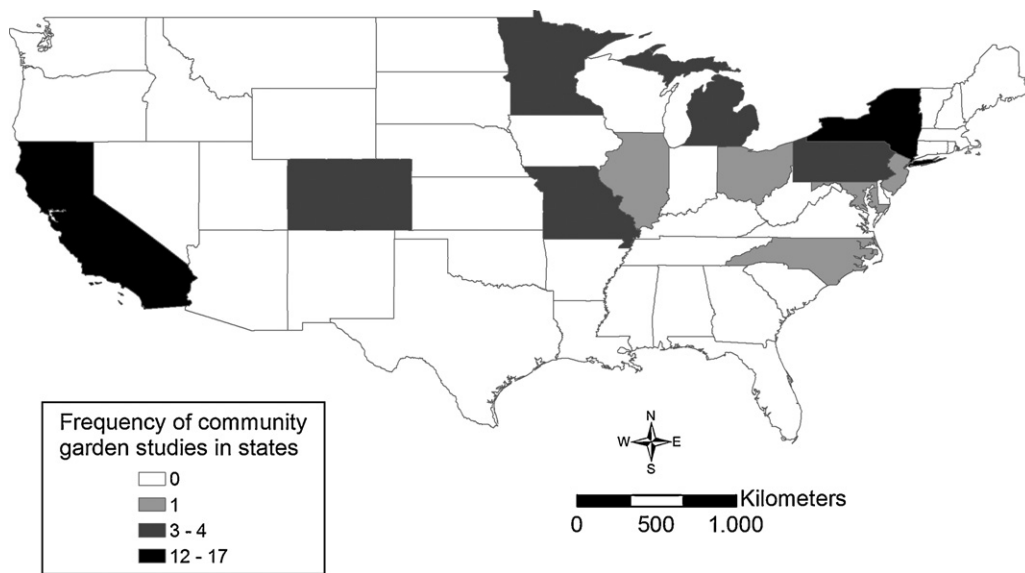


Fig. 1. Map of USA with locations of the community gardens that have been studied in the literature.

was limited research from other North American countries, with few papers from Canada (6%), Cuba (2%) and Mexico (1%). There were a few studies from Europe (12%), Australia (13%), Africa (4%), Asia (2%), and South America (1%) as well as one paper examining community gardens across three countries (Philippines, Mexico and Zambia). Reflecting the geographic dominance of gardens in the USA, was a dominance of USA authors, with 61% of the 195 authors of community gardens studies being affiliated with US institutions. Other authors were predominantly from Australia (13%), the United Kingdom (9%) and Canada (9%). There were only three authors from South Africa, two authors each from Singapore and Spain, and one each from Cuba, Mexico, Israel, Sweden and Portugal (Table 1).

Geographic scope

Research within the USA was predominantly in large east or west coast cities with most papers from New York (33%) (e.g. New York City, Rochester, New Jersey, Buffalo) and California (20%) (e.g. Los Angeles, San Francisco, Berkeley, Sacramento), followed by cities in Michigan (8%) (e.g. Flint, Detroit) and, Colorado (8%) (Denver), Philadelphia (6%), St. Louis, Missouri (6%) and the remaining (19%) were from cities in Minnesota, North Carolina, Maryland, Illinois and Ohio (Fig. 1).

Disciplinary scope

Reflecting the diverse interest in community gardens was the diversity of journals publishing papers on this topic (Appendix 1). These included journals in geography (28%), environment and planning (24%), society and culture (23%), health (12%), education (9%), economics (3%) and conservation biology (1%). The majority of the research in community gardens has examined social concerns such as social capital (Glover, 2004; Alaimo et al., 2010; Firth et al., 2011), gender roles (Parry et al., 2005) and quality of life (Waliczek et al., 1996) (52%) along with cultural issues such as cultural heritage (Barracough, 2009) and food citizenship (Baker, 2004) (7%). Other topics were environment and planning (31%) health (25.3%), economics (16.1%), education (12.6%) and policy (12.6%). Only one paper was entirely based within the natural sciences; it examined bee richness and abundance in New York City community gardens (Matteson et al., 2008). There were however, nine papers predominantly examining social issues that also considered some elements of natural science, such as describing what was grown in

the gardens, while the rest of the research focused solely on social sciences (Table 2).

Methods

Nearly all the research used qualitative data or a combination of qualitative and quantitative data, with only five studies using just quantitative data (Table 2). Researchers collected data using a wide range of social science methods including: interviews, surveys, text analysis, focus groups, case studies and participant observation (Table 2). Other methods that were less commonly used included: health assessments, personal journals, workshops and activity-oriented research. The only natural science methods used were bee collection, plant surveys and soil testing (Table 2). Data was mainly sourced from gardeners (e.g. via interviews and focus groups), although there were some studies that included information from garden managers, government agencies, other supporting organisations, police officers, park managers and local authorities.

Characteristics of community gardens

Papers often assessed the characteristics of the gardens including: crops grown, groups involved, and land tenure. When papers specified what was grown in the gardens (86%), all of the gardens were used for growing food, food and flowers, or food and native vegetation (Table 2). (Further consideration of research on the kinds of foods grown in gardens is explored in the discussion section of this paper.) Where flowers were grown, they were cultivated mainly for beauty or organic gardening practices (e.g. marigolds for managing certain pests).

Most papers (63%) did not define what they meant by the term 'community garden'. Perhaps the reason why papers readily use the term 'community garden' but did not define it, is because authors feel the term is self-explanatory. There is no standardised definition in the literature.

By far the most common groups operating community gardens were non-profit organisations, including cultural and neighbourhood groups (82%) (Table 2). The next most common group was schools, with the remainder run by faith based organisations, hospitals, jails, women's or senior centres, housing complexes or residents who grew their vegetables for profit (Table 2). For many gardens, more than one organisation was in charge and/or participated in the garden. Cultural diversity was a feature of the gardens,

Table 2

Number of published studies (1985–2011) on community gardens that used different methods characterised different aspects of the gardens, and examined motivations and challenges for gardens.

Category	Total	USA	Others
Methods used			
Science			
Social science	76	43	33
Natural science	1	1	
Mixed	9	6	3
Methods			
Interview	53	28	25
Case study	23	11	12
Observation	26	12	14
Survey	27	18	9
Text analysis	14	10	4
Focus groups	13	8	5
Natural science	2	2	
Other	17	11	6
Type of data			
Qualitative	51	28	23
Quantitative	5	4	1
Both	31	19	12
Characteristics of gardens			
Definition			
Yes	30	18	12
No	55	31	24
Typology	3	2	1
Food produced			
Yes	75	46	29
Food only	47	22	25
Food and flowers	25	23	2
Food and revegetation	4	2	2
No			
Not specified	12	8	4
Community groups			
School	16	13	3
Non-profit organisation	66	39	27
Faith-based organisation	6	4	2
Other	11	5	6
Not specified	6	4	2
Land ownership			
Private	3	3	
Government	33	18	15
Both	21	9	12
Not specified	29	21	8
Property value effect			
Increase	13	11	2
Decrease			
Not specified	74	40	34
Different cultural background			
Yes	70	49	21
No	5		5
Not specified	12	2	10
Low income earning areas			
Yes	71	47	24
No	1		1
Not specified	15	4	11
Motivations and challenges			
Motivations			
To consume fresh foods	46	26	20
Social development/cohesion	54	29	25
Saving/making money	27	11	16
Improving health	31	16	15
Enhancing cultural practices	20	11	9
Education	23	13	10
Increasing land accessibility	11	6	5
To enjoy nature	14	9	5
Environmental sustainability	10	3	7
Enhancing spiritual practice	6	3	3

Table 2 (Continued)

Category	Total	USA	Others
Challenges			
Future land access	26	17	9
Soil contamination	10	4	6
Lack of water	10	3	7
Safety issues	10	4	6
Funding	12	6	6
Cultural differences issues	3	1	2
Neighbourhood complaints	5	2	3
Waiting list	3		3

with most papers mentioning differences in cultural backgrounds (93%) and economic status (99%) among the people involved in the gardens (Table 2).

Most papers (67%) included information about land tenure, which was nearly always public, with only three papers examining entirely privately owned community gardens (Table 2). Several papers (15%) examined the impact on property values around the garden. They all found that there was an increase in property values for land surrounding the gardens, directly associated with the presence of the community garden (Table 2).

Motivations, benefits and challenges of community gardens

The motivations of the gardeners and benefits of the gardens are often very similar. A motivation is the desire for achieving something while the benefit is actually achieving it. For this reason there are some overlaps in the terminology used for motivations and benefits. Nearly all the papers (86%) discussed the motivations of people involved in community gardens. A wide range of motivations occurs both among and within papers (Table 2). The most common motivations reported were: to consume fresh foods, social development or cohesion such as community building and culture exchange, to improve health among members and to make or save money by eating from the garden or selling the produce (Table 2). Other less common, but still important motivations, included: to educate, to enhance cultural practices, to access land, to enjoy nature, environmental sustainability and to enhance spiritual practice. Most studies reported on the motivations of gardeners but some also discussed the motivations of project managers and institutions depending on who provided information.

The most common benefits of community gardening included: social development or cohesion, enhanced health, access to fresh foods, saving or making money, and education. Other benefits discussed included: reduced crime and increased safety, environmental sustainability, enhancing cultural heritage, life satisfaction, environmental equity and increased biodiversity (Table 3). All papers discussed between one and nine benefits (average 3.7), however only half (56.3%) of the papers were able to demonstrate between one and six benefits (average 2.1).

The most commonly demonstrated benefits based on the conclusion of the authors of the papers were social benefits, such as community building/resilience and social interaction (keeping in mind that some benefits might be easier to demonstrate than others and/or requiring less complex methodologies). For example, improving nutrition by increasing fruit and vegetable intake was a benefit that was often mentioned in the literature but in some instances could not be demonstrated because of the complexity of evidence required in this field of study (Alaimo et al., 2008). There were often differences between the benefits mentioned and those demonstrated. For example, environmental equity and increased biodiversity were two benefits that were mentioned

Table 3

Number of journal papers that discussed and demonstrated the different benefits of community gardens.

Benefit	Total		US		Others	
	Disc.	Dem.	Disc.	Dem.	Disc.	Dem.
Social	52	33	32	17	20	13
Access to fresh foods ^a		37		19		18
Economic	37	15	21	7	16	8
Health	43	14	25	6	18	8
Reduced crime/increased safety	23	6	20	5	3	1
Education	29	11	12	8	17	3
Environmental sustainability	19	2	6		13	2
Cultural heritage	16	6	8	3	8	3
Life satisfaction	13	4	8	3	5	1
Environmental equity	6		4		2	
Increased biodiversity	2				2	

Disc., discussed in paper but not explicitly assessed; Dem., demonstrated in paper.

^a It was assumed that this was a demonstrated benefit; not looked for discussed.

in papers but, they were seldom demonstrated. Environmental sustainability was similarly frequently mentioned in the literature but was only demonstrated twice (Stocker and Barnett, 1998; Holland, 2004). Holland (2004) for example, demonstrated how 'wasteland' or under-utilised spaces can be used to grow food, and how this type of community food production can be integrated with bush regeneration as an example of environmental sustainability. Economic benefits such as saving or making money were highly discussed and demonstrated, however only three papers actually quantified the produce and its value (Blair et al., 1991; Patel, 1991; Pothukuchi, 2004b).

Just over half of the published papers (55%) discussed challenges facing community gardens (Table 2). The most common challenge faced by USA gardeners was the insecurity of future land access. One fifth of the papers (19.2%) which discussed this issue reported negative results due to land tenure issues with gardens shutting down or likely to be demolished for development. However, issues such as soil contamination, lack of water, safety issues, and theft of tools and vegetables were of greater concern in other countries. Other issues included lack of funding, cultural difference issues, neighbourhood complaints, managing volunteers or volunteer drop off and lack of knowledge (Table 2).

Overall, three quarters (76%) of the articles presented positive outcomes from the gardens in each field of study. Papers that presented design tools or could not prove certain benefits or outcomes were classified as having a neutral outcome (9%). Papers that found positive outcomes of community gardens but also found some negative results were classified as mixed outcome (9%) (e.g. Eizenberg (2011) compared two different models for managing the gardens and found one to be very effective and the other ineffective). Only five papers found negative outcomes of community gardens, and they were all related to insecure land tenure and gardens being demolished for future development (Table 4).

Table 4

Number of journal papers by general discipline of study and overall result.

Journal discipline	Positive			Negative			Neutral			Mixed		
	Total	US	Others	Total	US	Others	Total	US	Others	Total	US	Others
Social	14	10	4	1	1		2	2		3	2	1
Environment and planning	16	5	11				2	2		3	3	
Health	9	4	5							1		1
Economy	3	2	1									
Education	7	6	1				1	1				
Geography	17	7	10	4	4		2		2	1	1	
Biology	1	1										
Total	67	35	32	5	5		7	5	2	8	6	2

Discussion

The aims of this quantitative review were to document where research has been conducted, by whom, on what, using which methods, and what was found. This literature mapping-type approach, quantifying what has been studied and what has been found, is particularly useful for emerging and diverse areas of research such as community gardens. Using this method, generalisations about the literature can be identified, but so too can the limits of those generalisations: where they may not apply and why. Also by highlighting key gaps in the literature, it sets the agenda for future research.

Community gardens literature is geographically limited

There is detailed academic literature on community gardens in English language journals, but it is mostly about gardens in low income earning areas with different cultural backgrounds in industrial cities in the USA. There was limited research from other cities in the USA or from other industrialised English language countries such as Australia, Canada, United Kingdom, and New Zealand. There is even less research from non-English speaking countries (albeit that which has been reported in English-language journals), irrespective of whether those countries were highly industrialised or not.

Four explanations are possible: (1) that the review was limited to English language journals; (2) there are fewer community gardens outside the USA; (3) there are more academics conducting research in the USA compared to other countries; and (4) disciplinary predilections have led researchers to focus more on community gardens in dense poor areas of inner cities in the USA than gardens elsewhere. Reviewing non-English language journals could broaden what is presently a skewed representation of community gardens as it might highlight different issues. Some commentators contend that more than 75% of papers in social sciences and humanities and more than 90% in the natural sciences are written in English (Hamel, 2007), so it may be unlikely that including other languages would dramatically alter the patterns found here. The second factor is improbable, with the geographic spread of the literature unlikely to reflect the real distribution of community gardens. For instance, the Australian City Farm and Community Gardens Network website lists 240 gardens (ACF&CGN, 2011), but only 13% of the papers were from Australia. In New Zealand a sustainable living magazine (Good, New Zealand's Guide to Sustainable Living) listed more than 50 community gardens (Good, 2011), but no research papers on gardens in New Zealand were found when searching the scholarly databases. For these reasons, the two latter factors are most likely to affect the geographical limit of the community gardens literature.

The dominance of the research in community gardens by USA academics is likely to reflect the general dominance of research by the USA, as is often found in reviews comparing the numbers of papers and citations by different countries (King, 2004). The focus

of USA academics upon principally dense poor areas of inner cities reflects socio political interest about the context in which these community gardens developed.

Community gardens literature is diverse

In contrast to the narrow geographical spread of research on community gardens, is a diversity of journals and research. This diversity is likely to reflect the inherent diversity in the motivations, benefits and limitations of community gardens. For example, researchers in health science have looked at community gardens to see if they improve health by improving the diet of gardeners and others (Blair et al., 1991; Somerset et al., 2005; Alaimo et al., 2008; Mundel and Chapman, 2010; Van den Berg et al., 2010), by increased exercise (Austin et al., 2006; Wakefield et al., 2007; Teig et al., 2009), and/or by improving mental health by involvement in nature (Kaplan, 1973; Armstrong, 2000; Milligan et al., 2004). Research has examined the educational benefits of community gardens including for science, nutrition and environmental education (Krasny and Doyle, 2002; Corkery, 2004; Graham et al., 2005). This is a major reason that educational organisations including schools have community gardens. Researchers have examined the economic benefits of community gardens in terms of their effect on adjacent property values (Voicu and Been, 2008), savings gained from accessing food from community garden (Schmelzkopf, 1996; Moskow, 1999) or the potential for other types of poverty alleviation (Hanna and Oh, 2000).

Current research reflects USA socio-political context

Due to the geographical dominance of USA researchers in this literature, it is important to consider how historical and social factors associated with the development of USA cities (e.g. New York and Los Angeles) may limit the capacity to apply their results more generally. Community gardening in the USA can be seen as a socialistic enterprise reflecting communitarian values. The social context in which USA community gardens have developed is arguably different to other countries (Ganapati, 2008; Emmett, 2011). For example, agri-business dominates food production in the USA influencing how and why community gardens are established (Pollan, 2007). In a country where food is mostly from large corporations, community gardens may be viewed by some as a means to reconnect people with clean and safe food sources (Ferris et al., 2001; Twiss et al., 2003). The literature strongly shows that a primary motivation of gardeners, managers and others was to produce fresh foods in a context of social interaction, community building and welfare (Hanna and Oh, 2000; Baker, 2004; Holland, 2004). This is different to socialist countries like Cuba, where oil vulnerability has meant the primary motivation underpinning urban gardens is food production, and where agricultural practices have been forced to rely upon biological control of pests and diseases rather than expensive pesticides and herbicides (Altieri et al., 1999; Chaplowe, 1998).

Research also shows that land in the USA cities for community gardens is scarce. Consequently the main challenge faced by community gardeners in the USA has been security of tenure. Most community garden land in the USA has been government-owned. Leases have typically been no more than five years in duration, creating insecurity for gardeners (Schmelzkopf, 2002; Staeheli et al., 2002; Barraclough, 2009). Further, the positive impact of community gardens on neighbourhood property values has created a conundrum in the USA. Rising property values have eventually forced out many community gardens (Armstrong, 2000; Voicu and Been, 2008). This issue is especially prevalent in low-income neighbourhoods in New York City (Schmelzkopf, 2002; Staeheli et al., 2002; Smith and Kurtz, 2003; Martinez, 2009) and Los Angeles

(Barraclough, 2009) where up to 400 community gardens have been closed for redevelopment. Property dynamics and property rights thus play a major role in shaping USA community gardens. The question is do community gardens in other countries experience similar issues, and if they do, what impact is this having on agro-biodiversity?

Future directions

An obvious focus for future research is to increase the geographical scope of research to include more gardens outside the industrialised cities of the USA. This will give a richer context to our understanding of community gardens, including potentially identifying differences in motivations, benefits and challenges to those found in the USA. This is particularly likely given that the social and political context of gardens in USA conurbations such as Boston–Washington or Southern California are likely to differ to those for community gardens in other major metropolitan areas (e.g. Tokyo in Japan, Cairo in Egypt, Sao Paulo in Brazil, Delhi and Mumbai in India, Shanghai in China, and Jakarta in Indonesia). The contexts in which community gardens exist are also likely to differ substantially between the large old industrial cities of the USA and other smaller and/or wealthy locations in the USA and elsewhere (e.g. settler societies such as Australia, New Zealand and Canada). More geographically diverse research is needed including comparative studies of gardens in different social and political contexts, before we can obtain a more accurate assessment of the characteristics, motivations, benefits and challenges for community gardens globally. In turn, more research is also needed about the ‘political ecology’ of community gardens (Heynen et al., 2006). In other words, how do the social and political conditions surrounding community garden formation and continuity over time impact agro-biodiversity specifically and biodiversity generally?

This review has demonstrated that despite the diversity of journals that have published research on community gardens, and the range of topics examined by scholars, important gaps remain, particularly in the natural sciences. Two important issues in the natural sciences are about agro-biodiversity (*what* gardens grow) and the sustainability of gardening practices (*how* people grow food in community gardens). Chappell and LaValle (2011, 3) for example, assert that empirical research shows an: ‘interdependence of biodiversity and agriculture, and the important role each plays in the maintenance of the other’. Although community gardens are likely to have important biodiversity benefits (Irvine et al., 1999; Buckingham, 2005), there has been limited research on this topic. Only one out of the 87 papers assessed in this review was principally focused on biodiversity, and it was about bee richness (Matteson et al., 2008). A political ecology analysis may go some way to filling this knowledge gap. Political ecology is an analytical frame that explores how the intersection of social and ecological factors can impact environmental outcomes such as urban biodiversity (Heynen et al., 2006).

Eight predominantly social science papers have examined some aspects of biodiversity in community gardens, mostly agro-biodiversity such as the types of crops grown in the gardens (Wade, 1987; Corlett et al., 2003; Baker, 2004; Saldivar-Tanaka and Krasny, 2004; Mundel and Chapman, 2010; Corrigan, 2011) and species richness of gardening plots (Blair et al., 1991). Crops grown in different community gardens in Mexico City, Quezon City, Philippines, Lusaka and Zambia (Wade, 1987) and Maryland (Corrigan, 2011) have been examined. Foods from other nations were considered in Chinese, African, Caribbean and Sri Lankan community gardens in Toronto (Baker, 2004), Hmong community gardens in California (Corlett et al., 2003), and Latino community gardens in New York (Saldivar-Tanaka and Krasny, 2004). Traditional medicinal herbs and plants grown in a First Nations community garden in Vancouver

were also studied (Mundel and Chapman, 2010). Yet no studies have systematically investigated how these different types of plants were grown, what factors affected the diversity of plants grown (type of organisation, motivation, gardening practices, age, size, etc.) and how might have crop choices and gardening practices interacted to configure biodiversity within community gardens? This is a startling oversight.

With global declines in agro-biodiversity (Fowler and Mooney, 1990; FAO, 1995), and increasing concerns about food security, community gardens may have an important role in maintaining in situ dynamic stores of food plants (Chappell and LaValle, 2011). Increases in industrial agriculture practices globally are contributing to a reduction in the diversity of plants used for food and agriculture (e.g. agro-biodiversity including cultivars, landraces, ecotypes, weedy races and wild relatives) (Wood and Lenne, 1997; Galluzzi et al., 2010). For example, high levels of inter- and intra-specific plant genetic diversity, especially in terms of traditional crop varieties and landraces, are preserved in home gardens (Galluzzi et al., 2010), but there is limited equivalent information for community gardens. Maintaining agro-biodiversity is crucial for global food production, food security and pest management (Dong et al., 2010). Studies could examine issues to do with agro-biodiversity including how seed is sourced, how diverse are the gardens and what factors contribute to food diversity in community gardens. Some of these issues have been examined for home gardens (Trinh et al., 2003; Negri and Polegri, 2009; Galluzzi et al., 2010), and similar methodologies could be adopted for future research on community gardens.

Correspondingly, how people garden is likely to influence the success of the gardens in terms of sustainability, health, education and social cohesion which were common motivations listed in the literature for those establishing and participating in community gardens. The different ways in which community gardeners add nutrients to the soil (e.g. using fertilisers versus compost), control pests (e.g. using pesticides versus companion planting and/or crop rotation) and use existing resources (e.g. tap water versus collecting rain water in tanks) can affect the environmental sustainability of a garden. This issue however, has not been examined in the community garden literature, although, some of these issues have been investigated in urban agriculture and home gardens (Chappell and LaValle, 2011; WinklerPrins, 2002; Kortright and Wakefield, 2009).

Urban agricultural practices including home gardening are also beneficial responses to climate change related food insecurity (Dixon et al., 2009) and community resilience (Okvat and Zautra, 2011). Given the insecurity of tenure in the USA – and perhaps elsewhere – how useful can community gardens be for community resilience and food security? Future research on this topic is vital.

Conclusion

There are increasing numbers of urban community gardens across the globe. Reflecting this is an expanding academic literature on these gardens, published in a wide range of journals, and covering a diversity of topics. Current research is disproportionately focused on gardens in low-income areas, upon gardeners with different cultural backgrounds, and in industrial cities in the USA, potentially biasing our understanding of the characteristics of the gardens, and their motivations, benefits and limitations. We need to know more about who gardens and why, as much as how they garden. Future research should therefore assess a greater geographical spread of gardens, and include more natural science, including examining gardening practices and agro-biodiversity conservation. Community gardens research needs to be about more than just the

social aspects of community gardens in poor areas, in the industrialised cities of the USA. Clearly researchers have only touched upon a small fraction of the potential scope of community garden research, and the future for community gardens research looks very promising.

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Appendix A.

Details of 87 papers examining urban community gardens.

Authors (year)	Journal	Location
Africa		
Flynn (2001)	Africa	Tanzania, Kenya, Zambia, Zimbabwe & Ghana, Africa
Karaan and Mohamed (1998)	Development Southern Africa	Cape Town, South Africa
Wills et al. (2009)	Health Promotion International	Johannesburg, South Africa
Australia		
Beilin and Hunter (2011)	Local Environment	Melbourne and Sydney
Cameron et al. (2011)	Local Environment	Newcastle
Corkery (2004)	Australian Journal of Environmental Education	Sydney
Evers (2011)	Local Environment	Perth
Freestone and Nichols (2004)	Landscape and Urban Planning	Melbourne & Sydney
Henryks (2011)	Local Environment	Canberra
Kingsley and Townsend (2006)	Urban Policy and Research	Melbourne
Kingsley et al. (2009)	Leisure Studies	Melbourne
Perkins and Lynn (2000)	Women Against Violence	Townsville
Somers et al. (2005)	Journal of the Home Economics Institute of Australia	Brisbane
Stocker and Barnett (1998)	Local Environment	Fremantle
Turner (2011)	Local Environment	Canberra
Asia		
Tan and Neo (2009)	Local Environment	Singapore
Europe		
Buckingham (2005)	Area	West London, UK
Crouch (2000)	Acta Horticulturae	UK
DeSilvey (2003)	Cultural Geographies	Edinburgh, UK
Domene and Sauri (2007)	Geoforum	Terrassa, Barcelona, Spain
Firth et al. (2011)	Local Environment	Nottingham, UK
Holland (2004)	Local Environment	UK
Howe and Wheeler (1999)	Sustainable Development	Leeds & Bradford, UK
Klein (1993)	Journal of Folklore and Research	Sweden
Martin and Marsden (1999)	International Planning Studies	UK
Milligan et al. (2004)	Social Science & Medicine	Carlisle, UK
Van den Berg et al. (2010)	Environmental Health	Netherlands

Appendix A (Continued)

Authors (year)	Journal	Location
North America – USA		
Alaimo et al. (2010)	Journal of Community Psychology	Flint
Alaimo et al. (2008)	Journal of Nutrition Education and Behaviour	Flint
Allen et al. (2008)	Journal of Hunger and Nutrition	Flint
Armstrong (2000)	Health & Place	New York
Austin et al. (2006)	Therapeutic Recreation Journal	New York
Barracough (2009)	The Professional Geographer	Los Angeles
Blair et al. (1991)	Journal of Nutrition Education	Philadelphia
Comstock et al. (2010)	Journal of Environmental Psychology	Denver
Corlett et al. (2003)	Economic Botany	Sacramento
Corrigan (2011)	Applied Geography	Baltimore
D'Abundo and Carden (2008)	Journal of the Community Development Society	North Carolina
DeKay (1997)	Journal of Architectural and Planning Research	USA
Doyle and Krasny (2003)	Environmental Education Research	New York
Eizenberg (2011)	International Journal of Urban and Regional Research	New York
Ferris et al. (2001)	Social Policy & Administration	San Francisco
Francis (1987)	Landscape Journal	Sacramento
Fusco (2001)	Journal of Research in Science Teaching	New York
Glover (2003)	Journal of Leisure Research	USA
Glover (2004)	Leisure Sciences	USA
Glover et al. (2005)	Leisure Sciences	St. Louis
Graham et al. (2005)	Journal of Nutrition Education and Behaviour	California
Hale et al. (2011)	Social Science & Medicine	Denver
Hanna and Oh (2000)	Bulletin of Science, Technology & Society	West Philadelphia
Jamison (1985)	The Sociological Quarterly	USA
Krasny and Doyle (2002)	Journal of Extension	Allentown, Philadelphia, Baltimore, Maryland, New York, Buffalo & Rochester
Krasny and Tidball (2009)	Cities and the Environment	USA
Kurtz (2001)	Urban Geography	Minneapolis
Lautenschlager and Smith (2007)	Agriculture and Human Values	Minneapolis & St. Paul
Lawson (2004)	Journal of Planning History	USA
Litt et al. (2011)	American Journal of Public Health	Denver
Martinez (2009)	Social Movements Studies	New York
Matteson et al. (2008)	Conservation Biology and Biodiversity	New York
Moore (2006)	Urban Geography	Columbus
Morris et al. (2001)	California Agriculture	California
Morris and Zidenberg-Cherr (2002)	The American Dietetic Association	California
Palamar (2010)	Nature and Culture	New York
Parry et al. (2005)	Leisure Studies	St. Louis
Patel (1991)	Journal of Extension	Newark
Pothukuchi (2004a)	Children, Youth and Environments	SW Detroit
Pudup (2008)	Geoforum	Berkley & San Francisco
Saldivar-Tanaka and Krasny (2004)	Agriculture and Human Values	New York

Appendix A (Continued)

Authors (year)	Journal	Location
Salvadori (2001)	Local Environment	Oakland
Schmelzkopf (1996)	The Geographical Review	New York
Schmelzkopf (2002)	Urban Geography	New York
Shinew et al. (2004)	Journal of Leisure Research	St. Louis
Smith and Kurtz (2003)	Geographical Review	New York
Staeheli et al. (2002)	Geo Journal	New York
Teig et al. (2009)	Health & Place	Denver
Voicu and Been (2008)	Real Estate Economics	New York
Waliczek et al. (1996)	Journal of Environmental Horticulture	New York & Los Angeles
Witzling et al. (2011)	Journal of Agriculture, Food Systems & Community Development	Chicago
North America – Canada		
Baker (2004)	Geographical Review	Toronto
Irvine et al. (1999)	Local Environment	Toronto
LaBonté (1986)	Health Promotion	Toronto
Mundel and Chapman (2010)	Health Promotion International	Vancouver
Wakefield et al. (2007)	Health Promotion International	Toronto
North America – Other		
Altieri et al. (1999)	Agriculture and Human Values	Havana, Cuba
Moskow (1999)	Environment & Urbanisation	Havana, Cuba
South America		
Madaleno (2000)	Cities	Belem, Brazil
Other		
Wade (1987)	Food and Nutrition Bulletin	Philippines, Zambia and Mexico

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