The Sustainability Contributions of Urban Agriculture: Exploring a community garden and a community farm

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Abstract

This exploratory analysis of the potential of urban food production in cities of the global North is based on empirical examination of a community garden in New York City and a community farm in London, combined with secondary analysis of studies in six cities in the United States (US) and the United Kingdom (UK). Urban cultivation is promoted by environmental and food activists and organizations who may overstate the potential scale of urban food production: cities will be able to grow a maximum of about one-twelfth of a healthy plate for their inhabitants, and realistically much less. The main benefits of urban cultivation are social, and differ between urban and peri-urban farms. Capturing these benefits as contributions to the social component of sustainability represents a challenge for the development of social Life Cycle Assessment (LCA) or life cycle sustainability assessment.

Keywords: social sustainability, ecological education, food production, social LCA

1. Introduction

Community gardens and farms are a leading edge of the contemporary upsurge in urban cultivation. A sign of popularity is the endorsement of political leaders. For example, Michelle Obama planted a garden in 2009 with the help of school children--the first White House plot since Eleanor Roosevelt's World War II Victory Garden. The rise in interest is also indicated by a change in the status of urban cultivation, increasingly referred to as *urban agriculture* amongst academics (McClintock 2010). "Agriculture" projects a new frame and a larger scale than does "cultivation": agriculture is about food production, so that the horticultural gardens which dominate present urban cultivation are downplayed. The shift in perception raises research questions about the present reality and future potential of urban agriculture's output and sustainability. We address these questions based on case studies of a community garden and a community farm. The study is exploratory and descriptive, and addresses cultivation only as practiced in cities of the global North; the picture is quite different in the global South (Altieri 2012; Zezza and Tasciotti 2010).

There are pressing reasons for the interest in urban cultivation. Starting with the *macro* context, the world has a rising and increasingly urban population (UN 2011). There will be 2 billion more to feed by 2050, when 69 percent of our population of 9 billion will be urban, compared to 50 percent today. This growth is projected to increase food demand by 60 to120 % (Conforti 2011; Foley *et al*. 2011; Tilman *et al.* 2011; cited in Garnett & Godfray 2012). Progressive urbanization leads to loss of farmland (Seto *et al.* 2011). Between 1970 and 2000, the land equivalent of Denmark was converted from farmland to urban settlement. The projection for 2000 to 2030 is the equivalent of Mongolia, about 36 times the area of Denmark. Urban growth is also associated with tropical deforestation (DeFries *et al.* 2010). To exacerbate the problems, climate change is projected to result in farm yield loss (IPCC 2014; USDA 2013). Although there is debate around how large the loss may be, there is agreement that food security is one of the principal concerns humanity must address in the context of global climate change. The US is currently the world's 3rd largest food producer and its largest food exporter (FAO 2013) yet the US Department of Agriculture projects the yields of major US crops to decline by mid-century due to rising temperature and precipitation extremes. Thus agriculture faces a number of challenges in raising sustainable production levels. Many hope and argue that increasing production in cities and their suburban and exurban peripheries can contribute to meeting these challenges.

The institutional or *meso* context for rising interest in urban agriculture includes the environmental movement and related food consumption campaigns (*i.e.,* organic, locally-sourced, healthy and sustainable diets). Community gardening and farming evoke a cultural orientation different from that of traditional urban allotments. Allotments were in large measure institutionalized as compensation for the land clearances involved in the emergence of industrial agriculture in the late 18th--early 19th centuries in Northwestern Europe (see Fairlie 2009). In the UK, statutory allotment sites receive protection under the Allotment act of 1925, although there are fewer safeguards for private and temporary sites (RCEP 2007). Contemporary community gardening

and farming represent a more recent movement, arising in the late 20th Century largely as neighborhood mobilizations to reclaim deteriorating open lands in post-industrial cities in North America and Europe.

It is at the local or *micro* level that urban agriculture has become a force for social change. In the context of this paper, "urban" refers to metropolitan areas (cities, suburbs and exurbs), while "cultivation" refers to controlled growing of any flora. The cases examined exemplify two common modalities of urban cultivation: one very small inner-city community garden and one larger but still small peri-urban community farm.

2. Methods

Data were collected through field observation, documentary and verbal information provided by informants, and accessing studies online. The main informants were the President of the West Side Community Garden (WSCG) and the Manager of the Sutton Community Farm (SCF). The WSCG in New York City was selected because one author had done volunteer work there since 2003 and began to study it in 2011; another author has visited it. The SCF in the southern outskirts of suburban London was selected because it had been the subject of a recent LCA (Kulak *et al*. 2013). All the authors took part in a site tour of the SCF in September 2013; one of the authors had worked on a similarly sized commercial market garden (known locally as a "smallholding") at that location some 50 years previously.

3. Results

3.1. Very small gardening: New York City's *West Side Community Garden*

The Garden began in the context of the massive 1970s Urban Renewal Program in the slums of gutted post-industrial cities (Martin 2011). The City of New York evicted occupants and razed tenement buildings in much of Manhattan's Upper West Side, leaving brown-field land available for redevelopment and gentrification (Wilson 1987). A high-rise condominium building was built on a site which included the future WSCG and another was awaiting capital investment. In the meantime the site became a dump for abandoned automobiles and other urban detritus. This dump site was transformed into a verdant garden in a spontaneous response by local residents to clean up a dangerous area in their midst that was also an eyesore. With construction imminent the neighborhood was assisted in saving this open space by the local Community Board and the Trust for Public Land. City government and developers acquiesced in part because community gardens enhance property values, thereby adding to tax revenues (while also, of course, adding to value for property owners). In an analysis of community gardens established in New York City between 1977 and 2000, Voicu and Been (2008:268) found that "gardens were located on sites that acted as local disamenities within their communities. . . after opening, gardens have a positive impact on surrounding property values, which grows steadily over time." The City administered a "sunshine test" and approved the site as a garden—with two stipulations for becoming untaxed land: that it would be open to the public and that it would pay for its upkeep.

The WSCG is located near the geographic center of New York City's Manhattan Borough. The land, 2/5 of an acre, is held by the Trust for Public Land and is governed by a board of officers elected annually from its 300+ paid members ("participants"). Membership is open to the public at a nominal annual fee.

Only about one-third of the Garden's space is used to grow food. Each gardener gets one raised bed of 30 ft^2. Gardeners reported that they do not grow much food—enough fruit and vegetables (f&v) for several meals a week over the late summer harvest period. "I just grow some nibbles," one said. Several informants related that growing food is not the main reason they gardened—rather, it was because they like to garden. Also, they reported that they like the cooperative aspects of the Garden and enjoy its ambience—a quiet, safe, public, and green island amidst Manhattan skyscrapers. Of the remaining 2/3 of Garden space 1/3 is devoted to horticulture. The final 1/3 is dominated by an amphitheater used for cultural productions.

The WSCG depends on a steady replenishment of labor to maintain compost bins and public areas, as well as to raise money. The Garden requires about $75,000 annually to operate. The bulk of the money goes to maintain pavements, towards insurance, and to purchase gardening supplies and tools. The labor required is skilled. This limits the available pool. Finding volunteer gardeners has been a general problem for community gardens. The largest pool of potential gardeners is women, mainly retired. New York City's gardens have declined in number since the mid-1980s largely due to lack of participation—many rely on one or two "tireless souls" (Tortorello

2012). The WSCG provides a range of cultural programs which attract thousands of visitors in the summer season who are potential sources of finance and labor.

3.2. Peri-urban small holding: London's *Sutton Community Farm*

This Farm comprises 7.1 acres, 3.5 of which are cultivated. It lies in the Borough of Sutton at the southern fringes of greater London, in what is termed "the green belt" in the UK planning system. It occupies green-field land but the soil is very poor. Until the 20th Century lavender had been grown on the site as it can thrive in poor soils. The land use was changed as part of the mid-century drive to increase food production in the UK and took advantage of labor from a nearby camp for prisoners of war. Fifty years ago, the smallholding was operated by a family who lived there; it produced mainly high-value glasshouse crops, primarily salad vegetables and cut flowers sold via large wholesale markets in London, with high inputs including horse manure. There are now 500 m² of poly tunnels at the SCF providing for year-around production but it requires large inputs of compost, an expensive appetite for a non-residential farm with no manure-producing animals.

The SCF is London's largest community farm. It was started in 2010 with the blessing of Surrey County Council, which owns the land and collects ground rent. It operates as a co-operative and plans to offer shares within its local community. Similar social enterprises engaged in up-scaling local food production include *Urbivore* in Stoke (Williams 2013) and *Farmscape* in Los Angeles (Collins 2013).

The SCF is not solvent and there are no plans to make a profit. The goal is to make the Farm pay for itself and become a platform for activities for the local community; examples include making gardening experiences available to local school children and to disabled people. However, because of its location and the lack of public transport, a visit must be a planned activity. Salad crops are still the most profitable output, accounting for around 1/3 of income but only 1/7 of acreage, but the produce is consumed more locally than 50 years ago. About 3/4 of the Farm's produce is distributed to retail customers in "vegetable boxes"; this scheme currently has 142 customers, with a capacity for 350. The remaining 1/4 is sold wholesale, largely to local restaurants and cafes. The demographics of vegetable box customers reflect the local residential area: they are largely middle class. Many are seasonal customers who grow their own f&v and therefore buy much less in the summer. The Farm's unsold produce is collected by a local charity which makes soup from it. The two major expenses are compost (purchased from a local municipal site) for which haulage is the principal outlay, and water for irrigation.

The Farm's manager is a university graduate who used to be a chef and became interested in food security issues. He has organized an apprentice scheme at SCF. His view is that expertise in managing small-scale farms is generally lacking in the UK. The manager also organizes volunteer gardeners. The volunteers are diverse: some are employees of local businesses who are paid to work on the Farm as part of a Corporate Social Responsibility program.

Most of the Farm's tilled acreage is devoted to leaf crops. Surrey County Council requires the land to be turned over within two years, and so the Farm has no fruit trees. The Farm has not applied for Organic Certification, although the manager said that its production is "based on organic principles" and the Farm is open to anyone who wants to come and see for themselves. The Farm uses small tractors but most work is manual. The sole full-time employee is the manager. A "sustainable farming" apprentice grower is paid for three days per week. One grower is paid for one day per week. The vegetable box scheme has one employee working 3.5 days per week to deal with customers, and two drivers are employed, each for one day per week. Total paid labor is equivalent to 2.7 full-time workers.

3.3. Comparison between the two cases

The WSCG is an example of an inner city brown-field site coopted for social benefits; it depends on volunteer labor and contributions. The SCF is an example of a low-productivity green-field site which has transmuted into a social enterprise with some income and a paid work force. Both have outreach educational programs for their local communities. The Garden gets a large number of "walk-in" users and provides a sizeable cultural program, while the Farm produces considerably more food.

Using present formatting the very small Garden can grow the f&v portion of an annual *Eatwell* plate for about 3 people; the small Farm, for about 71 people. Extrapolation of these calculations, which are based on

FoodPrinting Oxford data (LCO 2012:28), show that it would require about 40 % of the total land areas of the New York and London urban agglomerations (UN 2011) to provide the f&v portion of an *Eatwell* plate for their populations. As f&v represent one-third of the plate, it would take more than **all** the land areas of the two agglomerations to grow full plates for their populations.

4. Discussion

4.1. Food production

Studies in 6 cities in the UK and the US have produced good and bad news for the potential of urban agriculture. The good news is that there is room for great expansion. The bad news is that this growth would come from a very low base and the maximum potential is low. Our initial analysis of research in Cleveland (Grewal and Grewal 2012), Detroit (Colasanti *et al.* 2010), London (Garnett 2001), New York (Ackerman 2012), Oakland (McClintock *et al.* 2013), and Oxford (*LCO* 2012) shows that an average of about 6 % of current f&v consumption is produced locally; this could be tripled to a maximum of about 18 %, which would still only represent about 6 % of an *Eatwell* plate.

This maximum potential is reachable only by overcoming some challenging conditions. Cities struggle today to maintain their current green spaces. In London the area of domestic gardens which comprise 25 percent of the land upon which f&v could be grown is declining. Between 1998 and 2008 "the area of plant-covered land fell by 12 % and the area of hard surfacing increased by 26 %" (Vidal 2011:3)—largely due to paving for car parking (Smith 2010). This is but one example of an imposing array of structural limits to urban food production: land, sustainability, labor and capital. With regard to land, urban settlement covers only 1 percent of the earth's land mass (FAO 2011) and it is expensive property subject to intense economic and political competition.

Another challenge to expanding urban agricultural production is the condition of brown-field urban soils. A study of lead contamination in vacant sites in Oakland found a high level of variability that must be considered when undertaking cultivation (McClintock 2013). Finally, there are sustainability questions about the advisability of converting urban green spaces (parks, greenbelts, etc.) to food production. These spaces already provide for carbon sequestration, urban cooling, biological diversity and social sustainability.

One touted technical solution for the lack of urban land is vertical farming or *z*-farming, for zero acreage (Despommier 2009). There are two major sustainability obstacles for high-rise *z*-farming: the energy required for artificial lighting to grow plants away from windows, and the industrial fertilizers needed to optimize yields from hydroponic production (Specht *et al.* 2013:10). These inputs obviously add substantially to the life cycle impacts of food production; see below. A technical issue for roof-top greenhouses is their integration with buildings, especially with recycling systems.

While structural obstacles will likely prevent the development of urban cultivation into urban agriculture, it has niche roles in local food production. One study has shown that it can make a significant contribution to the tables of low-income immigrants from agricultural backgrounds (Mares and Pena 2010). Another study has shown that it can make a substantial contribution to improving the diets of low-income persons with high rates of obesity and diabetes, and limited sources of fresh produce (McMillan 2008). However, in both cases the (volunteer) gardeners had free access to large plots of arable land.

4.2. Ecological sustainability

Underlining the caveats entered above concerning the potential for urban food growing, Kulak *et al.* (2013) have carried out an LCA study of the SCF which indicates that ecological benefits over the life cycle are localized rather than distributed along the supply chain. For example, reductions in greenhouse gas emissions are gained from appropriate choice of local crops that can substitute for foods grown in energy-intensive glasshouses or flown to the UK from overseas. A locally sensitive design approach is crucial in maximizing the potential for urban farming as a contributor to ecological sustainability.

Like all urban green spaces, community cultivation plots make contributions to local ecological sustainability—by providing natural habitats, improving soil quality, reducing soil erosion, and mitigating the city heat island effect (Bousse 2009; Brown and Jameton 2000; Cattell *et al.* 2008; Comstock *et al.* 2010; Ferris

et al. 2001; Louv 2008; Pugh 2013; Relf 1992; SDC 2008; RCEP 2007; RHS 2011). Urban cultivation may make a greater contribution to carbon sequestration than other urban green spaces such as parks; Kulak *et al.* (2013) found this to be the case in their LCA study of the SCF. They may also reduce the run-off loss of rainwater exacerbated by the "concreting over" of cities and their environs (RCEP 2007); this is significant where, as in London, a principal aquifer may lie below the city itself.

Another contribution to ecological sustainability in which cultivation may outperform other urban green spaces is that it shelters biological diversity through a wide variety of flora—agricultural and horticultural. However, the contributions are dependent on local conditions; as a specific example, agriculture both supports and depends on the presence of bees to pollinate plants. The Farm at Sutton has three hives tended by a volunteer keeper, and is close to woodland and other commercial bee hives. Also, calendula, porridge, and ornamental flowers are grown to encourage pollination. In spite of being in the center of a large city, the WSCG has a good supply of bees from hives on nearby roofs and wild colonies in Central Park (Satow 2013). Thus, both the Farm and the Garden support bee populations by providing a diversity of flora—paralleling the practice of spacing ribbons of flowers amidst fields of crops in rural agriculture.

4.3. Social sustainability

The example of low-income immigrants illustrates that urban cultivation can make meaningful contributions to two major components of social sustainability—environmental justice and public health. However, it is in *education* that the WSCG and SCF make impressive efforts. The inter-generational principle of sustainability relies on ecological education. The Garden and the Farm are places where the practice of gardening is maintained and passed on to all age groups. The Garden reserves six plots for school children who participate in an ecology learning module during which they grow food. As follow-up to their experiences, children and their teachers have constructed several raised-bed plots in their schoolyard. In New York City, the number of registered school-based gardens has multiplied six-fold (Foderaro 2012). It is significant that most of the adult gardeners in the Garden have had previous gardening experience, many in their childhoods. The Sutton Farm operates a funded schools program, the *Green Grub Club*, in which pupils and after-school staff grow, cook, and eat vegetables. In addition, 16 students and their caretakers from a local school participate in a sponsored Disabled Farming Assistance program.

Informal education is a part of community cultivation as well. For example, whether WSCG should be primarily functional or "ornamental" is subject to on-going debate. There are four parties. "Foodists" make an environmental justice argument for converting flower space to f&v space in order to shorten the queue for beds (now a year) and provide more opportunity for those who are poor to grow their own. "Ornamentalists" make an aesthetic point for the beauty of flowers and its social psychological rewards, which are expanded to include a public health benefit. "Pragmatists" make an economic argument that flowers attract people who then contribute money and work to the Garden. "Ecologists" make a sustainability case for the biological diversity provided by flowers—and the bees that depend on them.

A latent result of the Garden's "great ornamental debate" is its contribution to the ecological knowledge of its participants. The debate takes place in informal interactions. Arguments are presented; this results in an exchange of information. Gardeners hear from each other about some of the complexities of food production and its relationship to sustainability. Several reported that they had learned about the four positions and "leaned" towards one or two of them. This communal learning is an example of the unique synergies that exist between ecological and social sustainability (see Martin 2013) and supports the argument here that small inner-urban plots mainly have social value. They add to conventional urban horticulture by being communal. The communality is a basis for development of social capital based on use value.

The social benefits of urban cultivation are felt mainly at a local level rather than distributed along a supply chain; they are outside the familiar framework of LCA. It is therefore questionable whether or not the benefits or relative disadvantages of urban cultivation can be captured by an approach based in LCA as currently conceived. The guidelines on social LCA (Benoit and Mazijn 2009) are "still very much in the developmental phase" (Paragahawena *et al.* 2009) and are in any case directed at detecting social "bads" in international supply chains. By contrast, urban cultivation can deliver social benefits which are then the driver for the activity. Similarly, the supply systems depend on inputs like imported compost, but also on affluent consumers—of vegetable boxes delivered to the doorstep in the case of SCF, and of cultural programs at WSCG.

Production, distribution and consumption are to be seen not just as a one-way flow of resources from supplier to consumer, leaving impacts in their wake, but as a channel by which benefits can flow back from the "consumer" (of food or land use) to the other agents in the chain (Clift *et al.* 2013). Adapting social LCA or life cycle sustainability analysis to this kind of case represents a new methodological challenge.

4.4. The role and future of urban cultivation

The difference between the two sites which are the focus of this study illustrates the big dilemma confronting urban cultivation. The WSCG is too small to provide a significant food output but has a high amenity value due to its location and accessibility. The SCF is large enough to provide a significant food output and some jobs, but its location makes its social value educational rather than amenity-based. Given the demand and price for land in "successful" cities such as New York and London, this distinction between urban and peri-urban land is likely to be persistent. The distinction is mitigated in distressed cities like Detroit where "abandoned houses, vacant lots and empty factories now make up about a third" of the city (Harris 2010:47).

Recognizing the difference between urban and peri-urban cultivation suggests a different approach to land provision, with planning and regulation on a regional or ecosystem basis. Being in the green-belt provides a measure of protection against development for the SCF. This kind of provision could protect existing food-growing land, particularly at urban peripheries, and could integrate food-growing spaces into new build and re-build. One vision for the UK is an increase from the current 4 % to 25 % of f&v urban and peri-urban production (*Growing Communities* 2012), representing 8 % of the *Eatwell* plate.

5. Conclusion

While structural limits prevent urban cultivation from becoming urban agriculture (at least in cities of the global North), there is a case to be made for it on the grounds of its contributions to ecological and social sustainability. Urban agriculture can produce little more than "nibbles" of food but it can contribute "oodles" to social-ecological sustainability. One can imagine an urban regional cultivation scheme in which there are more community gardens in the center, more allotments and domestic gardens in the suburbs, and more community farms in the exurbs. The WSCG and SCF cases illustrate that "To be a viable alternative in cities and compete with other land uses, the justification for urban agriculture must include the ecological and cultural function these systems offer, in addition to the direct benefits of food produced" (Lovell 2010:2516). Moreover, the co-benefits could include 'spill-over' of interest in local food to changes in other practices at household and community level, such as greater awareness of waste reduction, long-life product use and reduction in car dependency. How engagement in urban farming can act as a catalyst for wider practices of 'sustainable lifestyles' is a rich field for research.

Concerning the scope for the scalability of urban cultivation, perhaps we should be looking at food systems differently? What if there is a parallel with utilities in energy, and with the scope for distributed community energy systems? In this case food should be seen as a good currently supplied by oligopolistic intermediaries (retailers) from ever more consolidated primary producers (farmers), a state of affairs that needs reform for greater resilience - there are many parallels with energy generation and distribution. What if we had community farms that are hubs of services and production, with 'sub-stations' in residential areas (allotment tillers and keen back garden food growers) acting as the equivalent of a localized energy grid and generation system? As with decentralized energy, the aim would not be to achieve total self-sufficiency and grid-independence, but instead to boost system-wide resilience via redundancy, diversity and storage. After all, food systems represent flows.

The looming food security crisis will not be resolved by transforming urban cultivation into urban agriculture. Instead this will depend on meeting a daunting list of challenges: Reducing food waste, which accounts for up to one-third of production throughout the food chain (Kummo *et al.* 2012); shifting crops away from animal feeds and biofuels to human foods, which can increase global calories by up to 70 per cent (Cassidy *et al.* 2013); adopting *sustainable intensification*, in which productivity is raised without increasing environmental impact and without using more land (Garnett and Godfray 2012); and shifting to ***sustainable*** *Eatwell* plates on the consumption side (Harland *et al.* 2012; Macdiarmid *et al.* 2011; Thompson *et al.* 2013). Urban cultivation can have a small but significant role in such an evolving sustainable food system, as a provider of some local food, and as a catalyst for socio-economic sustainability.

Science has provided us with the ecological metrics needed to specify the requirements of food sustainability. The big gap in our knowledge is an understanding of the *social* processes and practices necessary to provide for food security. *Society* is the neglected child in the sustainability family. Urban cultivation offers a unique venue for assessing social sustainability and its synergies with ecological sustainability. The needed calculations pose a challenge to social LCA methodologies.

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