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Urban Agriculture's Synergies with Ecological and Social Sustainability: Food, Nature, and Community

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The European Conference on Sustainability, Energy and the Environment 2013

Official Conference Proceedings 2013

Abstract

The practice of urban agriculture (UA) is a flourishing topic in environmental discourse based on its promise for increasing sustainable food production in a world increasingly urbanized at the same time food security is threatened by climate change. Research indicates UA has potential for a substantial contribution to food sustainability in the global South where extensive poverty and large populations with traditional agricultural knowledge provide the material and social bases for growing an already appreciable level of production. However, UA may have a low ceiling in the global North due to the high value of land and the lack of unpolluted soil (a legacy of industrial production). It has been argued that UA in the global North can overcome this lack of affordable arable land by constructing vertical farms and expanding the production of current venues: allotments, kitchen gardens, community gardens, and peri-urban farming. This paper considers these arguments based on a case study of a community garden in New York City, supplemented by data from other studies. The conclusion is that the potential for UA in the global North will likely remain low. Still, it merits policy support on other grounds: its synergies with ecological and social sustainability. While UA may offer somewhat greater capacity to enhance ecological sustainability than other green spaces, its synergies with social sustainability are more substantial—generating social capital for community development, promoting environmental education, and advancing environmental justice. These synergies warrant increased attention in urban sustainability research.

"The garden is the smallest parcel of the world and then it is the totality of the world." Michel Foucault (1986:26)

Introduction: Parsing the potential of urban agriculture

My basis for parsing the potential of urban agriculture in this paper this is experiential as well as empirical: The experience comes from over a decade of participation in a community garden in New York as well as occasional workdays on friends' allotments here in the UK. Much earlier on, I grew up in a semi-rural environment in Kentucky.

My local community garden in Manhattan, the WSCG occupies 17,500 square feet (0.16 hectare) of rising land between two parallel streets. It is dominated by two features. At one end lies a large vegetable garden divided into 80-odd raised plots that are six feet by five feet in size. Six plots are reserved for school children. The small size of the plots considerably limits the scale of food production. Gardeners reported that produce served as occasional supplements to their tables. At the other end of the Garden is an amphitheater which is used for a series of cultural productions throughout the summer season.

The Garden's 300-odd members and thousands of users were found to represent a cross-section of the neighborhood's population—with two major exceptions: Age and gender. Older women are disproportionately represented. Studies of other urban gardens have shown similar findings (Garnett 2001: 484; Sokolovsky 2009).

The Garden is now decades old, having been developed by neighborhood activists on a rubble-filled vacant lot. Although quite successful, it requires large amounts of labor to operate. The labor includes physical work like turning compost and administrative work like fund-raising.
This labor falls to a small cadre of gardeners—as one told me, "our problem is that only a core does everything--a dozen or so people." This is a common problem for community gardens, and the small core of active persons is not always sustained. A national survey of US community gardens found that "the primary reason given for loss of [hundreds of] garden sites is lack of interest by gardeners" (ACGA 1998:3).

Urban Agriculture: Back to the future?

It was the development of agriculture some 10,000 years ago that made cities possible and it has sustained their growth over the millennia. This sustenance is becoming problematic in an era when a majority of humans are for the first time residing in urban areas—at the same time as the species is dealing with global climate change. The principal threat to the human species from this climate change is to agriculture. The UN (2009; 2011) projects a global population in 2050 of 9 billion, 70 percent of whom will live in cities. This population will require about 70 percent more food that the 2009 population. Meanwhile, expanding cities coupled with the floods and droughts expected from global climate change will reduce the store of arable land. The upshot of these changes is that our species must enhance its food production on a large scale, and do so in a sustainable fashion.

Gardening in urban areas has led to a full-blown movement which has acquired its own categorical identity—Urban Agriculture (UA). Thus, McClintock (2010: 191) argues,

> As we find ourselves once again in the throes of a crisis of capitalism, the popularity of UA in the Global North has surged and the discourse surrounding it has shifted from one of recreation and leisure to one of urban sustainability and economic resilience. Even the terms used to describe it have shifted in the Global North; "urban agriculture" is replacing "community gardening" in everyday parlance' placing it (despite its much smaller scale) in the same category as UA in the Global South . . . .

Of course, urban agriculture is as old as cities but what is the future of its revival? The potential of UA can be analyzed using three vectors of sustainability—food (or agricultural); ecological (or environmental); and social (or community).

Food Sustainability

The primary focus in UA is on cities of the global South, and with good reason—it is far more widely practiced there. The results of one comparative research project (Zezza and Tasciotti 2010) found that in cities in 11 of 15 countries (in Africa, Asia, Eastern Europe, and Latin America), the share of households participating in food production was over 30 percent. Participation was concentrated in the poorest strata of populations, with over 50 percent of the poorest quintile participating in 8 of the 15 nations. UA's contributions to total agricultural production ranged from a high above 20 percent in Madagascar and Nicaragua, to a low of 3 percent in Malawi. In only 4 nations was more a one-third of agricultural production marketed. A significant additional finding of this research was that urban agriculture was associated with indicators of dietary adequacy and diversity in a majority of the nations.

As to the potential of UA in the global South, the researchers concluded:

> On the one hand, the potential for urban agriculture to play a substantial role in urban poverty and food insecurity reduction should not be overemphasized, as its share in income and overall agricultural production is often quite limited. On the other hand, though, its role should also not be too easily dismissed, particularly in much of Africa and in all those countries in which agriculture provides a substantial share of income for the urban poor, and for those groups of households to which it constitutes an important source of livelihoods (Zezza and Tasciotti 2010: 255).

Thus, at present UA has a reasonable potential to be a significant food producer for the poorest people living in the poorest cities of the world, and it is receiving enhanced attention from climate change analysts. For example, at Rio+20, Altieri (2012) made a case for a considerable scaling-up of urban agroecology in the South.

What about the potential role of urban agriculture in producing food in cities of the global North?

Summaries of four pieces of research from two countries show the following:

> --London could produce 18 percent of the fruit and vegetables eaten by its residents (Garnett 2001)

--Oxford could produce one-half of its fruit and vegetables (*FoodPrinting Oxford* 2012)
--Cleveland, Ohio, 11 percent of food and beverage consumption by weight and 4.5 percent by expenditure could be produced (Grewal and Grewal 2012)
--Oakland, California has a potential for vegetable production of 5 percent of current vegetable consumption (McClintock *et al.* 2013)

These percentages are much higher than present production in these cities—Cleveland, for example, has the potential to produce more than 100 times its current level of food and beverage consumption. However, the percentages for potential production remain low and do not approach food sustainability. Thus, in Oxford, the potential of producing 50 percent of fruit and vegetables would represent only 2 percent of the city's overall requirement for land to feed itself. Moreover, these maximum potential figures are even less impressive if the following is considered:

--We are looking only at fruit and vegetable production which is a minority share of the human diet
--Even when that share is upgraded, as in the UK Eatwell Plate (FSA 2010), to one-third of a recommended sustainable dietary allowance, the result would be that London has a maximum potential of producing only about 6 percent of its total food needs

Additionally, there are major obstacles to reaching the potential production levels. The first is that an unknown portion of the land that would be converted to agriculture is too contaminated to sustain food production for humans. For example:

--Nearly 60 percent of London's vacant industrial land is contaminated and that even many allotments, domestic gardens, and other small pockets of land are too polluted for safe food production
--A study that assessed the lead contamination of soil in 12 vacant sites in Oakland, California, found a high level of site variability that must be taken into consideration when planning for urban farming; significantly, sites with contamination significantly higher than the Federal screening level were in predominantly low-income and African American neighborhoods, indicating a major environmental justice concern (McClintock 2012)

The other obstacle to greater urban food production is the land squeeze. Food production is land intensive and urban land has high commercial value and economic competition for its use. Thus, they feature skyscraper buildings. For example, two-thirds of the original lot rehabilitated by the WSCG was eventually taken by residential apartment buildings. The negotiation of conflicting land stakeholder interests is quite intense in many cities of the North, New York and London being prime examples.

Meanwhile, these cities struggle even to maintain their current levels of green space. For example, in London, the domestic gardens which comprise 25 percent of the land upon which fruit and vegetables could be grown, are declining. A recent study (Smith 2010) found that between 1998 and 2008, their area had declined by 12 percent. It is primarily being lost to paving for parking cars.

Vertical farming?—One idea to overcome the lack of arable land in cities of the North which is gaining traction is vertical farming, or high-rise structures devoted to food production (see Despommier 2009). These urban farms would use new, sustainable greenhouse technologies in order to mass produce food, including fish and perhaps even poultry. Although not a new idea, such a skyscraper has yet to be built.

Chicago is an example. There, a "mega" indoor vertical farm is being converted from an abandoned warehouse. *FarmedHere* as it is called is located in the suburbs and has 90,000 square feet in which to produce a million pounds a year of organic greens. The plant proposes to integrate aquaponics by using tanks of fish to clean water and provide fertilizer for the soil-less crops. It is a business that started with loan from the massive US organic food store chain, Whole Foods (FCRN 2013). Though large in floor space, this structure is only two stories tall. The goal of building a skyscraper for food production has yet to be met.

There are two major obstacles to achieving this goal. One obstacle is economic; *i.e.*, the high costs of skyscrapers. Currently, their costs are borne by corporations and governments for their offices, and by middle-to-upper class residents for their homes, or state-subsidized housing for lower-income citizens. The costs are for land, for construction (or conversion), for maintenance, and for taxes. Then there are the energy and labor costs of growing food. It appears quite problematic that a successful business model for skyscraper food production would include very high costs for its output.

In addition to economic obstacles, there are major presumptive questions about the sustainability of vertical farms. Energy will be required to get adequate artificial light to plants that are not at windows on all the floors of high structures in order to replace sunlight. The proponents of vertical farming recognize this sustainability issue. Dickson Despommier, its best-known advocate, has been quoted as saying that "powering farms is still the biggest hurdle for the industry" (*Chicago Impact* 2013: 2). The consensus of technology experts at an international meeting on vertical farming at the University of Maryland in 2012 was that there is a bottleneck in the development of more efficient LED lighting, which is now about one-half of what it needs to be to make such farming economically feasible (*The Vertical Farm* 2013).

At least in the near and mid-term, vertical farming appears to have low potential for making a major contribution to sustainable urban food production.

Scaling-up present urban farming?--Even if its food sustainability production prospects low, UA can still make a material contribution to the lives of some sub-groups in some cities of the global North—for example, for low-income immigrants with access to land, as the work of Mares and Pena (2010) indicate for community gardens in Los Angeles and Seattle. In both cases, the gardens were large ones (14 and 4 acres) and the immigrants came from agricultural backgrounds.

A best-case scenario for growing the scale of urban farming has been developed for Detroit, a distressed city which today has sizeable acreage of the vacant, publicly-owned land that would be required for the purpose (Colasanti *et al.* 2010). The scenario is based on the following assumptions:

--Soil would be non-contaminated or de-contaminated
--Field harvest could be stored as well as consumed immediately
--The growing season would be extended by using "hoop houses" (passive-solar greenhouses made with plastic sheeting stretched over metal frameworks)

In this scenario, it would be possible to supply a significant portion of the fruit and vegetables consumed locally—about 75 percent of vegetables and nearly 50 percent of fruits.

However, there are caveats to this scenario:

--If Detroiters increased their fruit and vegetable consumption to government-recommended and sustainable dietary allowances, three times as many acres would be required
--The significantly scaled-up gardening would require substantially more human labor, the source of which is unknown

That is the story at the moment for sustainable food production in cities of the North. What about the ecological and social sustainability vectors of UA?

Ecological Sustainability

All urban green spaces, including gardens, enhance natural environments is a number of significant ways (see Bousse 2009; RHS 2011):

--Contributing to biodiversity through sustaining a variety in flora and fauna
--Contributing to species preservation by providing food and habitat
--Reducing soil erosion and retarding flooding
--Mitigating the urban heat island effect

While community gardens likely are no better than other urban green spaces in providing these contributions to ecological sustainability, they are more likely to provide opportunities to link ecological and social sustainability; for example in environmental justice projects.

Thus, Palamar's (2010) case study of New York's Green Guerrillas illustrates the possibilities of for integrating ecological restoration and environmental justice within an urban setting. Additionally, in a study of community gardens in the San Francisco Bay area, Ferris *et al*. (2001: 567) concluded that "community gardens can be very positively linked to the implementation of Local Agenda 21 and sustainability policies and at the same time used to promote environmental equity."

Social Sustainability

As to social sustainability, UA offers a range of contributions--in health, education, and community development (see Relf 1992). With regard to health, gardens provide locally-accessible and free opportunities for both physical and mental well-being. Gardening is by nature a physical pursuit. Its physicality ranges from the fine motor

involvement of cutting flower stems to the aerobic gross motor tasks of turning a compost pile (Brown and Jameton 2000: 28, citing Mattson 1992). While gardening has positive consequences for physical health, it also "has been observed to be a way to relax and release stress" (Brown and Jameton 2000: 28). Thus, in addition to promoting physical health, gardens can support mental health—for their users as well as their gardeners. They provide a small plot of nature for people living in large and dense cities, access to which can be a form of therapy allowing for solitude, escape, serenity, and reflection. Such access has been found to be related to mental health by mitigating a psychological "nature deficit disorder" (Louv 2008).

It is with regard to education that community gardens may make their most significant contributions. The educational programs they provide for school children can be a vehicle through which coming generations are provided a structured opportunity to learn-by-doing some of the basic principles of ecological sustainability. Thus, in the WSCG, classes from nearby schools engage over the course of a term in sustainable agricultural practices such as working compost bins and growing organic vegetables. These classes have led to the creation of a small garden at the primary school across the street.

It is in community development that community gardens have received the most attention. They have been found to "contribute to neighborhood satisfaction, sense of community belonging, and social contacts" (Comstock *et al*. 2010, citing Clayton 2007; Kearney 2009). They have also been found to enhance community pride and serve as an impetus for broader community improvement by improving relationships among people (Comstock *et al*. 2010, citing Wakefield *et al*. 2001).

One study of an urban multi-ethnic area concluded that the social benefits of any public open space are to "provide relief from daily routines, sustenance for people's sense of community, opportunities for sustaining bonding or making bridges, and influence tolerance and raise people's spirits" (Cattell *et al*. 2008: 544). Finally, UA has been found to create opportunities for leadership development and community organizing and in this way contributes to neighborhood social capital (Brown and Jameton 2000: 29).

The social capital manifested in urban gardens is mobilized through political activity and they have become meaningful arenas for political action. Community gardens are increasingly landscapes that support and connect three vital spheres of political mobilization: Environment, food, and space. For example, a study of community gardens in Toronto by Baker (2004: 306) argues that: "By digging into their small plot of land, gardeners are challenging conventional ideas of urban planning and design, working on community-development projects, engaging with place-based social movements, and creating alternative food systems."

In Canada, an emergent community food-security movement aims to cultivate democratic food practices by raising awareness of where food comes from and by promoting locally grown food. This practice has as a model, "Food Citizens," who not only are consumers but also who are engaged in their communities and have an intimate connection to their food (Baker 2004:306; Welsh and MacRae 1998). Another framing of the new connections between urban space and food is that of "civic ecology" (Tidball and Krasny 2007: 158), a term that embraces the

management of nature, public education, and community development within urban settings.

Conclusion: Maximizing the Food, Ecological, and Social Sustainability of Urban Agriculture

While there is potential for increasing UA, it is probable that this will occur in the global South. There, widespread and deep poverty creates a material need and social basis for enhancing the already appreciable level of urban food production. Also, Altieri (2012: 17) noted also that "the reason why the potential resides in the South and not in the North is because in developing countries still resides a large peasant-indigenous population, with a rich traditional agricultural knowledge and a broad genetic diversity which conforms the basis of resilient diversified agroecosystems."

In the global North, UA has the potential to increase but its ceiling appears low due to the commercial value of real estate, a lack of safe land for growing food, the sheer amount of land needed to produce food, and questions about its energy sustainability. At least in the foreseeable future, the best prospects for any vertical farming lie in turning the spaces on the rooftops of urban buildings into gardens. This would require no new land and no energy for artificial light.

One model of the city for expanding food production is the regional or ecosystem approach. The ecological region focuses on the natural sustainability of urban agglomerations through the preservation of ecologically significant land such as wetlands, and the redevelopment of a regional agriculture (Luccarelli 1995). A schematic for a zonal scaling of agriculture in urban agglomerations might look like the following:

1. Core or inner city: Some fruit and vegetables. Continue to develop community gardens but direct the focus to social sustainability.
2. Suburbs: Even more fruit and vegetables, possibly with some poultry (meeting both public health and sustainability concerns). Expand allotment systems.
3. Exurbs: Small farms producing fruit, vegetables, and poultry that are taken to farmer's markets in the inner city.
4. Periphery: Small and medium size farms producing fruit, vegetables, poultry, pork, and dairy, the produce of which is marketed through retail outlets across the urban agglomeration.

Even assuming such a zonal scaling and a considerable increase in food production, UA will not be able to produce at least two groups of food, one that is a necessity—that is the food that requires large-scale land use, including all grains—and one that is discretionary—that is the exotic components of modern urban diets; for example, bananas and citrus in cities like London and New York.
In conclusion, the potential of the contemporary upsurge in urban agriculture is assessed as follows:

1. Agricultural (food): Limited potential and concentrated in the provision of fruit and vegetables, and in the South

2. Ecological (environmental): Meaningful potential but no more so than other urban green spaces except for synergies with social sustainability
3. Social (community): Substantial potential, especially in the mobilization needed for furthering education for sustainability and environmental justice

These considerations are by nature preliminary. We have a lot of questions about urban food production and a dearth of information. This means that UA can be the basis of a rich research agenda. In terms of knowledge we are probably at the end of the beginning of this research agenda.

Finally, whatever their agricultural, ecological, and social assessments, it needs to be said that urban gardens are also important resources for the personal lives of city dwellers.

Like all urban gardens, the WSCG is only a very small piece of nature in a very large city, but like all of nature it "has unusually potent power to heal broken human landscapes and to humanize and reinvigorate distressed cities and built environments . . . to restore community and hope at the same time that urban ecosystems are repaired" (Beatley 2011: 9).

The garden is indeed a "totality" for urbanites—providing for community solidarity, for a direct connection to nature, and for **some** food.

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