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The Edible City: Envisioning the Continuous Productive Urban Landscape (CPUL)

Katrin Bohn and André Viljoen

Continuous Productive Urban Landscape (CPUL) proposes a coherent strategy for the introduction of interlinked productive landscapes into cities thereby creating a new sustainable urban infrastructure and supporting a re-definition of open urban space usages.

The paper focuses on the environmental benefits of integrating urban agriculture into CPULs as one of their major spatial and occupational components. Making reference to recent high-profile international exhibitions and publications, the paper also traces urban agriculture's remarkable shift from a fringe interest to one at the centre of contemporary urban and architectural discourse.

The paper concludes that, while urban agriculture is receiving a great deal of attention, the theory underpinning the design of productive landscapes and the rationale for developing policy to support its practice will require sophisticated cross-disciplinary work to articulate the full potential of concepts, such as CPUL, to make essential infrastructure within future sustainable cities.

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The CPUL City concept

The concept of CPUL City provides a strategic and associative framework for the theoretical and practical exploration of productive landscapes within contemporary urban design. It describes the vision for a sustainable urban future based on the planned physical and societal introduction of continuous productive urban landscape (CPUL) into existing or emerging cities.

Continuous Productive Urban Landscape (CPUL) is a design concept advocating the coherent introduction of interlinked productive landscapes into cities as an essential element of sustainable urban infrastructure. Central to the CPUL concept is the creation of multi-functional open urban space networks that complement and support the built environment (Fig.1)

Fig.1 The CPUL concept. *Green corridors provide a continuous network of productive open space containing footpaths and cycle ways. Fields for urban agriculture and other outdoor work and leisure activities are located within the network and serve adjacent built-up areas.*
Image: Bohn&Viljoen Architects, 2002.

Key features of CPUL space include urban agriculture, outdoor spaces for people (leisure and commercial), natural habitats, ecological corridors and circulation routes for non-vehicular traffic. Its network connects existing open urban spaces, maintaining and, in some cases, modifying their current uses (Fig.2). Within the CPUL concept, urban agriculture refers in the main to fruit and vegetable production, as this provides the highest yields per square metre urban ground. Typical urban agriculture practice range from small-scale *food gardening* to high-yield, space-efficient *market gardening*.

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Fig.2 Imagine a CPUL *as an open urban space where intensive urban agriculture and convivial outdoor places for residents compliment each other and are designed and built into a coherent infrastructural landscape. Images: (bottom) Bohn&Viljoen Architects "Cuba: Laboratory for urban* agriculture", 2002, (top) Bohn&Viljoen Architects "The Continuous Picnic", 2008.

CPUL impacts on the city qualitatively with respect to citizens' experience and quantifiably with respect to reduced negative environmental impact.[1] The concept recognises that each site and city will present a unique set of conditions and competing pressures informing the final shape and extent of the CPUL (Fig.3). CPUL City visualises how this productive landscape could enhance a city's social, environmental and economic performance by questioning issues as diverse as urban lifestyles, air quality and agricultural yield.

[1] Viljoen, A. and Bohn, K, 'Continuous Productive Urban Landscapes: urban agriculture as an essential infrastructure,' *The Urban Agriculture Magazine*, 15 (2005): 34-36

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Fig.3: London LeisurEscape. A CPUL proposal connecting public art gallery, the Tate Modern, in central London to the town of East Croydon at the edge of London. The image shows how parts of parks may be given over to productive landscapes including urban agriculture and selected roads be "greened" without compromising other uses.
Image: Bohn&Viljoen Architects, 2003.

The CPUL concept grew out of design research exploring the role of urban agriculture within urban design and was first designed for and then defined by Bohn&Viljoen Architects respectively in 1998 and in 2005.[2]

At the beginning of this work, we made connections between three ideas emerging internationally during the 1990's, all supporting the need for detailed design research into productive landscapes. One was the design debate focusing on infrastructure, exemplified by the notion of *infrastructural urbanism*,[3] the second was an interest in reducing the environmental impact of architecture, influenced by *ecological footprint* research,[4] and the third was the revived discussion about *public open space* which confirmed urban landscape as major contextual and lifestyle component for the design of a sustainable contemporary city.[5]

Our conclusion to this research was that urban agriculture could indeed make a significant contribution to fruit and vegetable requirements, and that a case could be made for considering it as an essential element of sustainable infrastructure in existing and developing cities.[6]

2 André Viljoen (ed.), Continuous Productive Urban Landscapes CPULs: designing urban agriculture for sustainable cities. (Architectural Press: Oxford, 2005)

3 Allen, S. 'Infrastructural Urbanism, Performance Notations: Barcelona ZAL,' *Scroope 9*, (1996): 71-9

4 Mathis Wackernagel, and William Rees, *Our Ecological Footprint: Reducing Human Impact on the Earth*, (Canada: New Society Publishers, 1996).

5 Makoto Yokohari, Process Architecture 127: *Ecological Landscape Planning*, (Tokyo, Japan: Process Architecture Co, 1995).

6 Michael Chisholm, *Rural Settlement and Land Use*, (London:Hutchinson & Co; 1972). André Viljoen, and Katrin Bohn, 'Urban Intensification and the Integration of Productive Landscape.' In Proceedings of the World Renewable Energy Congress VI, Part 1, (Oxford: Pergamon Press; 2000) Department for the environment farming and rural affairs (DEFRA) (UK). The Validity of Food Miles as an Indicator of Sustainable Development, Final Report for DEFRA, ED 56254, Issue 7, (Oxford: AEA Technology; 2005)

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This resulted in the CPUL City concept being underpinned by a number of robust and interrelated social, environmental, economic and design arguments, for what would amount to a radical change in the configuration and programming of open urban space within an overarching desire to find more self-sustaining ways of living.[7] (Fig.4, Fig.5).

[7] Michael Chisholm, *Rural Settlement and Land Use*, (London:Hutchinson & Co; 1979). André Viljoen, and Katrin Bohn, 'Urban Intensification and the Integration of Productive Landscape.' In Proceedings of the World Renewable Energy Congress VI, Part 1, (Oxford: Pergamon Press; 2000) Department for the environment farming and rural affairs (DEFRA) (UK). The Validity of Food Miles as an Indicator of Sustainable Development, Final Report for DEFRA, ED 56254, Issue 7, (Oxford: AEA Technology; 2005)

Fig.4: The Pragmatic and the Visionary: a (UK-centred) dialogue on our society's relation to food and the city.
Image: Bohn&Viljoen Architects, 2008

Fig.5: London LeisurEscape. Munton Road, London, before and after implementing a CPUL. In this proposal, the road, which is lightly used by vehicles, would be converted into an urban agricultural field surrounded by cycle and pedestrian ways.
Image: Bohn&Viljoen Architects, 200

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The environmental case for Productive Urban Landscapes

There are three primary environmental benefits from organic urban agriculture for the urban food system: preserving bio-diversity; closing material/waste cycles and reducing the amount of energy used to produce and distribute food.

One of the most effective ways of assessing the environmental impact of a particular process or product is to find out how much embodied energy (the total amount of non-renewable energy used in production) is required. Embodied energy can be thought of as shorthand for assessing the climate change potential of a process. The energy (mainly non-renewable) currently used for conventional industrialised food production in Europe, for example, exceeds by far the energy received in return from consuming the produced food. This unlimited, daily energy usage contributes significantly to global resource depletion and global warming.

Apart from its conventional production, food is being transported further than ever before, often by air between countries on opposite sides of the world, whilst local crop varieties are replaced by a few commercial types popular with supermarkets.[8] This pattern of growing 'food miles' is far from sustainable, its by-product being increasing air pollution, notably of major greenhouse gases such as carbon dioxide, increasing road congestion and noise and increasing stress.

[8] Cook, H and Rogers, A 'Community Food Security', *Pesticide Campaigner*, 6 (3) (1996): 7-11

One might argue that concentrating on the energy consumed by current remote food production does not allow for the future development of environmentally clean energy technologies. But such a position fails to recognise that the inequitable distribution and consumption of resources extends beyond energy usage, i.e. to raw materials, desirable land, water and food. Reducing the energy requirements of goods and processes shrinks the divide between those who have access to abundant energy supplies and those who do not, without limiting the availability of final products.

Productive Urban Landscapes containing urban agriculture and supplying local outlets with the produce would offer an alternative to this environmentally dangerous situation. Our studies have shown that a city like London could produce about 30% of all fruit and vegetable requirements of its population from within the city boundary. It could achieve this by only using currently abandoned, leftover space.

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However, issues related to food security and food supply and the potential ways of improving our current modi operandi, are still only just starting to be discussed internationally:

> "Food is a sustaining and enduring necessity. Yet among the basic essentials for life — air, water, shelter, and food — only food has been absent over the years as a focus of serious professional planning interest."[9]

Designing for Urban Agriculture

In urban agriculture, a solid body of literature exists describing it in relation to food security, to development policy and the positive social impact of urban agriculture in places with high indices of social deprivation.[10] Mostly, this research originates in developing countries and/or uses cases studies situated there. In Western Europe and North America, urban agriculture is looked at in different organisational forms, which include for example urban farms, community gardens or allotments. Whilst the latter concentrates on the social impact of food producing spaces on contemporary cities, the former also explores yields and growing techniques.

Other areas of academic research relevant to Productive Urban Landscapes are just starting to appear, for example research assessing the impact of green and/or productive space in the urban environment with respect to human well-being,[11] research relevant to the *economic viability of urban agriculture*[12] or detailed contemporary studies into the *embodied energy and associated greenhouse gas emissions of foodstuffs.*[13]

However, within design disciplines, the dissemination of new ideas, especially spatial ideas, takes place as much through visual media such as exhibitions, as through the publication of academic papers.[14] In these disciplines, a rapid increase in interest, exploration and dissemination of ideas about designing urban space for productive landscapes / urban agriculture is evident (Fig.6).

9 American Planning Association. 'Policy Guide on Community and Regional Food Planning,' (2007) at http://www.planning.org/policyguides/food.html.

10 Egziabher, A., Lee-Smith, D., Maxwell, D., Mernon, P., Mougeot, L. and Sawio, C. *Cities Feeding People: An Examination of Urban Agriculture in East Africa*, (Ottawa: International Development Research Centre; 1994) Mustafa Koc, Rod Macrae, Luc Mougeot, and Jennifer Welsh (eds.) *For Hunger-proof Cities Sustainable Urban Food Systems,*(Toronto: International Development Research Centre; 1999)

Maria Caridad Cruz and Roberto Sánchez Medina, Agriculture in the City: A key to Sustainability in Havana, Cuba, (Kingston, Jamaica: Ian Randle Publishers; 2003) Luc Mougeot, *Agropolis: The Social, Political and Environmental Dimensions of Urban Agriculture*, (London: Earthscan and the International Development Research Centre (IDRC); 2005)

Veenhuizen, R. van (ed.) *Cities Farming for the Future: Urban Agriculture for Green and Productive Cities,* (Philippines: International Institute of Rural Reconstruction and ETC – Urban Agriculture; 2006)

American Planning Association. 'Policy Guide on Community and Regional Food Planning,' (2007) at http://www.planning.org/policyguides/food.html.

11 The Second International Conference on Urban Landscape and Horticulture (June, Bologna, Italy, 2009).

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[12] New Economics Foundation. 2001, nef surveys at http://www.neweconomics.org/gen/m6_i121_news.aspx [accessed 21/11/07].

[13] Brook Lyndhurst. 2008. London's Food Sector: Greenhouse Gas Emissions, Report for the Greater London Authority. See http://www.brooklyndhurst.co.uk/londons-food-sector-greenhouse-gas-emissions-_118?path=,118 European Commission. Environmental Impact of Products (EIPRO): Analysis of the life cycle environmental impacts related to the final consumption of the EU – 25, (2006) at http://ec.europa.eu/environment/ipp/pdf/eipro_report.pdf.

[14] Jac Smit, Annu Ratta and Joe Nasr, Urban Agriculture: Food, Jobs and Sustainable Cities, (New York: UNDP, Habitat II Series; 1996)

[15] André Viljoen (ed.) *Continuous Productive Urban Landscapes CPULs: Designing Urban Agriculture for Sustainable Cities.* (Architectural Press: Oxford, 2005)

[16] BLDGBLOG: (2009) http://bldgblog.blogspot.com/2009/06/london-yields-harvested.html [accessed 22nd June 2009].

[17] Greater London Authority: (2010). http://www.london.gov.uk/who-runs-london/the-london-assembly/publications/housing-planning/cultivating-capital-food-growing-and-planning-system-london [accessed 27th May 2010].

[18] Mark Redwood, *Agriculture in Urban Planning: Gen*erating Livelihoods and Food, (London: Earthscan and the International Development Research Centre (IDRC); 2009).

Fig.6: The increasing number of exhibitions about urban agriculture and CPUL hosted by arts and architecture institutions and galleries indicates how these subjects are entering the international architectural and urban design discourse. [The chart is not exhaustive, but reflects trends evident to the authors in their practice.]
Image: Bohn&Viljoen Architects, 2009.

The publication in 1996 of the book "Urban Agriculture: Food, Jobs and Sustainable Cities"[15] was a landmark in defining an international role for urban agriculture and may be considered seminal to a sequence of publications, academic and popular. While planning for urban agriculture has already been on the agenda, the publication in 2005 of "CPULs"[16] was the first time a book was devoted to presenting a design strategy for the coherent integration of urban agriculture into cities.[17]

A further milestone in the exploration of design consequences and possibilities arising from urban agriculture was reached in 2007, when the Netherlands Architecture Institute (NAi) Maastricht curated an exhibition titled "Die Eedbare Stad / The Edible City". For the first time, this brought together an international group of leading architects and artists all exploring urban agriculture within their work. Since then, the number of similar exhibitions and "public works" hosted by leading international design institutions has continued to increase[18] (Fig.7) (Fig.8).

Fig.7: Middlesbrough CPUL. Opportunity Map developed as part of the UK Design Council's Designs of the Time (DOTT07) a 2-year-long urban farming project. During 2007, the population of Middlesbrough, the local authority and community organisations participated in urban agriculture projects across the town. Bohn&Viljoen's proposal for a Middlesbrough CPUL shows the identified network of open spaces and indicates DOTT07 urban farming sites (small square raised elements).
Image: Bohn&Viljoen Architects, 2007.

Fig.8: The Urban Agriculture Curtain. A working prototype for a vertical productive urban landscape as part of the exhibition "London Yields". The system developed with Hadlow College utilizes industry standard hydroponics components and produces fortnightly crops for use in the Building Centre's restaurant.
Image: Bohn&Viljoen Architects, 2009

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In the UK, these activities are likely responsible for productive landscapes beginning to be integrated into planning policy. Evidence for this can be found in the Greater London Authority's / Design for London's proposals for the "Green Grid", a network of open spaces within the city including provision for productive landscapes [19] and the recently published London Assembly report "Cultivating the Capital: Food growing and the planning system in London." [20]

Notwithstanding these developments, the publication, "Agriculture in Urban Planning"[21] concludes that architects and planners require further "awareness of and sensitivity to "green" and agricultural features into the design process".

The 'behaviour change' potential of urban agriculture

Our own research suggests that this shift in perception is equally necessary for local residents, even in those urban areas where urban agriculture is not only present, but also essential for people's survival[22] (Fig.9).

Fig.9: Finding Parque Lenin. In 2006, Bohn&Viljoen carried out a survey about the perception of urban agriculture amongst local residents in Havana concluding that people do not see productive landscapes as equivalent to more established forms of urban landscapes.
Image: Bohn&Viljoen Architects, 2008.

However, at another scale, that of the individual non-commercial grower, evidence is emerging for a behaviour change related to food growing. In the UK, the allotment has shown itself to be a catalyst for changes related to diet and health. Surveys undertaken within Cambridge and Middlesbrough reveal the allotment's continuing influence across all socio-economic ranges. Most notable are a substantial increase in the quality

[19] André Viljoen, Katrin Bohn, Mikey Tomkins and G. Denny, 'Places For People, Places For Plants' keynote paper presented at the Second International Conference on Landscape and Urban Horticulture (June, University of Bologna, Italy, 2009).

[20] Johann H von Thünen, J Der isolirte Staat in Beziehung auf Landwirthschaft und Nationalökonomie, (Hamburg, 1826).

[21] Mark Redwood, Agriculture in Urban Planning: Generating Livelihoods and Food, (London: Earthscan and the International Development Research Centre (IDRC); 2009).

[22] André Viljoen and Katrin Bohn, 'CPUL: Essential Infrastructure and Edible Ornament in: Designing Edible Landscapes' Open House International 34(2). Urban International Press (2009).

and quantity of food being consumed by allotment gardeners during the growing-season, and decreased dependency on grocery stores as a source for fresh produce: 70% in growing-seasons and 24% during the off-season. Changes in 'food-miles' reduced personal carbon emissions by an average of 950 kg CO2/year, even while still predominantly utilizing grocery stores during off-season months and maintaining an overall dependence on fossil fuelled transport year round. Allotment tenants also surpass the recommended 30 minutes/day of daily activity, through time spent within the allotment itself and through active-commuting related to food procurement. Furthermore allotment holders, who ate less than the recommended daily intake of fruit and vegetables before they had an allotment, increased their fruit and vegetable intake once they started growing food, and this increase was reflected in an increased proportion of fruit and vegetables purchased thought the year.[23]

[23] André Viljoen, Katrin Bohn, Mikey Tomkins and G. Denny, 'Places For People, Places For Plants' keynote paper presented at the Second International Conference on Landscape and Urban Horticulture (June, University of Bologna, Italy, 2009)

Fig.10: The Urban Food System. Food impacts on more than our personal well being and enjoyment. If we look at it from a sustainable and spatial perspective, we begin to understand the complex nature of its importance for the urban.
Image: Bohn&Viljoen Architects, 2002

If this trend is validated in further research, it will indicate the significant behaviour change impact that may be attributed to even relatively modest urban agriculture interventions.

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Envisioning the future city (Conclusion)

As cities across the world seek policy guidance and further evidence on the impact of urban agriculture, it is worth noting how rapidly this subject moved from a "fringe interest" into the centre of public attention. While a long established literature documents and advocates urban agriculture in developing countries, the rapid shift of interest in urban agriculture that has taken place in North America, Europe and Australasia, is remarkable.

It appears that urban agriculture could be the term and the vision that holds together many different activities carried out for a variety of reasons in a variety of places by different groups of farming activists. The organisational or spatial details of these activities reflect their national and local context, but include dedicated urban food growing projects as much as allotments, transition town growing schemes, community gardens or urban farms. In Germany and Britain, for example,,Schrebergärten and allotments share similarities as well as Gemeinschaftsgärten and community gardens. Germany adds the Interkulturelle Gärten / intercultural garden movement to the richness of food growing projects (Berlin, Göttingen) and Britain is home to the first "food growing towns" (Todmorden, Middlesbrough). Both countries comprise cities where also larger scale urban farming initiatives are happening because of availability of space and strong stakeholder support (Brighton, Berlin). Across all populations and professions, ideas have taken hold to both, improve on the current urban food system and to use open urban space more productively.

Consequently, we are now talking about something more strategic and infrastructural. Now, the question is how a significant amount of urban agriculture can be *re*/integrated into cities. The term *re*-integration is important here, as cities have included productive spaces in the past, and the economic and agricultural logic for locating fruit and vegetable growing close to the city centre was clearly argued as long ago as the early 19th century in Von Thünen's writing.[24] Whilst historic models should not be romanticised, and by some accounts they were not particularly pleasant places, they do present examples of closed-loop, no-waste and energy efficient systems. Our task now is to rethink and redesign better spaces for urban food systems.

A strong environmental case can be made for the productive landscape as an essential element of sustainable urban infrastructure. Concepts like Continuous Productive Urban Landscape (CPUL) and CPUL City provide design strategies capable of giving spatial and organisational coherence to the infrastructural and qualitative aspects of urban agriculture.
To translate this concept into practice will require further cross-disciplinary work. The design, planning, landscape, horticultural and retail professions will need to relearn old skills and develop new ones

[24] Michael Chisholm, Rural Settlement and Land Use, (London:Hutchinson & Co; 1979).

to support, in particular, the practice of urban agriculture. If urban agriculture is to be widely adopted, its other functions and benefits such as providing social cohesion or urban ornament also require articulation (Fig. 10). The complexity of the urban food system is both a challenge and an opportunity at the same time.