4

AGRICULTURE IN URBAN DESIGN
AND SPATIAL PLANNING

André Viljoen,1 Johannes Schlesinger,2 Katrin Bohn1
and Axel Drescher2

1 UNIVERSITY OF BRIGHTON, ENGLAND, AND BOHN&VILJOEN ARCHITECTS
2 UNIVERSITY OF FREIBURG, GERMANY

Introduction
This chapter will focus on particular issues, driven by increasing urbanization
worldwide, that are affecting the planning for (intra- and peri-) urban agriculture
in the Global North and South. The attitudes taken in the future towards the
position of urban agriculture within design and planning theory and practice
will have a profound effect on the spatial qualities of the urban and rural
sectors. The chapter aims to draw out design and planning opportunities presented
by, in the main, intra-urban agriculture referring to a repertory of state-of-the-art
examples from around the world.

Planning and design

Developments regarding agriculture in urban design and planning

Since the publication of RUAF’s “state of the art” in 2006 (van Veenhuizen 2006),
the most significant planning document within a developed country has been the
Policy Guide on Community and Regional Food Planning adopted nationally by the
US American Planning Association (APA) in 2007. Most memorably it notes that

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. This is a puzzling
omission because, as a discipline, planning marks its distinctiveness by being
comprehensive in scope and attentive to the temporal dimensions and spatial
interconnections among important facets of community life.

(APA 2007: 1)
This policy guide followed on from the paper by Pothukuchi and Kaufman (2000) "The food system: A stranger to urban planning", as well as from other related writing, but none that dates back further than 20 or so years.

In developing countries, both at the planning and design level, important progress has also been made since 2000. On the planning side, for example in the context of the RUAF programme “Cities Farming for the Future”, 17 municipalities – working with other local stakeholders – developed a Strategic Agenda on Urban Agriculture as a basis for local policies and programmes to include urban agriculture into local land-use plans and regulations. Such global policies and strategies have then to be translated into concrete action plans and designs at the local level, such as house, site, cluster and neighbourhood.

In cities like Colombo (Sri Lanka) and Rosario (Argentina), McGill University’s School of Architecture (Canada) and the RUAF Foundation collaborated with local architects and stakeholders to elaborate lane, housing and neighbourhood designs that included urban agriculture. In Rosario, for example, local government, neighbourhood groups, local producers and invited experts jointly designed multifunctional “productive parks” in poor neighbourhoods, combining urban greening with community gardens, children’s playgrounds, food-producing school gardens, and facilities to capture and store excess storm water and grey household water (see: www.ruaf.org/projects/making-edible-landscape-integrating-urban-agriculture-urban-development-and-design).

In parallel with practical action on the ground, research publications and programmes have continued since the start of the new millennium. EC-funded projects were undertaken, for example, by the SWAPUA programme in five Eastern European countries implemented by RUAF and ICLEI in 1999 and 2000. Programmes like PUREFOOD, FOODLINKS, COMFOOD, Eating City/Ruteco, SUBURBFOOD, SUSCHAIN, RURURBAL and others followed in later years (see: http://publications.jrc.ec.europa.eu/repository). The outcomes of these programmes are directed towards high-level research and policy agendas and do not easily or quickly reach or inform practitioners in a way that addresses their day-to-day concerns. In part as a response to this, in 2009, a number of active European researchers undertaking work in this field established the Sustainable Food Planning Group under the umbrella of the Association of European Schools of Planning (AESOP). The aim of this group is to further cross-disciplinary dialogue, research and practice and to disseminate findings within schools of planning and design as well as within practice. An annual European Sustainable Food Planning Conference has been held since the group’s inception (see: www.aesop-planning.eu/blogs/en_GB/sustainable-food-planning).

Another strand of development has occurred within the field of design, often led by architects, and resulted in several publications, exhibitions and events aimed at envisioning and visualizing how, in the main, urban agriculture could contribute to the urban realm. For example, in Europe, 2005 saw, as far as we know, the publication of the first book advocating a comprehensive design strategy for the integration of urban agriculture into cities (Viljoen 2005), and in 2007, the
Netherlands Architecture Institute in Maastricht hosted the first major exhibition on the subject, titled De Eetbare Stad/The Edible City (see: http://culiliblog.org/2007/02/the-edible-city). A further publication with a significant public impact in the English-speaking world was Carolyn Steel's (2008) book Hungry Cities: How Food Shapes Our Lives. Since 2009, the Carrot City project, consisting of a travelling exhibition, a website (see: www.ryerson.ca/carrotcity) and a book (Gorgolewski et al. 2011), has been providing an important international overview of current urban agricultural design.

All these publicly accessible initiatives complement long-established resources like the online City Farmer News (see: www.cityfarmer.info) and RUAF's extensive international policy and practice-focused archive and journal (see: www.ruaf.org). The recent emergence of Food Policy Councils, especially in North America, highlights the start of a transition of the debate about urban agriculture and urban food within the wider population towards food systems planning. Figure 4.1 reflects the emergence of urban agriculture as a design subject and the increasing international attention paid to it, as evidenced by major design-related outputs (note: this chart is not exhaustive, but reflects trends evident to the authors Bohn and Viljoen in their practice).

Intra- and especially peri-urban agriculture has been encouraged in the Global South for a considerable period of time within the broad field of development initiatives, both as an area for practical implementation and academic investigation. Receiving ever more attention in the recent past, it has been – implicitly rather than explicitly – incorporated in urbanization studies as well as in urban planning initiatives. Von Braun (1987), for example, broached the issue of developmental potentials of urban agriculture in the late 1980s.

Comparing the world's situation in summary: Within developing nations, peri-urban agriculture remains a significant food-supplying land use, but one which is threatened by rapid urbanization and the consequent loss of land to building activities. Within developed nations, and especially evident in Europe, farms in peri-urban areas are diversifying their commercial activities towards recreation and health in order to remain financially viable (EU 2008).

Green infrastructure and multifunctional landscapes

Today, intra- and peri-urban agriculture can be theorized in relation to regional planning and the concept of multifunctional landscapes (Kasper et al. 2012). Multifunctional landscapes are often equated with the larger concept of Green Infrastructure, as in the case of the UK-based Landscape Institute advocating green infrastructure as a connected and multifunctional landscape (Landscape Institute 2009).

Four guides issued in 2012 by UN Habitat under the general heading Urban Patterns for a Green Economy are significant for explicitly linking calls for urban compaction, increased biodiversity and economic competitiveness within a context of environmental sustainability. Each guide focuses on a theme, namely i) Working
with Nature, ii) Levering Density, iii) Clustering for Competitiveness, and iv) Optimizing Infrastructure. Intra- and peri-urban agriculture is dealt with most explicitly in Working with Nature (UN Habitat 2012a) and Optimizing Infrastructure (UN Habitat 2012b).

**Issues affecting space for urban agriculture**

The high cost of urban land is common to all dynamic cities, whether in developing or developed nations, and poses very real challenges for the implementation of intra-urban agriculture, as does a general lack of policy to support it within planning documents. This is exacerbated by increasing levels of urbanization, which puts pressure on intra- and peri-urban agriculture. On the other hand, recognition of the need for enhanced urban biodiversity and access to open urban spaces for social interaction supports the importance of multifunctional landscapes including agriculture. Furthermore, agricultural production can facilitate local cradle-to-cradle systems, for example by utilizing organic waste to produce soil for growing food.

As a starting point for the rest of this discussion, we accept the rationale and desirability for thinking about intra- and peri-urban agriculture as part of an urban–rural continuum embodying multiple interdependencies, as most recently set out in the document *City Regions as Landscapes for People, Food and Nature* (Forster and Getz Escudero 2014). If this rationale is employed and if it includes urban (i.e. spatial) design – which, surprisingly, is missing from the mentioned document – then there is potential to improve qualitative and quantifiable aspects of daily life, while simultaneously creating a shift towards smaller ecological footprints and more enjoyable places to live.

**Urbanization and political-administrative challenges**

Actual and projected population growth and urbanization in developed and developing nations are having a major impact on the access to potential land for intra- and peri-urban agriculture. Dar es Salaam (Tanzania), for example, has quadrupled in size within just over 20 years (UN Habitat 2010; UN 2012), and Ouagadougou (Burkina Faso) show similar growth (Figure 4.2). Population growth and the respective rapid expansion of urban agglomerations – such as Lagos (Nigeria), Nairobi (Kenya) and Mumbai (India) – are the most severe challenges to urban planning institutions.

In many countries of the developing world, similar issues also arise in small and medium-sized cities. This particularly applies to smaller settlements in the vicinity of major settlements or along important rural–urban corridors, e.g. from Ouagadougou (Burkina Faso) to Accra (Ghana). Spatial growth of these cities is therefore usually understood as a threat to arable land in and around cities and to those farmers whose livelihoods depend on it.
As cities in the Global South grow, they can spread into territories over which the city authorities have no control, and there are manifold examples of repeated adjustments of municipal boundaries over time. The consequences for intra- and peri-urban farmers can be dramatic. As boundary changes are usually conducted following a political or administrative top-down approach without consulting the affected farming communities (Tinker 1994), they can appear arbitrary to the farmers. Peri-urban farmers are especially confronted with a lack of predictability about future development (Mougeot 2006). Sometimes without knowing about these changes, their farming activities might suddenly become illegal when territories are newly defined as urban and fall under municipal jurisdiction (van Veenhuizen and Danse 2007). As municipal by-laws tend to prohibit agricultural activities within areas classified as urban, farmers might be forced to stop their activities or shift to other areas. Additionally and regardless of its importance for many urban dwellers, agriculture is still often looked at as a traditional, old-fashioned form of securing livelihoods, which should be kept out of the administratively defined cities (Smit et al. 2001).

But there is cause for optimism too, as the UN Habitat’s *Working with Nature* report shows in the following very important work that is underway in Africa: “The Sustainable Cities International Network’s Africa Program is assisting the municipalities in Dar es Salaam to lobby for secure land tenure by requesting the government to allocate land for urban agriculture in the same way that land is allocated to residential developers” (UN Habitat 2012a: 35). Similarly, in its recent *State of African Cities* report, UN Habitat (2010: 20) emphasizes that “expanding the urban administrative territory is an option that should be considered by African governments and city managers, particularly in rapidly growing intermediate-size cities.” If such strategies are achieved and spread more widely, they will represent a quantum leap in the progress of integrating urban agriculture into urban planning in the Global South.
Consequently, urban growth poses new challenges to planning institutions in the Global South. Planning in the Global North also deals with new challenges due to urbanization, especially as population numbers grow without cities being able to expand proportionally. Compared to developing nations, however, settlement patterns in cities of the Global North are largely consolidated, as their natural increase in population and rural-urban migration rates are rather low. To deal with population growth, city councils apply the planning tool of “secondary densification” through in-fill and redevelopment by which existing underutilized open urban space is used for construction of infrastructure and housing. Outlining long-term strategies for the (temporal) use of underutilized land still remains crucial for minimizing the city’s ecological footprint through the productive use of that land.

The environmental need for (food) productive spaces

Environmentally, urban agriculture can impact on cities of the Global South and North in various ways at a micro and macro scale (Smit et al. 2001; Rakodi et al. 2002). For example, keeping green areas in the cities can cushion the impact of an increasing number of heavy precipitation events (Smit et al. 2001; Freshwater Society 2013). And by lowering average temperatures in the “urban concrete jungle”, as another example, agriculturally used surfaces can improve the urban micro-climate and hence the well-being of the urban population (van Veenhuizen 2006; Lovell 2010; de Zeeuw et al. 2011). However, whilst “planting” is beginning to be specified in urban planning documents as a way to mitigate climate change and reduce climate-related stress, “edible planting” is still specified much less. Furthermore, including food waste as a source of compost as, for example, advocated in the cradle-to-cradle system by Braungart and McDonough (2002), would not only reduce environmental footprints, but the quantity of compost thus generated would also provide a measure of the amount of urban agriculture that a city could support (Viljoen and Bohn 2014).

The urgency with which the loss of urban and regional biodiversity needs to be reversed to achieve environmental and economic resilience has been articulated in the UN Habitat’s (2012a) publication Urban Patterns for a Green Economy – Working with Nature. This document makes the case for “landscape mosaic patterns” as defined by Richard Forman (2008), consisting of different-sized patches of open space connected by green corridors of small “stepping stone spaces”. These are ideally suited to organic agriculture, which enables the maintenance of diverse ecosystems. In 2010, the United Nations’ University Institute for Advanced Studies made an even more explicit connection to urban agriculture when they noted that “as the rule of interdependent adjacencies in urban ecology has it: the more diversity, the more collaboration between unlikely partners, the better the chances for biodiversity, sustainability, and resilience. Linked to this idea is the concept of Continuous Productive Urban Landscapes (CPULs), which represents a powerful
urban design instrument for achieving local sustainability while reducing cities’ ecological footprints (Viljoen 2005)” (UNU 2010: 31–32).

With respect to planning, Bohn and Viljoen have long argued that, if land is to be provided for intra- and peri-urban agriculture, a conceptual leap is required by which it becomes considered “essential infrastructure” (Viljoen and Bohn 2005). The many-faceted arguments in favour of urban agriculture, beyond yields, allied to the recognized needs for changing consumer behaviour and enhancing urban biodiversity, are all advancing this argument. Detroit (USA), for example, which is well known as a shrinking city facing multiple challenges, has concluded in its 2012 Strategic Framework Plan to “utilize productive landscapes as the basis for a sustainable city” (Detroit Future City 2012).

Spatial opportunities for agriculture in and around cities

According to Moutgeot, manifold types of locations can be identified “respective to residence (on-plot or off-plot), development status (built-up or open space), modality of tenure/usufruct (cession, lease, sharing, authorised or unauthorised – through personal agreement, customary law or commercial transaction) and the official land-use category of the sector where [urban agriculture] is practised (residential, industrial, institutional, etc.)” (Moutgeot 2000: 7–8). This can include cultivation on private land, such as backyards and around houses, or on community and other public lands, such as parks, along roads, railways, under power lines and alongside streams, or in areas that are too steep for construction (Bryld 2003; Viljoen et al. 2004; Drescher and Gerold 2010; de Zeeuw et al. 2011).

The economic use of these sites can be increased, “since income is generated from temporarily available land and lands not suitable for building” (Bryld 2003). Thus, urban agriculture can take place in a broad range of settings, often transforming vacant or under-utilized land into productive areas (de Zeeuw et al. 2000). Accordingly, the areas where urban agriculture is conducted are as diverse as the farmers cultivating the land, and despite the increasing pressure on (intra- and peri-) urban arable land, farmers manage to find locations to pursue agricultural production. The locations where agriculture occurs are important because “this points to specific constraints and opportunities such as the degree of land access, the land tenure situation, costs and time related to travelling to and from the production site, closeness to markets and risks” (van Veenhuizen and Danso 2007).

The importance of tenure

The lack of formal land titles appears as one of the key obstacles to increasing the access to finance for urban farmers in the developing world (Drescher and Iaquinta 1999). In general terms, lack of secure tenure is a major disincentive for farmers because it restricts their access to land or becomes a barrier to financial investment. A programme developed in Freetown (Sierra Leone) provides a promising example of how to address this problem:
The Freetown Urban and Peri-Urban Agriculture Forum, involving key political institutions, credit institutions and farmers, have designed an innovative financing mechanism in 2010. The new program relies on authorities for the permanent allocation of valleys, slopes and low lands for urban and peri-urban agricultural use. Land is allocated to registered and functioning farmers' groups for a period of 5 years for a token rent provided that they abide by the agreement regulations. The groups receive technical training and monitoring, and four credit institutions (First International Bank, Access Bank, Luma Micro Finance Trust Limited, Salone Micro Finance Trust) have agreed to accept such land agreement together with the groups' existing savings or current accounts as a collateral for two purposefully designed credit products (personal comment, Marco Serena 2011). The first is a micro credit of between 100 and 400 EUR (repayment period 1 year); the second is a loan between 1,000 and 2,000 EUR (repayment period 2 years) with a yearly interest rate of 24%. The number of households who could potentially benefit from the scheme once fully established is estimated at 2,500.

(Cabannes 2011)

If planning policies can be agreed and enforced in developing countries, as in the example above, a tremendous opportunity exists to incorporate designated spaces for urban agriculture within their cities' future urban expansion areas. By contrast, cities in developed countries, even dynamic ones like London (UK), Rotterdam (The Netherlands) and New York (USA) are seeking the evidence for supporting planning policies to retrofit or reintroduce productive spaces within their current boundaries.

Integration of agriculture into urban and city-region land-use planning

Planning tools

The most commonly used planning tools include master plans, strategic plans and structure plans (Dowall and Giles 1997). Different zoning measures are part of those plans. Experience has shown that general and master plans tend to be static, prescriptive or assume slow-growing cities. They also tend to ignore how households and the commercial sector alter their demand for land as prices change. Even when such master plans have taken substantial time and effort to make, they could be of limited relevance to real developments on the ground, unless the most powerful stakeholders are willing to adhere to them. In other words, the authority of a master plan can vary a great deal (van den Berg 2000).

A more appropriate and dynamic planning tool is "structure planning". It provides a broad framework for local decision making and involves public participation. The structure plan sets out a framework for the development of a community. Being more indicative than master plans, it requires not only projections of future demands and needs of the community, such as housing, infrastructure,
employment, transport, local markets, etc., but also environmental aspects like waste management. We can see this approach being applied more formally in developing and developed countries where elected city authorities are increasingly cash-strapped and aim to facilitate development rather than lead it as was often the case during the second half of the last century. To facilitate structure planning, participatory processes are required as described in Chapter 3 of this volume.

**The increasing use of remote sensing tools for urban land-use planning**

The use of remote sensing (RS) for mapping and monitoring (intra- and peri-) urban green spaces facilitates the mapping process, but needs to be combined with actual ground data evaluation if it is to be of practical use. Although urban planning has made wide use of geographical information systems (GIS) for decades, this hardly ever included the management of open spaces. The experience of applying GIS to urban food production activities has, however, rapidly increased in recent years in many cities in the Global North and South. GIS is not only used for urban planning and open space mapping, but also for monitoring the loss of agricultural land within city boundaries, to visualize food security indicators or for measuring urban greening indicators (Ldbamerica 1998; American Forests 2000; Fazal 2000). It also has the potential to foster the preparation of urban food policies and strategies by providing detailed analyses of food flows from the production sites to the different locations within cities, as exemplified by the US Foodprints and Foodsheds project (see: www.foodprintsandfoodsheds.org).

In a situation where cities continue to undergo rapid changes, GIS allows planners to more easily monitor changing urban food production trends by applying this tool to the entire urban food system (Dongus and Drescher 2000; Drescher et al. 2013; Schlesinger and Drescher 2013; Schlesinger 2013). Innovations in the field of “unmanned aerial vehicles” (UAV) further reduce costs for GIS data collection. The significant comparative advantages of these systems typically include: very high ground resolutions (ca. 3 cm/pixel), flexibility in terms of payload (e.g. RGB-, Infrared- or Laser-systems) and applications (e.g. crop mapping, site monitoring, digital surface models). UAVs were already successfully applied in the quantification of crop production areas in West Africa by Schlesinger (2014) (Figure 4.3).

Nevertheless, the use of RS reveals institutional difficulties in planning. Planning can only be carried out efficiently if the different data on space, infrastructure, markets, nutrition, health, soils, water, waste, socioeconomic, agriculture, etc., amassed by different departments is linked together. Furthermore, the technical equipment (data, computers, plotters, computer networks) and the skills needed in applying RS are often missing. Traditionally, GIS has been used in a rather centralized way, in that one institution takes the lead in the planning process with little or no participation from other units. GIS does not automatically facilitate the dialogue
with the decision makers, but it needs to be used innovatively. Community building is a prerequisite for enabling participatory planning, and the successful application of GIS for participatory urban planning has been demonstrated in Cagayan de Oro (The Philippines) (Holmer and Drescher 2005).

Planning and access to land

Once sites for urban agriculture have been identified, whether they are plots on the ground or building-integrated agriculture, we come back to the question of tenure, which remains critical because of the significant investments of time and infrastructure required to raise crops. As regards the protection of existing agricultural land, the lessons learnt from a radical “zero-loss policy” being applied in India will be relevant to the future of urban agriculture: “As proposed by the Indian National Planning Commission, new development activities should be carried out with zero loss of agricultural productivity; if agriculture land has to be used, innovations should be included to introduce new forms of agriculture in the same premises” (NAAS 2013).

Protecting spaces for (intra- and peri-) urban agriculture by securing tenure

Experiences from site-and-service schemes, whereby areas are designated for self-help housing and provision of basic services such as roads and water to upgraded squatter settlements, have shown that the poor tend to gradually improve their housing, provided they have land security. Similar observations are true for urban agricultural activities, as shown in South African townships (Small 2001). On the
other hand, experience shows that the poor, because of high costs, often tend to sublet or sell these sites and move back to the original squatter settlement (Dowall and Giles 1997). Also, increasing population density of squatter sites reduces agricultural land in these areas. Sometimes in-town or rural-urban chain migration is the cause of this, but often the owner of the plot sublets part of the plot to strangers to make money. With respect to the public interest in the conservation of open spaces in cities, this is a strong argument to lease and not to sell urban agricultural land.

Leasehold provides a limited right to use land for a specific time and for a specific purpose often including protected tenure with rights for prolongation and of transfer (Österberg 1998). Contrary to outright landownership, leasehold (from public bodies) prevents land speculation, thus protecting public interest in open spaces. Proper leasehold is closely related to customary tenure, which, for example in Africa, often includes land use for specific purposes. Another model is community leasehold whereby land is given to a community or association to use it for specific purposes. The European allotment systems work along this line. Nevertheless, this requires the establishment of management associations, garden clubs or similar community-based groups (Drescher 2001).

Within Europe and North America, Community Land Trusts (CLTs) are emerging as a new way of providing tenure for urban producers. Urban agriculture is not usually the primary driver behind the establishment of CLTs, but they can, through cross-subsidy or because of community concern support UPA practitioners. A 2012 study by the US-based Lincoln Institute of Land Policy usefully explored this potential in greater detail:

Community Land Trusts (CLTs) are non-profit, community-based land organizations with a place-based membership, a democratically elected board, and a charitable commitment to the use and stewardship of land on behalf of local communities. In most cases, CLTs retain permanent ownership of land, which is then leased – through a system of inheritable leases – to various users that own the improvements upon the land, such as residential homes, recreational facilities or, more recently, also urban agriculture. Such ground leases have different benefits: (1) they secure occupancy rights for land users; (2) they preserve affordability by restricting the resale price of improvements; (3) they prevent undesirable uses and improvements of the land; (4) they prohibit predatory lending and reduce foreclosures; and (5) they create a source of income through monthly lease fees to support CLT activities.

(Rosenberg and Yeun 2012)

Planning and practical action

Municipalities, professional bodies and enterprising individuals still have the power to make forward-looking interventions and are increasingly doing so. However, the picture is uneven, for example in former British colonies the category of
farming or agriculture did not exist in urban master plans and this has still not changed in many of these countries (personal communication, Pay Drechsel 2014). Furthermore, local authorities are often overwhelmed by the dimension of urban development. In the few cases where the planning institutions are willing to support urban agricultural schemes, it is often the sheer lack of human resources in the respective administrative bodies that hinders locally adjusted urban development measures that take into account the importance of urban agriculture. As pointed out by Allen et al. (2014) for the example of Accra (Ghana), unsolved land tenure conflicts and increasing land speculation — especially in the peri-urban areas — often hamper long-term planning for agricultural activities in African cities. Even proper institutionalization of urban vegetable farming was, in the case in Accra, not leading to long-term sustainability. For example, the revision of Accra’s bylaws lost its dynamic when external funding expired (Drechsel et al. 2014).

In India, by contrast, the role of urban food production is increasingly recognized not only by the scientific community but also by policy makers and urban planners. The Indian government developed a vegetable production scheme, and the Planning Commission for the 12th Five Year Plan (2012–2017) has emphasized the potential of urban agriculture with regard to environmental services and health care (NAAS 2013). Similar trends can be observed in some cities in Latin America. In Rosario (Argentina), for example, urban planners start recognizing the importance of including the local population in urban design and development measures, to enhance the local food production (Dubbeling et al. 2009). The support by the municipal Urban Agriculture Office led to the development of more than 700 community gardens as well as four large parks located in the vicinity of marginalized communities (POLIS 2010).

Looking to North America and Europe, we can identify concrete initiatives in support of urban food planning. In 2011, for example, the American Planning Association followed up their Policy Guide on Community and Regional Food Planning (APA 2007) with a substantial advisory report specifically addressing urban agriculture (Hodgson et al. 2011).

Although policy in support of urban agriculture within municipal legislation is still by no means the norm, it is beginning to appear, and precedents continue to be set since about the last ten years. In addition to those cases described above, notable examples at the municipal level include Brighton & Hove (UK) Council’s adoption, in 2011, of a non-binding planning advisory document titled Food Growing and Development, advocating the integration of food-growing spaces within urban development proposals. This advisory notice, the first of its kind in the UK, has resulted in a measurable increase in the integration of food-growing spaces within subsequent planning applications. Similarly, US cities like New York City have relaxed restrictions on the construction of rooftop greenhouses to remove barriers to the implementation of rooftop gardens as well as greenhouses. Furthermore, cities are beginning to promote productive urban landscapes within development plans, e.g. Berlin (Germany) (SenStadt 2012) and, as already mentioned, Detroit (USA) (Detroit Future City 2012).
Designing urban spaces for and with agriculture

Urban design and agriculture

Due to its relatively large and visible presence, urban agriculture has a very significant impact on urban space. It is apparent that these spaces have the potential not only to be unique spaces, but also to contribute to a new evolution within thinking about urban space. An early design study titled *Cuba Laboratory for Urban Agriculture* (Viljoen and Howe 2005) took the approach that the pragmatic positioning of extensive “organoponicos” (commercial urban market gardens applying large amounts of organic materials in raised beds and eventually established on paved and concreted areas) in Cuba provided an opportunity to speculate on their design potential. The fact that “organoponicos” had been positioned using a set of clearly defined horticultural criteria, but had not consciously been planned as part of an urban design strategy, meant that these provided an ideal vehicle for examining how they could be designed to contribute beneficially to their surrounding environment. This study published in 2005, was so far as we know the first attempt to apply design criteria to agricultural sites. From this a set of principles were proposed related, for example, to the design of edges, paths, topography and uses in addition to food growing. The subsequent expansion of urban agriculture has reinforced these and we refer readers to the original document for further elaboration. Another major ongoing and accessible resource, making the case for understanding the design potential of urban agriculture and documenting international projects, is the *Carrot City* (2009) repository that has been referred to at the start of this chapter.

Other significant and recent pieces of work led by architects and landscape architects are the *Edible Rotterdam* project (Graaf 2012) and the Swiss research programme titled *Food Urbanism Initiative* (see: www.foodurbanism.org). The former develops design strategies based on spatial opportunities identified within Rotterdam (The Netherlands), whilst the latter produced an online definition of particular *Food Urbanism* typologies of use to planners and designers and categorized under the headings “Site”, “Cultivator”, “Motivation” and “Production Entity”.

From the body of work that the above examples belong to, we can extract a number of key ideas with which a designer can work, which will be briefly discussed in the next section.

**Key design ideas**

*Programme and place*

It is when additional programmes of use are added to food production that spaces require the most design input. And where intra-urban agriculture is not self-evidently required on conventional economic grounds (e.g. in much of Europe), it is often the multiprogramming of space that makes agriculture economically viable by providing opportunities to meet social needs. A number of ambitious projects like this are underway in Europe.
For example, R-Urban is a neighbourhood project in the Paris suburb of Colombes (France) led by Atelier d’Architecture Autogérée (AAA), which includes agriculture as a major spatial and social component using co-design principles (Figure 4.4). Edible Landscape projects are being integrated in the Dutch neighbourhoods of Rotterdam, Den Haag and Amsterdam by Urbaniahoeve’s Social Design Laboratory for Urban Agriculture, using arts-based practice as a way of engaging in dialogues with city authorities and local stakeholders (Figure 4.5). Multifunctional communal food gardens have been developed by the Department of City and Nutrition within the Technical University of Berlin’s Landscape Architecture programme for the Berlin suburb of Marzahn (Germany) (Figure 4.6). As well as food production, they have various functions for different age groups, such as children’s playground, environmental and food education, and recreation for the elderly.

**FIGURE 4.4** Agrocié: the agricultural site designed by the R-Urban neighbourhood project in Colombes near Paris (France)
*Source: Bohn&Viljoen.*

**FIGURE 4.5** The borough Schilderswijk in The Hague (The Netherlands) designed as a Continuous Productive Urban Foodscape by Urbaniahoeve
*Source: Urbaniahoeve.*
Importance of scale — urban or architectural scale

Intra-urban agriculture spaces can be thought of as “urban rooms”, “floors” or “corridors” within the city. Without understanding that these spaces can be made part of a wider network, they will remain disconnected from the wider urban structure even if by themselves they create attractive individual spaces. Concepts like GPUL City or Food Urbanism aim to offer design solutions for knitting agriculture into the urban fabric.

Recent strategic city-scale urban designs from Bobo Dioulasso (Burkina Faso) and Detroit (USA) provide good examples for this approach. As part of an overall climate change adaptation strategy, the city of Bobo Dioulasso, with a population of 800,000, plans to implement a series of productive and “climate smart” land-use strategies within green corridors (Figure 4.7). A demonstration project has been constructed along a 1.65 km long, 50 m wide green corridor which previously existed as a long dusty void in the city. In design terms, this project exemplifies the multifunctional planning and design of open urban
FIGURE 4.7 Multifunctional greenways (Trames vertes) in Bobo Dioulasso, Burkina Faso.

Source: Sy
space. The site has been divided up into a sequence of four zones, dealing respectively with forestry, food growing, recreation and education. This intelligent mix of uses creates a place with different attractions for different groups, and, by facilitating these uses, has transformed a void from a space into a place. The material means by which this transformation has occurred are minimal: paths, planting beds and fields are demarcated by small changes in level and surface texture (in this case due to compaction or the breaking open of soil) (Sy et al. 2014).

In certain respects, the ambition and scale of Robo Dionoussis's productive landscapes echo one of the earliest and most ambitious examples of a “place making” productive landscape, namely that developed in conjunction with RUAF by residents of Rosario (Argentina) (Dubbeling et al. 2009).

In a very different climatic and demographic context, Detroit (USA), well known for its severe financial problems and loss of population, has used a comprehensive multi-stakeholder planning methodology to develop a strategic framework plan titled Detroit Future City to guide future development. The plan includes the intention to “utilize productive landscapes as the basis for a sustainable city” (Detroit Future City 2012). It specifically defines “innovative productive” as a new land-use category, including food growing, greenhouses, fields of flowers, aquaponics and ecological services. Detroit has so much partially occupied former suburban territory that its condition is not such that agricultural space is under obvious pressure from urbanization. Rather it has developed a scenario for intensively cultivated modern smallholdings alternating with large-scale horticultural production, resulting in an extensive mosaic of differently sized productive territories around and between which inhabited areas occur and between which inhabited areas occur (Figure 4.8). The productive territories are analogous to lakes in a landscape, and in many respects offer citizens similar benefits as a health-improving recreational landscape, without detracting from the critical densities required to create a vibrant and desirable urban culture. So-called carbon forests have been designed to run as long avenues leading towards the city center from the periphery, demarcating territory while also giving directionality and presence to ecological and personal corridors. Detroit's strategic framework plan demonstrates how essential infrastructure can create desirable territorial identity as well as climate-sensitive landscapes. The scale and process by which Detroit has developed its framework plan provides a working model for large expanding cites, such as those found in China or Africa, where, despite many challenges, the current and future prospects, including human capital, are far more optimistic than for Detroit.

Programme, place, architectural and urban scale operate at a strategic level. The following section aims to extract more site-specific ideas which help to determine particular components of a design.
FIGURE 4.8 A leading spatial design from the Detroit Future City framework plan including various types of urban agriculture.
Source: Detroit Future City.

**Site-specific ideas and components**

**Strongly demarcated horizontal or vertical surfaces**

Horizontal topographies tend to create a sense of openness and public conviviality in dense cities. Within horizontal territories small-level changes can create powerful demarcations of space. Vertical surfaces for agriculture are usually created by vegetation, either by means of traditional planting or technologically intensive systems such as hydroponics or aquaponics. The vertical surfaces so created are usually screen-like and visually permeable and well suited to subdividing space to create more private areas for small groups of people.
Public, open-air rooftop gardening, which has become increasingly prevalent within the USA in recent years, as for example in New York’s well-publicized Eagle Street Rooftop Farm (Figure 4.9), accentuates many of the qualities associated with horizontality. Rooftop farms also have an additional and enormously powerful characteristic conferred by being isolated and elevated. Jerry Caldari, architect for New York’s Brooklyn Grange Farm, particularly commented on the “universal, childlike amazement of everyone who come to see it, whoever these people are” (personal communication, Aug 2011).

A more subtle form of building-integrated urban agriculture, including vertical elements, is evident in projects where intensive, but low technology and low-cost techniques are used to improve low-income informal housing areas as for example applied in Wanathamulla, Colombo (Sri Lanka), where improvement of the sanitation was combined with mainly vertical greening turning a rundown alleyway into an attractive space (Figure 4.10).

FIGURE 4.9 Eagle Street Rooftop Farm, Queens, New York (USA): one of several rooftop farming initiatives in North America
*Source:* Bohn & Viljoen.

FIGURE 4.10 Wanathamulla, Colombo (Sri Lanka): lane improvement incorporating vertical greening
*Source:* Dubbeeling.
A more high-tech version of this, but in design terms using a conceptually similar approach, is evident in the designs for prototype *Growing Balconies* proposed for use in high-density dwellings in London (Figure 4.11).

**FIGURE 4.11** *Growing Balconies*: prototype developed by Bohn & Viljoen in 2009 as part of an exhibition in London

*Source:* Bohn & Viljoen.

**Inclined planes/slopes**

In addition to solar aspect and opportunities for some forms of irrigation, inclined surfaces enable agricultural sites to be seen from below, and in so doing they provide for a visual connection with a large number of inhabitants, for whom, if located in dense urban environments, this can offer an essential connection with the natural seasonal cycles. To exploit effects like this, alignments with streets, the disposition of tall buildings and distance are all important design considerations. An interesting example exists in Villa Maria del Triunfo in Lima (Peru) (Figure 4.12), where a sloped site over which power cables run has been used to establish a highly productive site. Because the site is on a slope it is visible from buildings within the valley, providing a register of seasonal change for residents. The bottom of the sloped field, where it meets the settlement, provides a great opportunity for establishing a market, much in the same way as at the new Parc Agro Urbain de Bernex et Confignon (Switzerland), referred to below.
FIGURE 4.12 Small garden (on steep hill, in dune sand) in Villa Maria del Triunfo (Lima, Peru)
Source: IPES

Paths and bridging elements

Paths are extremely significant within the design of agricultural spaces. Their requirement for cultivation is self-evident, but it is in their use as access routes to sites for the public where much design occurs. The interface/edge between cultivation areas and the public, where a formal separation will often be required, is significant in design terms, even if this is in practice mainly to provide a symbolic measure of security. Level changes, fences, streams and planting are all typical tools for achieving this. Often public paths will be structured so as to provide a fast route (following a so-called desire line), off which a series of branching or forking paths are set, configured to minimize disruption to the sites of cultivation. The integration of well-used existing public paths as spatial dividers that also enable views of crops under cultivation is a particular feature of the Marzahn project in Berlin (Germany) (Figure 4.6). Here paths also define a space for gathering in what would otherwise be a space used only for circulation (Figure 4.13).

In Switzerland on the outskirts of Geneva, a new nine-hectare “agro park” (Figure 4.14) designed by Verzone Woods Architects is, at the time of writing, scheduled to go on site, having been selected following an architectural competition. This park, named Parc Agro Urbain de Bernex et Conflins, is of note for several reasons: strategically, the city authorities have been far-sighted in deciding to implement this project on a site that is currently on the edge of the city, but that will shortly become a “green finger” due to planned development beyond the existing municipal boundary. The site will be one of Europe’s first productive
FIGURE 4.13 Marzahn community garden, Berlin (Germany): raised beds for food growing intersect with footpaths and spaces for public gathering, sightseeing and playing
Source: Bohn & Viljoen.

FIGURE 4.14 The Parc Agro Urbain de Bernex et Consignon, Geneva (Switzerland)
Source: Verzone Woods Architects.
parks and will integrate crop fields, a market space and leisure space. The design accommodates several different users and has adopted a highly refined and controlled system of paths that give structure to the site and define territories for sport, gatherings, a market, picnics and walking, in addition to growing food.

In many cases, entire linear agricultural sites operate as urban bridges, connecting otherwise separated parts of a city or settlement; this is a powerful element of urban design, supporting biodiversity and ourselves as residents. This bridging could possibly be explored at the Villa Maria del Triunfo site by, for example, connecting different parts of the city, or by directing people to viewing platforms as a destination for walkers or families. Here, developing a path with stopping-off points along the way, combined with a footpath and cycle way, would add a whole new layer of significance to this site.

**Edges - thick, thin and topographical**

Edges can have a thickness and support particular uses, such as markets, restaurants, sports areas, and sitting, picnicking and viewing spaces. The material and architectural language of the structures required by these uses will have a major impact on how they are perceived and valued, as evidenced by New York’s High Line (USA) (Figure 4.15), which, although not an urban agricultural project, embodies many of the design considerations referred to here. Vantage points along this regenerated former

![Image](http://en.wikipedia.org/wiki/File:High_Line_30th_Street_looking_downtown.jpg)

**FIGURE 4.15** The High Line, New York (USA)

railway line provide spaces accommodating individuals and groups, allowing for sitting and lying, looking out and beyond, over and into planted areas. The popularity of New York’s High Line demonstrates the desire for coherently designed urban landscapes combining paths, planting and spaces for stopping.

Materiality

The choice of materials for use in a design has a huge impact on its appearance, durability and public acceptability, but until (intra- and peri-) urban agriculture is recognized as having an important contribution to make to wider concerns about the city and public well-being, cost will have a large bearing on what is available and accessible. In some instances the temporary nature of a project can be its strength, allowing for changeable and responsive solutions that are capable of accommodating a multitude of programmes in addition to food growing. Berlin’s Prinzessinnengärten (Figure 4.16) is an exemplary case for the extremely successful and popular transformation of an abandoned urban space through the development of a “nomadic food garden”.

![Image](image_url)

**FIGURE 4.16** Prinzessinnengärten, Berlin (Germany): a food garden on derelict urban space


Building-integrated agriculture

Although rooftop urban agriculture has been practised at a domestic scale for a number of years within developing countries, a quantum leap has occurred with respect to scale and publicity of this new type. In design terms the questions and
opportunities they raise depend very much on the degree to which they are enclosed by a glass house and are typically private working concerns, or if they are open fields, typically operating with a number of sub-programmes in addition to growing food. Enclosed rooftop greenhouses do act as markers for developments, as for example, in the case of Arbor House New York City (USA); here a municipal housing project including a commercial rooftop greenhouse is expected to yield 80,000 to 100,000 pounds of fresh produce per year (Figure 4.17). Furthermore, rooftop greenhouses have the potential to be integrated into the building’s heating and cooling system as thermal buffer zones, by means of utilizing heat pumps to transfer heat from one part of a building to another.

![Image of Arbor House, New York City (USA) with green houses on top](image)

**Figure 4.17** Arbor House, New York City (USA) with green houses on top

Source: Bernstein Associated.

The concept of vertical city farming, developed by Dickson Despommier, who proposes multistorey food-producing buildings (Despommier 2010), has generated a great deal of interest within the popular press and resulted in a number of dramatic and speculative proposals by architects and designers. With more design work aimed at facilitating multi-use strategies and the optimization of natural energy systems, such as designing vertical thermal buffer spaces operating symbiotically between spaces for people and for planting, it is likely that the future will see the emergence of vertical farms as one of a diverse set of urban agriculture types.

That rooftop gardening can also take place at small scale and at low cost is shown by the rooftop gardens in Kathmandu (Nepal) (Figure 4.18) established by the project Monitoring the impacts of urban agriculture on climate change adaptation.
and mitigation implemented by the NGO ENPHO and the Kathmandu Metropolitan City Authority with support from CDKN (UK) and the RUAF Foundation (The Netherlands) (Dubbeling and Massonneau 2014).

Layered-growing for small spaces

Techniques for maximizing the growing capacity and yield of urban agriculture, either by physically stacking planting containers, or by using hybrid systems such as aquaponics that combine hydroponic and fish farming techniques, are closely related to building integrated urban agriculture. The relationship comes about because these systems require structures for support, are frequently enclosed by a protecting structure for climatic control, and due to their three-dimensional forms are inherently architectural. This space-making potential has yet to be fully realized, and prototypes that exist tend to be experimental, as found in Skygreen’s prototype constructed in Singapore, or they are more modest but probably more resilient, as found for example in El Alto (La Paz, Bolivia) (Figure 4.19).

Incremental architecture and urbanism

Perhaps the most important strategy for designers and planners to adopt is one that accommodates an incremental approach to implementing urban agriculture. Planning and design strategies should accommodate the potential for the incremental development of local food projects (like the many community gardens in Cape
FIGURE 4.19 Low-space, low-cost horticulture using tables and racks in El Alto (La Paz, Bolivia)

Source: IPES.

FIGURE 4.20 A community food garden in Cape Town (South Africa)

Source: Abalimi Bezekhaya.

Town, South Africa), enabling growth and refinement as the community itself develops, and would enable the demarcation of space for future use (Figure 4.20).

Community food gardens are often established with the minimum of resources, either driven by the needs of food security or community cohesion; but as the
communities become more stable and prosperous, the site's potential with respect to the wider use and design potential can be realized. Without a long-term plan, it is all too easy for sites to be built on, at precisely the time when, due to densification and urbanization, open space needs to be protected.

Conclusions

During the past ten years, intra- and peri-urban agriculture has moved from a peripheral position on planning and design agendas to one that is now being taken seriously in developed and developing nations. A rich and mutually beneficial dialogue and knowledge-sharing is emerging between practitioners and academics in developed and developing countries.

Urban agriculture is beginning to be understood as part of wider urban and ecological planning and design strategies, operating at a regional scale. Typologies and design strategies are beginning to be defined. For example, spatial network concepts, such as Green Infrastructure, support design strategies that specifically include intra- and peri-urban agriculture, such as Food Urbanism or the CPUL City concept. Cradle-to-cradle strategies can also enable multiple benefits. Design research and knowledge transfer, such as exemplified in the Carrot City project, help build new online design-based repositories of best practice that are of value to designers and planners.

The increasing density of building in cities and unprecedented levels of urbanization, especially in developing countries, pose great challenges for the coherent planning of urban agriculture.

Planning methods therefore need to be adaptive and include participation by active and relevant stakeholders. Emerging Food Policy Councils are likely to help shift thinking towards a food systems approach capable of integrating intra- and peri-urban agriculture into the wider urban food system (see Chapter 2). Technological inventions, such as GIS systems, utilizing remote sensing and data from direct observation on the ground can, if dynamic and current, offer a powerful tool to aid decision making.

The rural–urban relationship in the future is likely to be seen as a continuum, rather than as a relationship between discreet entities. Equally, future farming practices will most likely happen on a spectrum, combining social and economic benefits and utilizing a range of technological approaches.

Regardless of the type and location of farming, it is evident that appropriate tenure agreements for farmers will be critical for long-term success, especially when involving livelihoods. Where food security is not a major driver, specific ways of adding value to intra- and peri-urban enterprises are required, especially where land is scarce and expensive.

Urban policy is being developed by some cities to support and remove barriers to the implementation of intra- and peri-urban agriculture. But the speed at which intra-urban projects are being established, for example in Europe and North America, or peri-urban agriculture is being lost, for example due to urban expansion in Africa, is outstripping the speed at which supportive
policy is being developed. Successful pathways to policy need to be found urgently. If this shift is to be consolidated, then the next step is to collect and disseminate metrics to encourage its further integration into intra- and peri-urban design.

Summing up: During the last decade a lot has happened enabling and supporting the integration of urban agriculture into cities in the Global South and North, but a conceptual shift is still required, if agriculture is to become and remain valued as an essential element of urban infrastructure.

References


Dongus, S.; Drescher, A. W. 2000. La aplicación de Sistemas de Información Geográficos (SIG) y Sistemas de Posición Global (SPG) para trazar un mapa de actividades agrícolas urbanas y el espacio abierto en ciudades. Presentation to the workshop La Agricultura Urbana en las Ciudades del Siglo XXI, Quito, Ecuador, 16–21 April 2000.


UN Habitat. 2010. State of the world’s cities 2010/11 — Cities for all: Bridging the urban divide. Nairobi: UN Habitat.


