

BURLEIGH DODDS SERIES IN AGRICULTURAL SCIENCE

Achieving sustainable urban agriculture

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Achieving sustainable urban agriculture: setting the scene

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Urbanization challenges

A major demographic milestone occurred on Wednesday 23 May 2007, when the world's population, at that time about 6.8 billion people, became more urban than rural. Although this date is an estimation, it symbolizes that we are living in an era of rapid urbanization. In 1950 approximately 30% of the world's population was living in urban areas and this will be increased to almost 70% by 2050, when the world population is expected to have grown to 9.5 billion (UN, 2018).

Population growth and urbanization pose a number of challenges. One of these is resource use (Madlener and Sunak, 2011). At the point when about half the world's population was living in urban areas, cities consumed approximately 75% of the world's resources, while covering just 2% of the world's surface (Pacione, 2009). This is often referred to as the urban ecological footprint: *the total area of productive land and water required continuously to produce all the resources consumed and to assimilate all the wastes produced, by a defined population* (Rees and Wackernagel, 1996: 228-9). Ongoing urbanization means that the urban ecological footprint will increase, particularly due to dietary change (more animal protein and more processed food), the growing energy demand for mobility, cooling and heating of houses and offices, and long-distance transport, processing, packaging, cooling and storage of food (Lang, 2010; Madlener and Sunak, 2011; Popkin, 1999). This growing energy demand has been and will be, at least in the short term, largely based on the use of fossil energy.

This contributes to two other major urban challenges: air pollution and climate change. Air pollution is considered to be the biggest environmental health risk of our time and most acute in urban areas (UNEP, 2019). A particular health risk is the exposure to fine matter particles and lead. This causes learning disability in young children, increases in premature deaths and an overall decrease in quality of life (Cohen et al., 2005; Cohen, 2006). The prevalence of air pollution in cities worsens due to the disappearance of urban green

spaces (Pataki et al., 2011). The lack of urban green spaces also contributes to urban heat islands, an urban environmental health challenge that is aggravated by climate change (Susca et al., 2011). Heat islands '*intensify the energy problem of cities, deteriorate comfort conditions, put in danger the vulnerable population and amplify the pollution problems*' (Santamouris, 2014: 682). Many emerging climate change risks are concentrated in urban areas, especially urban deltas. Key urban climate change problems in addition to urban heat islands are extreme weather events, flooding and urban food insecurity. Rapid urbanization will increase the number of highly vulnerable urban communities, which are by and large the urban poor.

This brings us to another challenge: the urbanization of poverty. Cities, especially the rapidly growing cities in the global South, are characterized by increasing socio-economic inequalities in wealth, health, access to resources and availability and affordability of services, such as clean drinking water and electricity and presence of adequate sewerage and solid waste disposal facilities (Cohen, 2006; Broto et al. 2012). The reproduction, or perhaps even acceleration, of urban inequalities is often attributed to poor urban governance – that is municipal authorities unable to keep up with the speed of urban growth and with the increasing complexity of urban governance as a result of decentralization of policies – and neo-liberal reforms of urban services, which tend to exclude the urban poor from access to these services (Broto et al. 2012).

A fifth urbanization challenge is urban food provisioning. The combined effect of rural to urban migration, urban sprawl and overall population growth implies that in the next 30 years the world's urban population will increase by over 200 thousand people per day. And these are mouths that have to be fed. In relation to this, Steel (2013: ix) writes in the introduction of her book '*Hungry city: how food shapes our lives*': *When you consider that every day for a city the size of London, enough food for thirty million meals must be produced, imported, sold, cooked, eaten and disposed of again, and that something similar must happen every day for every city on earth, it is remarkable that those of us living in cities get to eat at all. Feeding cities takes a gargantuan effort; one that arguably has a greater social and physical impact on our lives and planet than anything else we do. Yet few of us in the West are conscious of the process. Food arrives on our plates as if by magic, and we rarely stop to wonder how it might have got there.* Food provisioning as an urban challenge is not only about finding ways to improve and safeguard urban food and nutrition security for all urban dwellers, but also about developing more sustainable urban food provisioning systems, and, ultimately, about the question of how food can contribute to sustainable urban development.

Food and agriculture on the urban agenda

The challenge of feeding urban populations implies that we need to see and understand the interrelations between food and other urbanization challenges. For example, the share of the urban ecological *foodprint* in the urban ecological footprint is approximately 40–45%, but with huge differences between cities (Goldstein et al., 2017). Climate change is another challenge with multiple links to urban food provisioning. The frequency and severity of extreme climate events will have negative consequences for food production and food security (Easterling et al., 2007), affecting food availability, food accessibility, food utilization and food systems stability (FAO, 2008). Yet the food system also contributes to climate change by emitting greenhouse gases in all stages of the food supply chain. However, this implies that the food system can also help to mitigate climate change by transforming food provisioning practices. Collecting and processing waste is another urban challenge, especially as cities grow and consumption patterns change. A large part of the urban waste basket consists of food and food packaging. Collecting and processing food waste requires (fossil) energy, and moreover, wasting food is also wasting the energy that was needed to produce it (Cuéllar and Webber, 2010). Public health is another food-related challenge as more than 2 billion people suffer from diet-related ill-health: obesity, malnutrition and hunger (De Schutter, 2014; Lang, 2010). All forms of diet-related ill-health are more prevalent among the socially and economically disadvantaged segments of the urban population, which is a clear sign of the link between food and socio-economic inequality.

The multiple links between urban food provisioning and other urban challenges, such as reducing the urban ecological footprint, mitigating and adapting to climate change, reducing socio-economic inequalities and improving public health, implies that these challenges cannot be addressed singly, but that they must be addressed collectively (Lang, 2010). The need for an integrated and comprehensive approach to sustainable urban development, which includes strengthening the sustainability and inclusiveness of the urban food system, is gradually being understood by a growing number of cities. Supporting and developing urban and peri-urban agriculture is increasingly seen as one of the starting or entry points for a more integrated and comprehensive approach. As a result, urban and peri-urban agriculture have been taken up in municipal, metropolitan and sometimes also national programmes and policies (Blay-Palmer, 2009; Rocha and Lessa, 2009; De Zeeuw et al., 2011; Moragues et al., 2013; Wiskerke, 2015). In many countries in the global South the focus was initially (and still is) on improving food and nutrition security and reducing poverty through urban agriculture. With climate change becoming a more prominent urban challenge in recent years, strategies to reduce the urban ecological footprint and urban heat islands and to mitigate climate change have

been incorporated as additional goals for urban and peri-urban agriculture programmes. In Europe and North America public health concerns (obesity and malnutrition) together with concerns about the ecological footprint of urban food systems, have been the main reasons for municipal and regional authorities to place food and agriculture on the urban agenda (Moragues et al., 2013). Before elaborating further on the relations between and (potential) contributions of urban and peri-urban agriculture to sustainable urban development, it is important to define what urban and peri-urban agriculture is.

Urban and peri-urban agriculture: definitions and diversity

One of the first definitions of urban and peri-urban agriculture is that of:

an industry that produces, processes and markets food and fuel, largely in response to the daily demand of consumers within a town, city, or metropolis, on land and water dispersed throughout the urban and peri-urban area, applying intensive production methods, using and reusing natural resources and urban wastes, to yield a diversity of crops and livestock (Smit et al., 1996).

A slightly broader and more appropriate definition for this book is one inspired by the definition of the RUAF Foundation (the Global Partnership on Sustainable Urban Agriculture and Food Systems):

Agricultural production (of crops, livestock, fish, and trees) in urban and peri-urban areas for food (e.g. vegetables, milk, eggs, poultry and pig meat) and other uses (e.g. herbs, flowers, fodder), the related input supply, transport, processing, and marketing of the agricultural produce and the provision of non-agricultural services (such as agritourism, urban greening and water storage) (RUAF, 2019).

A defining characteristic of urban and peri-urban agriculture and a key difference with rural agriculture is that it is an agricultural production system that is closely intertwined with the urban socio-economic, ecological and legal system. This means that urban and peri-urban agriculture makes use of urban resources, delivers produce and services to urban consumers and is influenced by urban laws and market forces.

Urban and peri-urban agriculture manifests itself in multiple forms, resulting in a large diversity of practices, organizational forms and business models. The diversity in urban and peri-urban agriculture is shaped by the following dimensions (RUAF, 2019):

- **Location.** Urban agriculture may take place inside cities (intra-urban agriculture) or in the urban fringe (peri-urban agriculture). Agriculture activities may be carried out outside (on plots and fields, but also on rooftops and balconies) or inside (in buildings and greenhouses). Locations

can be private property (owned or leased), public space (parks, along roads and railways, conservation areas) or semi-public space (schoolyards and grounds of hospitals and care and nursing homes).

- Types of production, which may include plants for human consumption and animal feed (root and tuber crops, grains, fruits, vegetables, mushrooms), trees (fruits and nuts), animals (such as poultry, rabbits, guinea pigs, pigs, fish) for meat, milk and eggs and non-food products (aromatic and medicinal plants, ornamental plants). The focus is often on perishable, nutritional and relatively high-value products. Urban agriculture production units may range from specialized to diversified.
- Size of production units, which may range from (very) small (one or several square metres, such as on balconies or in-home gardens) to large, depending on the location of production. The urban farming company Agropolis is planning to open the world's largest rooftop farm with a surface of 1.4 ha (Nosowitz, 2019). Larger fields and farms can be found, especially in peri-urban areas.
- Individual or collective. Urban agriculture may be an individual activity or a collective one, with the collective being the family, a community group or a cooperative.
- Degree of market orientation. In many cities, food is being produced for self-consumption with surpluses being exchanged for other food items or sold. However, a large share of urban and peri-urban farms are partially or fully commercial, selling fresh and processed products at the farm gate, in local markets and shops or to supermarkets.
- Kind of technologies used. This differs greatly and ranges from production units primarily based on manual labour using simple equipment like shovels, spades and hoes to fully automated vertical units with LED lights and hydroponics and everything in between.
- Integration with other production activities or services. This also differs greatly and ranges from specialized production (e.g. one particular product), to multiple products, processing of products and providing a variety of services, such as composting of organic waste, educating children, health care, water storage and maintenance of public space.

Based on a comparison of a large number of urban and peri-urban farms, Van der Schans (2015) developed a typology of different business strategies in urban agriculture:

1. *Differentiation*, which is based on developing production processes and food products that distinguish themselves from conventional agricultural production processes and products. This may include short and transparent food chains, specialty products and adding value to

- products by not only producing but also processing and distributing food products;
2. *Diversification*, which involves the combined provision of food products and other goods and services, such as energy production (from urban green waste), recycling of urban organic waste (composting, insect rearing), management of urban green, water storage, and youth education;
 3. *Low cost*, by using urban resources that are currently underutilized or not used at all, such as vacant plots of land, empty buildings, urban organic waste as compost, excess rainwater, urban wastewater and urban heat;
 4. *Commoning*, which is about shared ownership of a decision-making about the utilization of public space and/or food provisioning activities, and more in general, about a sharing economy by sharing resources (including knowledge and skills) and participating in barter exchanges to foster a more socially inclusive and participatory urban food and agriculture system;
 5. *Experience*, which is based on the premise that urban agriculture becomes more valuable by providing memorable experiences rather than basic goods. Urban agriculture then becomes a carrier of a new urban culture, enriches the urban landscape and improves the quality of urban living.

It is important to keep in mind that in practice elements of different strategies are combined.

The (potential) benefits of urban agriculture for sustainable urban development

As mentioned before, municipal authorities are becoming increasingly interested in urban and peri-urban agriculture, because of its proven, but also potential, capacity to address several challenges that cities are facing, such as food and nutrition insecurity, poverty, diet-related ill-health, environmental pollution and impacts of climate change. Dubbeling et al. (2011: 18–20) distinguish three main types of benefits of urban agriculture, which are summarized in Figure 1:

1. *Social*, which refers to issues such as food security, poverty alleviation, social inclusion and community building. These social benefits are generally achieved through subsistence urban agriculture, in which individuals, households or community groups produce food and medicinal plants for home consumption. This helps to reduce food and health care expenses, making cash available for other costs like rent, school fees and clothing.

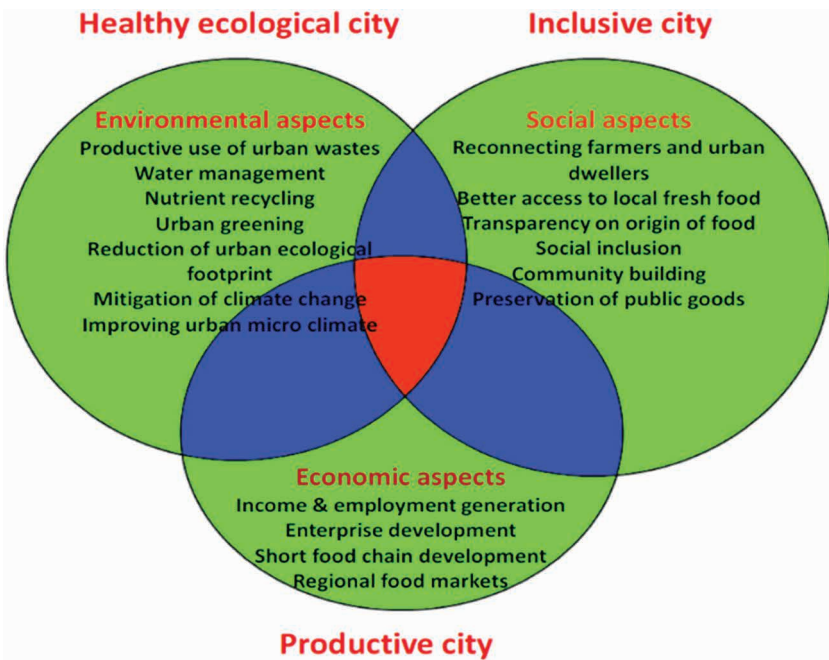


Figure 1 The multiple benefits of urban and peri-urban agriculture for sustainable urban development. Source: adapted from Dubbeling et al. (2011).

2. Economic, which includes income and employment generation and the development of businesses. Economic benefits are realized through market-oriented or commercial urban agriculture, creating jobs and income by producing food and non-food products and selling these directly to consumers (farm gate and markets) or to shops and supermarket.
3. Health and ecological, which refers to a range of services provided by and through urban agriculture, such as urban greening, leisure and recreation, waste recycling, reduction of the urban ecological footprint and climate change mitigation and adaptation. The health and ecological benefits are achieved through multifunctional urban agriculture. Producing food close to where it is consumed reduces food transport and quite often also the need to store and package food. This implies a reduction in energy use and greenhouse gas emissions and thereby a means to mitigate climate change. Urban agriculture also contributes to urban greening and this can help to lower the urban heat island effect, reduce air pollution and improve the urban microclimate. As such it is a means to alleviate the effects of climate change and improve urban environmental health (Fig. 1).

About the book

Achieving sustainable urban agriculture implies that a large variety of topics have to be addressed, given the multiple ways in which urban agriculture can contribute to sustainable urban development and taking into account the diversity in practices, organizational models and business strategies in urban agriculture. Hence, as a domain of research, urban agriculture, needs to be explored and understood by a broad spectrum of disciplines, spanning both the social and natural sciences. The inter- and multi-disciplinary character of urban agriculture research is reflected in the titles and contents of the chapters in this book and in the disciplinary backgrounds of the authors of these chapters.

The book has been divided into three parts. Part 1, which consists of five chapters, is entitled 'building urban agriculture networks' and explores and discusses the social, economic, political and spatial networks that are needed for urban agriculture to thrive, but which are simultaneously also developed and transformed through urban agricultural practices:

- In Chapter 1 Han Wiskerke reviews the development of urban agriculture policymaking. He assesses the key dilemmas, challenges and tensions involved in creating supportive policy frameworks for urban agriculture and presents examples of four cities that have developed an urban food and agriculture policy. Based on the lessons learnt from these four and other cities, conclusions on future policy development are drawn and trends and priorities for future research are identified.
- In Chapter 2 Nevin Cohen discusses how urban agriculture's popularity over the past few decades has required cities to address whether, to what extent, and how food production fits into the cityscape. Planners have used various policy levers, from revised zoning codes to tax incentives, to protect existing farms and gardens and expand urban food production. Cohen reviews these strategies of planning for urban agriculture, but argues that an emerging role of planners is to shape urban agriculture so that it helps solve seemingly intractable urban challenges. He offers examples of how planners can use urban agriculture to address two of these challenges: social justice and climate change.
- In Chapter 3 Laine Young and Alison Blay-Palmer explore the benefits of urban agriculture through the lens of community building and social cohesion. They highlight how urban agriculture is important to a City Region Food Systems (CRFS) approach to food system change, and how techno-urban agriculture initiatives linked to concepts like smart cities might help or hinder city's capacity to meet their goals. The authors also address how urban agriculture can be linked to international agreements

like the Sustainable Development Goals (SDGs), the New Urban Agenda (NUA), and the Milan Urban Food Policy Pact (MUFPP).

- In Chapter 4 André Viljoen and Katrin Bohn focus on the essential role that nature and landscape play in cities by contributing to climate change adaptation and mitigation while advancing biodiversity and enhancing the quality of urban life. They state that urban and peri-agriculture provide one means to meet many of these objectives and use urban and architectural design as a frame for exploring this. The authors propose two design concepts advocating landscape, namely Continuous Productive Urban Landscapes (CPULs) and Landscape Urbanism, as an essential element of urban design, and review opportunities and challenges for doing this.
- In Chapter 5 Stefano Pascucci discusses how to develop more self-sufficient, regenerative types of urban agriculture. He begins by showing how existing systems have been trapped in the paradigm of a linear economy model and then continues to show how regenerative urban agri-food systems can be built through a circular economy approach. Pascucci reviews strategies and examples of how this can be achieved, as well as bottlenecks and how they can be overcome.

Part 2 of the book focusses on new and emerging technologies that can (or already do) support the development of sustainable urban agriculture. The technologies presented and discussed range from technical solutions for specific thematic challenges, such as nutrient recovery from urban waste and pest and disease management, to complete production systems that are or can be embedded in the urban fabric and infrastructure: rooftop systems and vertical farming systems. Part 2 consists of four chapters:

- In Chapter 6 Elisa Appolloni, Francesco Orsini and Cecilia Stanghellini argue that contemporary challenges as urban population growth, competition in land use, climate change and lack of productive resources, stress the necessity of a new form of agriculture that is free from soil exploitation and able to ensure food security to urban dwellers in the most sustainable way. They do so by examining and discussing rooftop farming as a form of building-based agriculture that may help to address urban food and nutrition insecurity, but also deliver multiple social, environmental and economic benefits such as social inclusion, reduction of the urban heat island effect and storm water damages and alleviating urban poverty. In order to achieve these goals, the authors argue that it is fundamental to improve some aspects related to rooftop farm design and management, with particular reference to technologies applied, minimization of resources use, building wastes recycle, rooftop accessibility and structural security. In addition they contend that local and governmental authorities'

intervention is important to facilitate the future development of the rooftop farming systems.

- In Chapter 7 Dickson Despommier describes and evaluates technologies and methods for growing edible plants indoors. He presents an international overview of a large number of commercial vertical farms currently operating that employ them. Furthermore he discusses the challenges for vertical farming as well as the multiple benefits it may deliver. Despommier concludes by arguing that the rapid growth of the vertical farm industry over the last five years will imply that vertical farming is to become a common feature of the built environment on a global scale within the next ten to twenty years.
- In Chapter 8 Rosanne Wielemaker and Jan Weijma discuss how nutrients in urban waste can be redirected to urban agriculture. The authors state that the current interest in economically developed countries to implement urban agriculture and resource-oriented sanitation systems brings about new narratives to the status quo of both food production and 'waste' management, and reintroduces the opportunity to partially close nutrient cycles at the urban scale. Their chapter provides an overview of wastewater sources, scales and systems and discusses the opportunities and constraints of recycling human excreta to urban agriculture as a means to restore the nutrient cycle in the food system.
- In Chapter 9 Giovanni Bazzocchi focuses on pest management for urban agriculture. He claims that pest management for urban agriculture differs from pest management in conventional and industrial agriculture. The urban context means that pest management strategies must address a plethora of peculiar factors, such as: proximity to citizens living environments, microclimate and environmental conditions, plot and field size, multiplicity of goals and objectives of urban growers. In his chapter, he proposes a knowledge framework for urban agriculture ecological pest management, which keep together a systemic approach based on scientific ecology concepts and the application of simple and practical tools in a participatory approach. Bazzocchi discusses preventive measures based on the concept of plant and ecosystem health, below and above ground environments management, functional biodiversity and urban ecology, and simple biological pest control methods.

Part 3 of this book presents a series of case studies about urban and peri-urban agricultural production systems and how these can be optimized: horticulture, livestock production, aquaculture and aquaponics, beekeeping and urban forestry. These case studies also include discussions and reflections about topics and issues that feature in Parts 1 and 2 of this book. Part 3 consists of five chapters:

- In Chapter 10 Beatrix Alsanius, Magnus Jirström, Most Tahera Naznin, Sammar Khalil and Eva-Charlotte Ekström present and discuss different typologies of urban horticulture. The authors reflect on the underlying motives for urban horticulture and state that these differ within and between cities, depending on the economic preconditions. In many low income countries, the authors argue, urban horticulture is needs-driven, providing and securing food and livelihoods. Although these may also be the driving force in some high income countries, urban horticulture in those parts of the world is often less needs-driven, and instead based on environmental considerations, social integration and human wellbeing. As a consequence of varying needs, purposes, and preconditions, but also of knowledge, know-how, and skills in horticultural crop production, implementation of technological solutions and their outcomes can differ sharply. In their contribution the authors discuss the optimization of urban horticulture in terms of environmental and social sustainability, including food security and food safety.
- In Chapter 11 Delia Grace, Annie Cook and Johanna Lindahl focus on urbanization and the increase in the consumption of livestock products. According to the authors this increased demand, alongside infrastructure challenges making transporting and storing LP challenging, encourages urban livestock, close to the final consumer. While data on urban livestock keeping is limited, substantive evidence indicates that large numbers of livestock are kept, and that many processing and retailing activities occur in cities. Key issues for urban livestock keeping, the authors argue, are related to human health, nutrition, environment, economy and ethics, and while it has many benefits, it is also implicated in significant problems. The chapter describes these in depth, with reviews of key research, and reflects on how research can contribute to enhanced, sustainable livestock keeping in cities.
- In Chapter 12 Anja Steglich, Grit Bürgow and Angela Million present a case of aquaponics: the roof water-farm. The roof water-farm is an urban agriculture production system in which fresh fish and fresh vegetables are harvested directly from the roof, produced with treated wastewater from the building. The authors present and discuss a research and implementation project that was carried out between 2013 and 2017 and that investigated the link of lightweight farm systems known with technologies and modules of building-integrated (waste-)water recycling. Noticing the challenge of already developed systems – like hydroponics and aquaponics and also the well-developed technologies of grey water recycling – which are still not applied widely in urban contexts and in the construction of new housing the aim of the research described in Chapter 12 was also to tackle the implementation gap, the gap from research into practice, the gap from pilot plants to an implementation on regular base.

- In Chapter 13 Erik Stange explores urban beekeeping, a growing trend that owes its newfound popularity at least in part to the perception that increasing the numbers of honeybees in cities will help alleviate the global decline in pollinating insect abundance and species diversity. He argues that while the urban environment may provide suitable foraging opportunities for honeybees, it does present challenges that are different to larger scale beekeeping operations in peri-urban or rural areas. Stange shows that the concentrated abundances of bees on patches of urban flower combined with the increasing virility of honeybee-targeting pathogens makes disease transmission both among honeybees and between honeybees and wild bees a particular concern. By mapping the spatial variation of cities floral resources, he argues, important insight can be gained about the appropriate placement and suitable abundances of urban beehives for optimal urban beekeeping that minimizes the negative effects urban honeybees might have on local wild bee populations. He concludes that the most important contributions which both municipal managers and private individuals can make involve measures that can increase the overall availability of floral resources in the urban environment.
- In Chapter 14 Cecil Konijnendijk and Hyeone Park examine urban forestry's contributions to urban food provision. They argue that although historically forests and trees in and near cities played an important role in local food provision and security, priority given to this provisioning ecosystem service decreased over time as the focus shifted to cultural and regulatory ecosystem services. Recently, efforts have been made to readdress the links between urban forestry and food provision, as reflected in the emerging concepts of urban food forestry and urban foraging. Both concepts are introduced by the authors and for each a couple of case studies are described. The authors conclude that urban food forestry and urban foraging offer a promising way forward for sustainable cities, and for linking urban forestry and urban agriculture.

Concluding remarks

As outlined in the beginning of this chapter, the ongoing process of urbanization and population growth gives rise to several major sustainability challenges. This has spurred research on sustainable urban development from a broad spectrum of disciplinary perspectives. However, the role of urban food provisioning and urban agriculture in scientific research and political debates about sustainable urban development – both as urban sustainability challenges and as means for sustainable urban development – was largely neglected, overlooked or misunderstood. This has changed quite fundamentally in recent years. Urban agriculture has appeared on the research and policy agenda, as more and more

researchers and policymakers begin to understand the (potential) role of urban agriculture in sustainable urban development. This is also clearly reflected in all chapters of this book, in which the links between urban agriculture and sustainable urban development challenges and goals are explicated. While this has shed new light on the dynamics, impacts, pros, cons, opportunities and bottlenecks of urban agriculture, a lot is still to be explored. We hope that this book, which reflects the broad spectrum – from a thematical, disciplinary and geographical point of view – of contemporary research on urban agriculture, will be a useful reference in taking stock of where we are and where research needs to go next.

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Part 1

Building urban agriculture networks

Chapter 1

Creating a supportive public policy framework for urban agriculture

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- 1 Introduction: the development of urban agriculture policy making
- 2 Dilemmas, challenges and tensions in urban agriculture policy making
- 3 Case studies
- 4 Conclusions
- 5 Future trends
- 6 Where to look for further information
- 7 References

1 Introduction: the development of urban agriculture policy making

While the production of food has always been a social, economic and spatial urban practice – albeit that its importance has differed in time and across space – it has been largely absent from the urban public policy domain for many decades. Rooted in the historical process of urbanization, which led to the definition of certain issues as essentially urban and others as essentially rural, food and agriculture have become typical rural policy topics (Pothukuchi and Kaufman, 2000). Concomitantly, urban agriculture gradually became to be perceived as a remnant of the past and, as a result, policies and legislation about cultivating food in cities became to be considered as irrelevant and outdated. This persistent dichotomy between urban and rural policy has resulted in three shortcomings in food studies, planning and policy (Sonnino, 2009):

- The study of food provisioning is confined to agrarian and rural development studies, thereby missing the fact that the city is the space, place and scale where demand for food products is greatest.
- Urban food insecurity is seen as a production failure instead of a failure of availability, accessibility and affordability and this has restrained much-needed interventions in urban food security.

- Food policy has been viewed as a non-urban strategy, delaying research on the role of food and agriculture in sustainable urban development as well as on the role of cities as food system innovators and food policymakers.

However, in recent years a growing number of cities have become very active in the field of food and agriculture. Municipal authorities and city councils have appeared as new actors in the food policy arena (Moragues-Faus and Morgan, 2015), together with new urban social movements. A recent milestone in this respect has been the signing by over 100 cities in October 2015 of the Milan Urban Food Policy Pact – now over 200 by late 2019 (MUFPP, 2019) – in which they commit themselves to ‘develop sustainable food systems that are inclusive, resilient, safe and diverse, that provide healthy and affordable food to all people in a human rights-based framework, that minimize waste and conserve biodiversity while adapting to and mitigating impacts of climate change’ (MUFPP, 2015a). Key reasons why food policy is increasingly seen as an urban issue is the fact that many social, ethical and environmental problems of cities are food-related and understood as such by urban policymakers. These problems include: hunger, nutrition value and food insecurity, access to culturally appropriate food, diet-related ill health, carbon footprint, energy consumption, water contamination, loss of farmland and rural decline (Wiskerke, 2015). Nowadays there is a growing awareness that food is more central to many urban problems than urban planners, designers, and policymakers have realized in the past.

The growing recognition that food is as much (or even more) an urban issue than a rural issue has also spurred interest in the development of policies for urban and peri-urban agriculture (Van Veenhuizen, 2006). In the urban-rural policy dichotomy era, much of the political attention focussed on the tensions between urban development and farming close to and inside cities, as these two activities were thought to compete for the same space. More recently, the political interest is shifting towards urban agriculture and city development in terms of mutually beneficial relationships (Viljoen and Wiskerke, 2012). The short distance between urban farms and urban residents allows for positive interactions between farmers’ needs and urban citizens’ demands: locally grown freshly available food, authentic experiences, closeness to farms and farmers, protection of farm land in and around cities, public procurement of regional produce, facilitating farmers’ markets and so on. From an urban development perspective, urban and peri-urban farming can contribute to a city’s capacity to satisfy the basic needs of its citizens. Furthermore, there is growing awareness among local authorities that multifunctional urban and peri-urban green open spaces have a critical role to play in the environmental management of the city, such as storm water storage and infiltration and run-off reduction, lowering the ‘urban heat island’ effect and reduction of cooling costs, climate change

mitigation and adaptation, and recycling of nutrients from organic urban waste and wastewater (De Zeeuw and Drechsel, 2015).

The political interest in urban and peri-urban agriculture is also expressed by the following Milan Urban Food Policy Pact actions focussing on or related to urban and peri-urban food production (MUFPP, 2015b):

- Promote and strengthen sustainable urban and peri-urban food production and processing and integrate urban and peri-urban agriculture into city resilience plans.
- Seek coherence between the city and nearby rural food production, processing and distribution, focussing on smallholder producers and family farmers, paying particular attention to empowering women and youth.
- Apply an ecosystem approach to guide holistic and integrated land use planning and management in collaboration with both urban and rural authorities and other natural resource managers by combining landscape features.
- Protect and enable secure access and tenure to land for sustainable food production in urban and peri-urban areas, provide access to municipal land for local agricultural production and promote integration with land use and city development plans and programmes.
- Help provide services to food producers in and around cities, including technical training and financial assistance to build a multigenerational and economically viable food system with inputs such as compost from food waste, grey water from post-consumer use and energy from waste while ensuring that these do not compete with human consumption.
- Support short food chains, producer organisations, producer-to-consumer networks and platforms, and other market systems that integrate the social and economic infrastructure of urban food system that links urban and rural areas.
- Improve (waste) water management and reuse in agriculture and food production through policies and programmes using participatory approaches.

These actions are based on and have inspired urban and city-region agricultural policies and programmes in hundreds of cities around the world.

Based on a review of a large number of municipal food and agricultural policies, Baker and De Zeeuw (2015) state that urban food and agriculture policies address four areas of concern:

- To provide equitable physical and economic access for all citizens to safe, healthy, affordable and appropriate food;

- To secure adequate nutrition and public health (reduce diet-related ill-health);
- To stimulate sustainable urban and regional food economies;
- To contribute to urban environmental sustainability, diversity and resilience.

While many local and regional governments have developed or are in the process of developing urban or city-region food and agricultural policies that address one, several or all of these areas of concern, a review of literature on (cases of) urban food and agriculture policies shows that cities and city-regions face several dilemmas, challenges and tensions in the development and implementation of these policies and strategies. In the next section I will discuss the key dilemmas, challenges and tensions involved in creating policy frameworks for urban agriculture. After that several examples of cities that have developed an urban (food and) agriculture policy will be presented and discussed: Rosario (Argentina), Belo Horizonte (Brazil), Antananarivo (Madagascar) and Toronto (Canada). Based on the dilemmas, challenges and tensions faced by urban policymakers, as well as these four examples, conclusions will be drawn and trends and priorities for future research will be identified.

2 Dilemmas, challenges and tensions in urban agriculture policy making

In recent years a significant number of papers and books have been written about urban and city-region food and agricultural policies. The majority of these publications focus on specific cases, such as Dar es Salaam (Schmidt, 2012), New York (Cohen and Reynolds, 2014), Mexico City (Dieleman, 2017), Toronto (Mulligan et al., 2018) and Rosario (Dubbeling and Bracalenti, 2018). Others are comparative analyses of several cases (e.g. Gore, 2018), reviews of multiple cases (e.g. Baker and De Zeeuw, 2015; De Bon et al., 2010; Halliday, 2019; Hamilton et al., 2014; Mok et al., 2014) and edited volumes (e.g. De Zeeuw and Drechsel, 2015; Viljoen and Wiskerke, 2012; Wiskerke and Verhoeven, 2018). Based on a review of these different kinds of publications, six key challenges for and tensions in creating and implementing a supportive policy framework come to the fore:

- 1 Who is leading and responsible for the process of making and implementing policies for urban agriculture? This dilemma refers to the role of the government and of other stakeholders in creating and executing urban agriculture policies. According to Cohen and Reynolds (2014) policy frameworks for urban agriculture have 'been

developed through a variety of government-driven approaches (...) with public agencies and legislative staffs taking the lead in making policy decisions. These decisions may take the form of regulations, agency programs, budgets, and local legislation, or nonbinding white papers, policy plans, and strategic planning documents that ultimately influence the development of laws, regulations, and programs'. The case of Belo Horizonte, introduced in the next section, is an example of this approach to policymaking and implementation. If the government is in the lead, it does not imply that non-governmental stakeholders are excluded from decision-making processes. On the contrary, quite often local public authorities engage other stakeholders in deliberations and collaborative decision-making (Moragues-Faus et al., 2013; Moragues-Faus and Morgan, 2015). There are, however, also many examples of policy frameworks instigated and developed by partnerships of entrepreneurs, NGOs, and community-based organisations, which sometimes also include public authorities (Moragues-Faus et al., 2013; Viljoen and Wiskerke, 2012). The activities and policy proposals of these multi-stakeholder partnerships 'also influence policy by generating knowledge, identifying problems, proposing solutions, and producing design prototypes that can guide the decision making of city officials' (Cohen and Reynolds, 2014). According to De Zeeuw and Dubbeling (2015) multi-stakeholder approaches to designing and implementing urban agriculture policies are highly recommended due to complexity of the agro-food system and its links to different sectors, such as public health, urban environmental management and spatial planning. The same authors state that while multi-stakeholder policymaking is a time-consuming and complex process, it contributes to more participatory governance, higher quality of decision making and better likelihood of successful implementation. The Toronto Food Policy Council, which features in the next section, is a typical example of a multi-stakeholder platform as a key driver of urban agriculture and food policies.

- 2 What is the appropriate scale or level of policymaking and implementation: local, regional, national or international? For many decades agricultural policymaking and implementation has been (and still is in many countries) a national-level task and responsibility. An exception to this is the European Union with its Common Agricultural Policy (CAP), resulting in an agricultural policy framework that all national authorities of the member states need to comply with. In the EU, urban agriculture appears to fall outside the scope of the CAP. Although member states are allowed to use the CAP's rural development programme for the benefit of urban agriculture, member states tend to view urban agriculture as either not sufficiently agricultural or as not

sufficiently rural to secure CAP support (McEldowny, 2017). As a result national-level policies to support urban agriculture are largely absent in the EU. This does not hold true for some Latin American countries that have policy frameworks in place that (in)directly support urban agriculture, as the examples of Rosario and Belo Horizonte will show. But in these countries, urban agricultural policymaking is also done at the local level. The locally specific nature of conditions and challenges affecting urban agriculture requires place-based policies (Halliday, 2019). And, last but not least, there is a general tendency - in the global North as well as in the global South - for decentralization of regulatory responsibilities and policy implementation: "In the areas of health, education, and poverty alleviation, many national governments have begun to allow (...) local governments to operate the levers of policy and programs" (Cohen, 2006: 74-5).

- 3 How to create and safeguard space for urban food production? One of the big problems for practicing urban agriculture is the availability of space for food production, due to competing claims on and the value of land in and around cities. Space in cities for food production is scarce and expensive, while direct economic revenues from food production are much lower than real estate. As a result urbanization (and in particular urban sprawl) often goes at the expense of urban and peri-urban space for agricultural production (Hamilton et al., 2014; Mok et al., 2014). And even if land is (made) available for agricultural activities it is quite often only a limited number of years. Creating and protecting space for urban and peri-urban agriculture in a systematic way, or at least for longer periods of time, is important for urban food growers to invest in the development of urban farming (Baker and De Zeeuw, 2015). While protecting and enabling secure access and tenure to urban and peri-urban land for sustainable food production is one of the actions of the Milan Urban Policy Pact, many local governments do not (yet) have policies and regulations in place to do so. The cases that feature in the next section are, however, examples of cities where protection of space for urban and/or peri-urban agriculture is legally safeguarded.
- 4 How to deal with food safety and health impacts of food produced in urban environments? Perceived health risks have caused city authorities to be reluctant to acknowledge urban agriculture as a legitimate form of urban land use. However, neglecting or tolerating urban agriculture does not mean it is not practiced. Failing to regulate urban agriculture may then lead to negative impacts on public health (De Zeeuw et al., 2011). Food safety and public health risks include issues such as the impact of air and soil pollution on food safety (Meenar et al., 2017; Mok

et al., 2014), the contribution of urban agriculture to communicable diseases (Hamilton et al., 2014; Meenar et al., 2017) and microbial and chemical contamination of urban waste and wastewater used as fertilizer and for irrigation (Drechsel et al., 2015). Given the variety of (potential) health risks associated with urban food production, it is important to have policies that actively manage these risks (De Zeeuw et al., 2011).

- 5 Should the focus be on urban agriculture policies or on urban food policies? Ever since food and agriculture have re-appeared on the urban policy agenda, there seems to be a tendency to develop support measures, regulations and legislation for urban and peri-urban food production as part of a broader urban or city-region food policy framework rather than through a specific policy framework for urban and peri-urban agriculture (Baker and De Zeeuw, 2015). The production of food in an urban environment cannot be separated from questions and challenges regarding food and nutrition security, access to affordable, safe and healthy food for all, food distribution and reduction and recycling of food waste. The Milan Urban Food Policy Pact is a clear example of this. At the same time, broadening the scope from agriculture to food may make the creation of a policy framework more complicated and more difficult to govern, depending on regulatory responsibilities at different government levels, and this may also delay actions to support urban and peri-urban agriculture.
- 6 Is it important to link urban agriculture to other urban policy domains? The urban-rural dichotomy in policymaking has, for many decades, resulted in defining food and agriculture as non-urban issues. As a result the links between agriculture and food, on the one hand, and urban policy domains such as public health, education, transport and employment, on the other hand, remained invisible. In the past two to three decades, with agriculture and food appearing on the urban policy agenda, the links between these 'new' urban domains and traditional urban domains are gradually becoming clear (Van der Schans and Wiskerke, 2012). This is especially true with new urban challenges that are now arising. These include: the effects of climate change (flood risks and urban heat island effects), diet-related ill-health (malnutrition and obesity), growing socioeconomic inequalities, traffic congestion in cities and the need to move from a linear towards a circular economy (Wiskerke, 2015). The (potential) role of urban agriculture in addressing these challenges is gradually becoming clearer. At the same time, this multifunctionality of urban agriculture makes the creation of a supportive framework for urban agriculture more difficult. It requires interdepartmental policymaking or other innovative forms of urban

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