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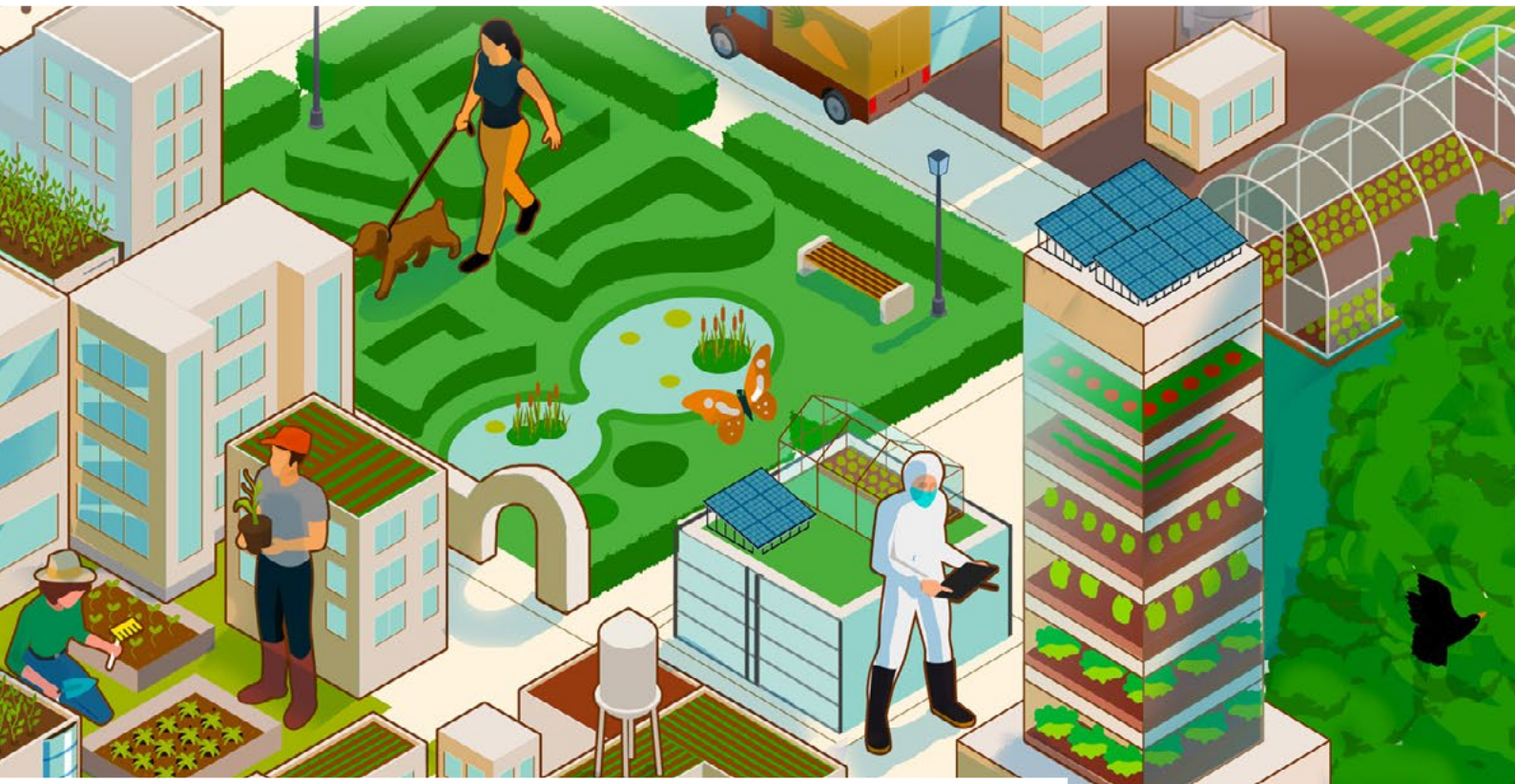

URBAN AND PERI-URBAN AGRICULTURE SOURCEBOOK

FROM PRODUCTION TO FOOD SYSTEMS

URBAN AND PERI-URBAN AGRICULTURE SOURCEBOOK

FROM PRODUCTION TO FOOD SYSTEMS

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Foreword

By 2050 the world's population is expected to reach 9.7 billion, 70 percent of which will be living in urban areas, mainly in low and middle-income countries in Africa and Asia. At the same time the current COVID-19 pandemic and the increasing climate emergency is forcing us to rethink how we produce, process and distribute food.

Since history has recorded cities, urban and peri-urban agriculture (UPA) has played an important role in food production, and the impacts of UPA have multiplied as cities have expanded. In the last few decades, the importance of UPA has grown and been progressively recognized as a key player in feeding growing urban populations, supplying safe and nutritious food from different types of crops and animals, and contributing to all urban food systems. The role of UPA is specific and complementary to food supply from rural areas, as it helps meet local demand and contributes to short, efficient supply chains, thus reducing food loss and waste. UPA also generates various benefits in the daily lives of billions, from social to educational aspects, and from economic to environmental functions, ensuring urban and peri-urban dwellers are able to engage in prosperous livelihoods.

In 1999, the Food and Agriculture Organization of the United Nations (FAO) was formally mandated by its Members to include UPA as an integral part of agricultural production systems, and to specifically consider the contributing role of UPA in feeding cities, providing employment and generating incomes. In collaboration with global, national and local partners and stakeholders, FAO has been supporting the transformation of UPA into a recognized urban land use and economic activity, integrated into national and local agricultural development strategies, food and nutrition programmes and urban planning. In 2020, FAO launched the Green Cities Initiative, to improve people's well-being and the environment by promoting sustainable and resilient agrifood systems and green spaces in urban and peri-urban areas, where UPA is critical to contributing to the lives of people and, overall, to urban sustainability and resilience.

The practise of UPA is central to FAO's current mission in support of the transformation to more efficient, inclusive, resilient and sustainable agrifood systems, through mainstreaming green innovation and digitalization under four betters – Better Production, Better Nutrition, a Better Environment and a Better Life. In addition, UPA is critical to the operationalization of linkages between the Sustainable Development Goals (SDG) 1; 2; 3; 8; 11; 12; 13 and 16.

This publication was designed by FAO in partnership with the RUAF Global Partnership on Sustainable Urban Agriculture and Food Systems (RUAF) and Rikolto to collect, analyse and systematize existing experiences and case studies on global UPA. The reader will enjoy the specific insights and lessons on targeted and context-specific UPA typologies, approaches and practices, as well as the key components required to create the enabling environment to sustainably scale up UPA within the context of broader urban development.

This sourcebook will serve as a reference to provide guidance and recommendations when planning and implementing UPA interventions. Target readers include local decision-makers, policy advisors, urban planners, and others involved in the design and implementation of production systems strategies and policies.

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Director, Plant Production and Protection Division (NSP), FAO

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The book was developed by a team led by Guido Santini (FAO), comprising Jia Ni, Shulang Fei, Makiko Taguchi, and Bruno Telemans from FAO; Charlotte Flechet, Dale Erwin, Gert Engelen and Michaela Boyen from Rikolto; René van Veenhuizen and Jess Halliday from RUAF; Amber Steyaert from Ghent University; and Joe Nasr from Ryerson University who provided leading technical guidance.

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The team benefited from technical inputs and revisions by Melvin Medina, Tian Cai, Michela Conigliaro, Roman Malec, Rebeca Koloffon from FAO. Fenton Beed (FAO) provided additional strategic guidance.

Léo Keller and Jia Ni from FAO coordinated the visual identity and design of the infographics. Gabriele Zanolli and Davide Moretti worked on layout design and production. Rosemary Allison edited and proofread the final text.

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Acronyms and abbreviations

AGRUPAR	Participatory Urban Agriculture Programme (Quito)
CFRS	City Region Food Systems
COST	European Cooperation in Science and Technology
CSA	Community Supported Agriculture
EUR	Euro
FAO	Food and Agriculture Organization of the United Nations
GAIN	Global Alliance for Improved Nutrition
ICLEI	International Council for Local Environmental Initiatives
ICT	Information and communication technologies
IFAD	International Fund for Agricultural Development
IFOAM	International Federation of Organic Agriculture Movements
ILO	International Labour Organization
IPES-FOOD	The International Panel of Experts on Sustainable Food Systems
IWMI	International Water Management Institute
MUFPP	Milan Urban Food Policy Pact
NGO	Non governmental organization
NSP	Plant Production and Protection Division, FAO
NUA	New Urban Agenda
NYC	New York City
PGS	Participatory Guarantee Systems
RUAF	RUAF Global Partnership on Sustainable Urban Agriculture and Food Systems
SDG	Sustainable Development Goals
TECA	Technologies and Practices for Small Agricultural Producers
UA	Urban agriculture
UCLG	United Cities and Local Governments
UPA	Urban and peri-urban agriculture
USD	USA dollar
WHO	World Health Organization

Names of countries and territories in this sourcebook

Official name of country or territory	Short name used in the sourcebook
Antigua and Barbuda	Antigua and Barbuda
Argentine Republic	Argentina
Australia	Australia
The People's Republic of Bangladesh	Bangladesh
The Kingdom of Belgium	Belgium
The Republic of Benin	Benin
The Plurinational State of Bolivia	Bolivia
Bosnia and Herzegovina	Bosnia and Herzegovina
The Federative Republic of Brazil	Brazil
The Republic of Cameroon	Cameroon
Canada	Canada
People's Republic of China	China
The Republic of Colombia	Colombia
Democratic Republic of the Congo	Democratic Republic of the Congo
The Republic of Côte d'Ivoire	Côte d'Ivoire
The Republic of Cuba	Cuba
The Republic of Ecuador	Ecuador
The Arab Republic of Egypt	Egypt
The Kingdom of Eswatini	Eswatini, formerly Swaziland
The Federal Democratic Republic of Ethiopia	Ethiopia
The Republic of Fiji	Fiji
The French Republic	France
The Federal Republic of Germany	Germany
Gaza Strip	Gaza Strip
The Hellenic Republic	Greece
The Republic of Haiti	Haiti
The Republic of Honduras	Honduras
The Republic of India	India
The Republic of Indonesia	Indonesia
The Republic of Iraq	Iraq
The Islamic Republic of Iran	Iran
Japan	Japan
The Republic of Kenya	Kenya
Republic of Korea	Republic of Korea
The Republic of the Union of Myanmar	Myanmar
The Federal Democratic Republic of Nepal	Nepal
The Kingdom of the Netherlands	Netherlands
The Republic of Nicaragua	Nicaragua
The Kingdom of Norway	Norway
The Republic of Madagascar	Madagascar
The United Mexican States	Mexico

The Republic of Mozambique	Mozambique
The Republic of Peru	Peru
The Republic of the Philippines	The Philippines
The Portuguese Republic	Portugal
The Independent State of Samoa	Samoa
The Republic of Senegal	Senegal
The Republic of Singapore	Singapore
The Kingdom of Spain	Spain
The Republic of South Sudan	South Sudan
The Democratic Socialist Republic of Sri Lanka	Sri Lanka
United Republic of Tanzania	Tanzania
The Kingdom of Thailand	Thailand
Tuvalu	Tuvalu
The Republic of Vanuatu	Vanuatu
United Kingdom of Great Britain and Northern Ireland	United Kingdom of Great Britain and Northern Ireland
United States of America	United States of America
West Bank	West Bank
The Republic of Zambia	Zambia

Executive summary

According to the United Nations, 68 percent of the world's population will be living in urban areas by 2050, and around 90 percent of this increase will occur in small cities and towns[1] in Africa and Asia.

The impact of these global trends in population increase and urbanization is compounded by other global trends such as climate change and pandemic shocks. The overall increase in food security and malnutrition, rise of diet related non-communicable diseases, such as obesity, are a few of the issues affecting the food system. The recent COVID-19 pandemic demonstrated the importance of stable food production, shorter and simplified supply and distribution chains (FAO, 2020a).

In this context, urban and peri-urban agriculture (UPA) is increasingly becoming a valid solution adopted by urban and peri-urban dwellers, and promoted by local institutions to face the above-mentioned challenges.

FAO's global survey (FAO, 2020b) revealed that many cities have identified the importance of promoting local food production and improving access to locally produced food – e.g. newly created initiatives that have responded to the pandemic, or the expansion of existing programmes to ensure continued food supply and to protect the most vulnerable residents.

Urban and peri-urban agriculture is not a new concept, as it has been practiced for decades at the global level, through formal and informal practices. Global society has recognized the importance of UPA and the need for it to be integrated into urban planning. In this regard, innovative actions are being implemented to promote the development of UPA in both the global South and North.

Since the 1990s, FAO has been working with Members and key partners such as the RUAF Foundation to promote UPA through various activities, the Food for Cities/City Region Food Systems (CFRS) Programme, *Growing Greener Cities* programme, the Framework for the Urban Food Agenda and Green Cities Initiative. RUAF, Rikolto, Ryerson University, who co-authored this sourcebook, as well as city networks such as the International Council for Local Environmental Initiatives (ICLEI), C40 Cities, Milan Urban Food Policy Pact (MUFPP), among others, are active partners that bring together experiences and share innovation. Partners also include private companies, promoters, agencies, individuals working with cities and citizens to promote resilient and sustainable urban agriculture production and value chains.

It is time to renew the focus on UPA and its evolution by collecting and classifying typical cases and examples, analyse the key elements and challenges faced by practitioners, so as to provide useful information for those who are interested in taking an active part in urban food production.

The purpose of this book is to set out the key lessons learned and to provide recommendations and guidance based on existing cases and examples for a wide range of actors involved in urban food systems. In particular, the aim is for this publication to serve as a sourcebook for local decision-makers, policy advisors, urban planners, specialists, practitioners and others involved in UPA. The sourcebook is also for those involved in the design and implementation of production schemes, planning of urban food strategies, and policies concerning agriculture in urban and peri-urban areas.

Readers can expect to gain knowledge of the following topics:

- What is UPA?
- What are the benefits and impacts of UPA?
- Why and where to invest in UPA?

[1] According to the World Organization of United Cities and Local Governments (UCLG), small cities and towns include any urban centre with fewer than 50 000 inhabitants (www.uclg.org/en/agenda/regions-and-small-towns).

- What options are there for different contexts and scopes?
- What are the requirements and conditions for implementation (natural resources, finance, labour, etc.)?
- How should beneficiaries be targeted and involved?
- What examples are there of policy instruments and institutions to facilitate the scaling up UPA?

The sourcebook is part of a set of stand-alone but linked products, which are as follows:

- This sourcebook covering UPA typologies and practices, scopes and benefits, recommendations and guidance related to: land/water/financial/labour resources, production practices, value-chain and marketing, resilience enhancement, governance and policy, multi-stakeholder collaboration and coordination.
- A report containing six case studies on UPA from across the globe, which provides an overview of impacts and the key requirements of a broad range of typologies and practice.
- A comprehensive matrix that includes examples and cases cited in the sourcebook, which have been organized and catalogued according to typologies and criteria.

The sourcebook defines UPA as:

“Urban and peri-urban agriculture can be defined as practices that yield food and other outputs from agricultural production and related processes (among others transformation, distribution, marketing, recycling), taking place on land and other spaces within cities and surrounding regions, involving urban and peri-urban actors, communities, methods, places, policies, institutions, systems, ecologies and economies, largely using and regenerating local resources to meet changing needs of local populations while serving multiple goals and functions.”

In short, UPA is defined as:

”The production of food and other outputs and related processes, taking place on land and other spaces within cities and surrounding regions.”

This definition builds on the most significant studies and experiences of UPA at the global level, and to better understand various types of UPA activities, this sourcebook defines the following typology, under which most examples reported are catalogued:

- Home-based gardening
- Community-based and other shared gardening
- Commercial crop production, livestock and fisheries
- Institutional food growing

These typologies are defined by the following characteristics and criteria:

- Primary scopes and functions
- Production practices, approaches and products generated
- Land use and management (including access and tenure)
- Use and management of water resources
- Labour and financial resources (including infrastructure)
- Marketing, distribution and use of products (household consumption, sale, processing...)

In challenging contexts such as urban environments, where there is competition for limited resources, UPA can play a key role thanks to its multiple scopes and benefits, spanning from food security and nutrition, social inclusion, education, livelihoods and employment, environmental functions, etc..

The niche of food production close to urban markets is filled by UPA. As it is adapted to an urban setting

thanks to the various low and high tech innovations that improve production, minimizing land and water use, for example digital and information and communication technologies (ICT) and advanced farming systems (e.g. zero-acreage farming).

The consumption of fresh food is promoted by UPA through improved access to fresh and nutritious food and through nutrition education on healthy diets.

Opportunities are also created for income-generation and employment. Urban horticulture, in particular, is key to improving the productivity of land, generating employment, strengthening the economic status of farmers and entrepreneurs, while substituting for imports, to meet consumers' demand for high-value products, such as vegetables, fruits, meat, dairy and processed food, for which more employment opportunities are created.

Social cohesion is also enhanced by UPA. Exchanges among local communities facilitate the inclusion of vulnerable groups through participation in allotments and community gardens, agritourism and inter-cultural gardens. Besides, UPA helps build recreational spaces where citizens can connect with nature and learn about agriculture.

Finally, UPA contributes to the greening of cities, helps reduce food miles, protects biodiversity, supports green infrastructure, builds a resilient local food system (via a short supply chain, low food loss during distribution), and mitigates the impact of shocks on local food systems.

A broad range of context-specific solutions are provided by UPA that respond to local needs and challenges in relation to production practices, land tenure and the management of soil and water resources; labour and finance; and marketing and distribution.

However, UPA has to compete with other sectors such as housing, infrastructure and industry for the use of scarce resources, (land, water and labour) in urban and peri-urban areas. In addition, farmers face challenges in terms of limited accessibility and availability of land, water and access to various services to help develop their activity. Land and water contamination can add significantly to the cost of developing UPA. Furthermore, limited finance and narrow access to credit can constrain the sustainability of UPA.

In order to scale up UPA and support farmers, institutions, development partners, non-governmental organizations (NGO) and others can take a variety of actions to promote UPA around the world.

Chapters 3 to 7 provide an overview and examples of key practices, challenges and actions that support UPA from the viewpoint of production, land, water, finance, labour and marketing.

UPA is part of the wider urban and city region food system, which touches on a wide range of urban management areas (e.g. land-use planning, environmental and waste management, economic development, public health, and social and community development), and involves a broad diversity of systems and related actors (input provision, vegetable production, aquaculture, livestock production, processing, marketing, waste management and resource recovery). This requires multi-stakeholder governance as well as integrated planning and policies that will ensure UPA becomes and remains part of a resilient urban food system. Key to this endeavour will be the effective collaboration and coordination across multi-sectors and levels of governance to ensure the successful development and implementation of UPA policies and initiatives.

INTRODUCTION TO THE SOURCEBOOK

Context

It is estimated that the global population will reach 9.7 billion by 2050, 70 percent of which will be living in urban areas. This rapid process of urbanization and population growth can directly lead to shrinking rural agrarian land and an increasing number of mouths to feed in cities, while indirectly relating to the rise of unhealthy diets and consequent health issues such as overweight, obesity and diet-related non-communicable diseases. Meanwhile, the population suffering from food insecurity and malnutrition is on the rise. In 2018, worldwide, 704 million people experienced severe food insecurity with the majority located in sub-Saharan Africa and Southern Asia, comprising 37.5 and 38.6 percent respectively of the total. Globally, 238.1 million children under five years are suffering various forms of malnutrition, while 2 billion adults are overweight (FAO, 2019a).

Havana, Cuba – An urban farmer cultivating crops at the peri-urban agriculture cooperative

©FAO/Vivero Alamar

According to the *State of Food Security and Nutrition in the World 2020* (FAO *et al.*, 2020), it was predicted that a further 83 to 132 million people would become undernourished because of the COVID-19 pandemic. The exacerbating climate change, increasing health crises and other shocks have threatened sustainable production and the supply of nutritious food to urban dwellers, urging the establishment of more resilient and sustainable food systems to meet the increasing demand for safe and nutritious food in cities.

Urban and peri-urban agriculture (UPA) is increasingly recognized as a key component of the resilience of City Region Food Systems (CRFS)[2] (FAO, 2019b) as it diversifies food supply chains, improves the livelihood of city dwellers, and brings about multiple benefits to sustainable urban development through local food production and short supply chains. Often, UPA is practised informally – or in some contexts illegally – usually there are no official statistics on UPA, or the people directly or indirectly involved. Despite this limited information, in many cities and regions growing research and awareness of the variety of food-growing practices is bringing to light the significant contributions made by UPA, even more so during the COVID–19 pandemic.

[2] A city region is defined as: "a larger urban centre or conglomeration of smaller urban centres and the surrounding and interspersed peri-urban and rural hinterland". A City Region Food System is defined as "all the actors, processes and relationships that are involved in food production, processing, distribution and consumption in a given city region" (www.fao.org/in-action/food-for-cities-programme/overview/crfs/en/).

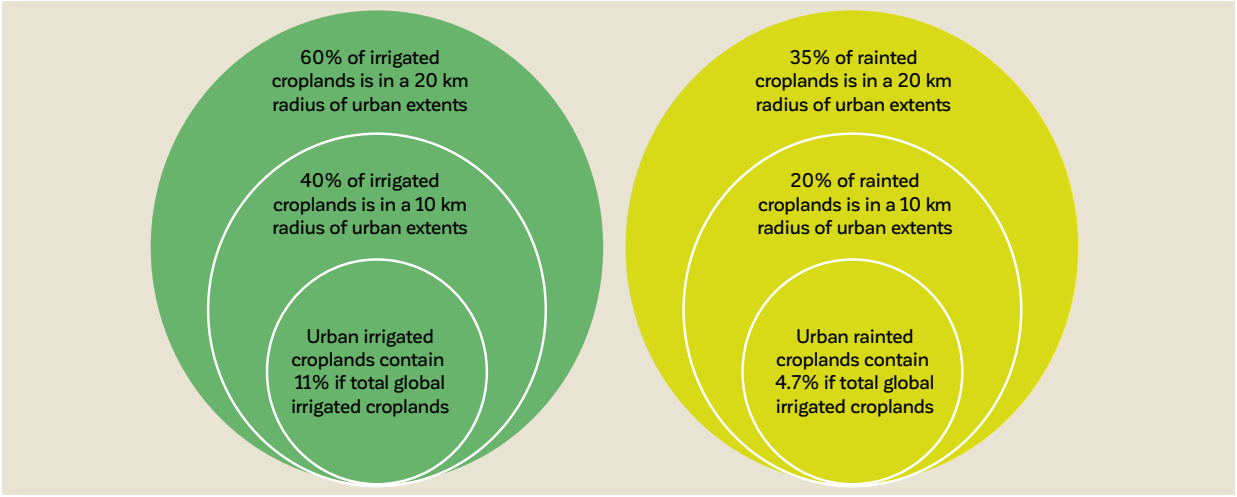
The terms “urban agriculture” and “peri-urban agriculture” are both used, sometimes interchangeably, without clearly defining what each term means. A major question for quantitative studies is where the urban and peri-urban areas start and end. Drechsel and Keraita (2014) suggest that “urban” refers to the administrative city boundary, while “peri-urban” is used for land outside the immediate perimeter of the city; emphasizing administrative considerations gives rise to issues of definition, since cities around the world are defined in different ways. Chapter 1 discusses the question of definitions; in this book, we use “urban and peri-urban agriculture” to cover a broader geographic and functional scope.

Although the role of UPA in local and global food security is increasingly acknowledged, its exact contribution and value often remains anecdotal and a topic for discussion. Research on UPA consists largely of case studies (as presented in this sourcebook), as UPA is rarely included in agricultural statistics. Thebo, Drechsel and Lambin, (2014) analysed global data to estimate the global area of urban and peri-urban irrigated and rainfed croplands. The global area of urban irrigated croplands was an estimated 24 million ha (11 percent of all irrigated croplands) with a cropping intensity of 1.48. The global area of urban rainfed croplands was approximately 44 million ha (4.7 percent of all rainfed croplands). It was shown that 60 and 35 percent, respectively, of all irrigated and rainfed croplands fall within the range of being 20 km from a city. The latest data indicate a global farm area of more than 60 million ha within urban agglomerations, as illustrated in the drawing below.

Karg and Drechsel (2018) studied the dependence of urban centres on their “hinterland” over several seasons for more than 50 commodities in several cities in West Africa. According to an analysis of more than 40 000 records of food flows in two cities, about half of basic urban food needs were met by farming within a distance of 100 km. Extending to 300 km, 80 to 90 percent of all food items were sourced for Tamale, Ghana and 60 to 80 percent for Ouagadougou, Burkina Faso. In comparison, an average processed food item found in shops and supermarkets travelled 3 700 km before reaching local shelves.

According to some early accounts (Smit, Ratta and Nasr, 1996), UPA was estimated to involve 800 million urban residents worldwide in income-earning and/or food-producing activities[3]. Based on a combination of national census data, household surveys, and individual research projects in specific cities, it has been estimated that one-quarter to two-thirds of urban and peri-urban households are involved in agriculture

Share of Urban and peri-urban land in total global agriculture land



Source: Thebo, A.L., Drechsel, P. & Lambin, E.F. 2014. Global assessment of urban and peri-urban agriculture: Irrigated and rainfed croplands. Environmental Research Letters, 9(11). https://doi.org/10.1088/1748-9326/9/11/114002

[3] This figure was estimated during Habitat II (1996); since then there has been no update.

(FAO, 1999). More recently, 40 percent of urban dwellers in African countries are engaged in some form of agricultural activity, and this percentage rises to 50 percent in Latin American countries (Zezza and Tasciotti, 2010). Given that the global population is around 8 billion, and a greater percentage of this population lives in cities, it is likely that well over one billion people in urban and peri-urban areas are growing food or are engaged in other agricultural activities.

Building on authors' current and past work

Since the late 1990s, when FAO was officially mandated to work on UPA, the Organization has been actively promoting UPA globally through multiple projects and initiatives[4]. The combination of these projects led to the creation in 2008 of the **Growing Greener Cities Programme**[5], which lasted for six years and enabled FAO to assist many low and middle-income countries with implementing UPA initiatives and optimizing urban farming production systems based on the local context. The programme also conducted a wide range of surveys on UPA in these countries: comprehensive findings are demonstrated in a series of FAO reports (FAO, 2012; 2014).

Growing Greener Cities programme aimed to recognize and integrate urban policy and planning into many creative initiatives developed by the urban poor to strengthen their communities and improve their lives. These objectives can be achieved by ensuring the political and institutional commitment and participation of all UPA stakeholders. An essential feature of UPA initiatives is green city planning in richer countries, and in a growing number of the low and middle-income countries. It is essential these initiatives are underpinned by appropriate policies so that access to land and water can be secured, as well as information and technologies to support sustainable production and markets created for the sale of products.

Over the past two decades, several countries have requested and received FAO's assistance in removing barriers and providing incentives, inputs and training to low-income urban farmers who reside in large cities and small towns in Africa, Asia and Latin America. FAO has implemented multidisciplinary projects to assist governments and city administrations optimize policies, institutional frameworks and technical support services for UPA, and improve production systems. FAO has promoted a broad range of practices and approaches that include irrigated commercial market gardening in urban peripheries, simple hydroponic microgardens in slum areas, green rooftops in densely populated city centres, urban-agroforestry practices and other approaches.

As the FAO programme has demonstrated in recent decades, along with many other organizations and researchers, agriculture can empower the urban poor, and contribute to their food security and nutrition. Agriculture can also help grow greener cities that are better able to cope with social and environmental challenges, from slum improvement and management of urban waste to job creation and community-development.

In the last decade, FAO has promoted and adopted a food system approach to implement agriculture related projects and initiatives. Building on the experience of the Growing Greener Cities programme and the key role of UPA, FAO and RUAF established the CRFS approach and developed the CRFS toolkit[6]. The **CRFS programme** promotes understanding of the wider food system and its vulnerabilities to climate change and pandemics, supports city, local governments and key stakeholders in the assessment and understanding of local food systems, in defining integrated policies and strategies and implementing actions to ensure improved sustainability and resilience with stronger urban–rural linkages. As part of this programme, FAO, RUAF and Rikolto have harnessed the potential of UPA as an entry point to reinforce local food systems by ensuring improved food and nutrition security for urban and peri-urban dwellers.

[4] These projects and initiatives have been in collaboration with other agencies, such as IDRC and GiZ, and with programmes such as RUAF and Urban Harvest.

[5] For more information see http://www.fao.org/ag/agp/greenercities/en/whyuph/index.html.

[6] For more information see http://www.fao.org/in-action/food-for-cities-programme/overview/crfs/en/

In September 2020, FAO launched the **Green Cities Initiative**[7] on the occasion of the Seventy-fifth Session of the United Nations General Assembly. The Initiative focuses on small, intermediate and metropolitan cities to improve people's well-being. This will be achieved through improving the urban environment, strengthening urban-rural linkages and the resilience of urban systems, services and populations to external shocks. While ensuring access to a healthy environment and healthy diets from sustainable food systems, the Green Cities Initiative also contributes to the mitigation of and adaptation to climate change. The Initiative supports the development of local government and community capacities, as well as those of national governments to implement and scale up coherent and context-specific strategies, policies and investment plans that promote improved UPA, forestry and sustainable food systems. The Initiative will drive and frame FAO's support to local and national governments in the upcoming decade to assist countries achieve the Sustainable Development Goals, especially SDG1 (No Poverty), SDG 2 (Zero Hunger), and SDG 11 (Sustainable Cities and Communities), under Agenda 2030.

The development of sustainable and resilient urban and peri-urban agriculture and city region food systems is supported by RUAF[8] which is a consortium of strategically selected expert institutions with a track record in UPA and urban food system solutions. The Partnership brings together cities, research institutes and civil society organizations. Celebrating 20 years since its formation in 1999, RUAF, led by the RUAF Foundation, has worked over 20 years with cities in more than 40 countries. The Partnership advises on multi-stakeholder policy and planning, provides services and builds the capacity of cities and stakeholders in UPA and city region food systems. Since 2000, RUAF has published the Urban Agriculture Magazine and has worked on several publications with key partners that have influenced policy agendas at the local and international level. In addition, RUAF has collaborated with FAO on many reports; played an important role in drafting the Milan Urban Food Policy Pact (MUFPP), and has successfully lobbied for the inclusion of urban agriculture and food systems in the New Urban Agenda (NUA).

Rikolto[9] (formerly VECO) is an international non-governmental organization (NGO) with more than 40 years of experience in partnering with farmer organizations and food chain actors across Africa, Asia, Europe and Latin America. Rikolto works towards a sustainable income for farmers and nutritious, affordable food for everyone by building bridges between smallholder farmer organizations, companies, authorities and other actors across rural and urban areas. With inclusive business facilitation as its main focus, Rikolto and its partners strive to develop innovative ways to access, distribute and produce nutritious, quality food, so no one is left behind. As part of its global Food Smart Cities programme, Rikolto aims to catalyse collective action among local actors for interventions in three priority domains: sustainable production of healthy and nutritious food; inclusive urban food markets that cater to smallholder producers and vulnerable consumers; and enabling environments that incentivize sustainable and healthy diets through policies and partnerships.

Carrot City is an initiative of Ryerson University's Department of Architectural Science, supported by its Centre for Studies in Food Security. It explores the relationship between design and urban food systems as well as the impact that agricultural issues have on the creation of urban spaces and buildings as society addresses the issues of a more sustainable pattern of living. Through a travelling exhibition, a website[10], a book (Gorgolewski, Komisar and Nasr, 2011), the initiative has documented practices related to the designing and building of urban agriculture around the world, working with numerous partnerships, including FAO's Food for Cities programme. Many case studies in this sourcebook are documented on the Carrot City website.

[7] For more information see http://www.fao.org/green-cities-initiative/en/

[8] For more information see www.ruaf.org

[9] For more information see https://www.rikolto.org/

[10] For more information see www.carrotcity.org

Purpose and audiences

The present publication catalogues the documented experience and evidence of UPA, organizes and analyses various existing cases and examples at the global level in order to set out the key lessons and provide recommendations and guidance for a wide range of actors involved in urban food systems. In particular, the publication aims to serve as a sourcebook and proposes targeting, in particular, local decision-makers, policy advisors, urban planners, specialists, practitioners and others involved in the design and implementation of production schemes, planning of urban food strategies, and policies on agriculture in urban and peri-urban areas.

The sourcebook gathers and analyses about 150 different examples of practices and typologies from various agroclimatic and socio-economic contexts that can be easily accessed, consulted and analysed in-depth. All cities and urban regions around the world are different, and the characteristics of UPA in each city region are specific to the context of a particular city region and may play different functions in each locale. This great variety of UPA within and across cities and regions is reflected in the book. The inclusion of a range of cases from the past couple of decades is intended to inspire various urban actors in their respective roles. Although many other relevant cases have not been included, and some of these may not be pertinent to a particular city, the overall set of examples found in this sourcebook – and particularly in its central section – outline the range of practices, challenges and forms of interventions that can enable UPA to play an ever more significant role in cities and their regions.

Based on concrete cases, this publication will answer the following questions:

- What is UPA?
- What are the benefits and impacts of UPA?
- Why and where to invest in UPA?
- What options are there for different contexts and scopes?
- What are the requirements and conditions for implementation (natural resources, finance, labour, etc.)?
- How should beneficiaries be targeted and involved?
- What examples are there of policy instruments and institutions to facilitate the scaling up of UPA?

However, in view of how extensive, diverse and complex UPA typologies, practices and experiences are globally, we recognize there are limitations and gaps in this book. Such gaps are clarified in the following section.

Structure and methodology used in the sourcebook

Structure and methods

The book is part of a set of stand-alone, linked products as follows:

- A **main report** (this book) in which typologies and practices of UPA, scopes and benefits are defined. Guidance is provided on design and implementation, taking into consideration aspects and practices related to: land-use planning, water resources management, financial and labour resources, production and agronomic practices, value-chain and marketing, resilience enhancement, governance and policy, multi-stakeholder collaboration and coordination.
- A **report detailing six in-depth case studies** of urban and peri-urban agriculture from across the globe to provide an overview of the impacts and key requirements of a broad range of UPA typologies and practices (see Annex 1 for an overview of the report).
- A **comprehensive matrix** that includes examples and cases cited in the sourcebook, organized and catalogued according to typologies and criteria (see Annex 2 for an overview of the matrix). The matrix is organized flexibly so as to allow further evidence to be collected and enriched at a later stage.

Literature review

Secondary data collection was conducted based on a range of existing sources (see References and Matrix), including academic research articles, publications by international organizations and institutions such as FAO and RUAF, open access databases such as European Cooperation in Science and Technology (COST)-Action Urban

Agriculture Europe[11] and Carrot City[12], the MUFPP city case collection[13], public websites, as well as relevant materials from FAO's Technologies and practices for small agricultural producers (TECA) platforms. A total of almost 300 publications and materials were collected from online databases and analysed. Representative cases have been extracted and presented in the relevant sections of this sourcebook.

In-depth case studies

For the purpose of this sourcebook, six new in-depth case studies on urban and peri-urban agriculture were produced for Leuven (Belgium), Quito (Ecuador), Tegucigalpa (Honduras), Surakarta (Indonesia), Dakar (Senegal) and Arusha (Tanzania). All six cities are partners in Rikolto's Food Smart Cities programme[14], which aims to connect smallholder farmers to urban markets and improve citizens' access to healthy, sustainable and nutritious food.

Following an initial review of the literature, and a collection of primary biophysical and socio-economic data, several tools were developed to collect the information needed for the case studies: two qualitative surveys to guide semi-structured interviews with UPA practitioners and local authorities, and a quantitative questionnaire for UPA practitioners focusing on production and commercialization practices. UPA practitioners represent four types of gardens: commercial farms, home gardens, institutional gardens and collective gardens (allotments/community gardens). Between 20 and 30 respondents were interviewed in each city. The quantitative data were collected and analysed by local consultants using Kobo Toolbox, an online platform connected to smartphones and tablets that facilitates the aggregation of information in a central interface.

Data collection took place during the global COVID-19 pandemic, requiring the team to find innovative ways to connect to respondents.

Insights and examples from the case studies are reported in different chapters and sections of the sourcebook. A summary of each individual case study can be found in Annex 1.

Areas for further development

In view of how extensive, diverse and complex the UPA types, practices and experiences are at the global level, we recognize a number of limitations in this book. The examples used and the analysis and recommendations proposed, present a few aspects have been emphasized less so as to enable a relatively concise publication. There are also a few knowledge gaps related to finding or accessing documented examples and their systematization. For either of these reasons, it is acknowledged that there are limited areas in this book, which will benefit from further development in future updates.

Furthermore, some examples in this book are from some years back, but serve to illustrate the points made, while others are more recent. Moreover, UPA relates to many dimensions, touching on all of them equally would have led to a much weightier publication that could not have been completed in the time, and with the resources, available for this project. However, the book is structured in a flexible and open manner that will allow FAO and the authors to update and enrich the publication in the future, as further evidence is collected.

[11] For more information see www.urban-agriculture-europe.org/online-atlas.html

[12] For more information see www.ryerson.ca/carrotcity/index.html

[13] For more information see www.milanurbanfoodpolicypact.org/award/

[14] For more information see www.rikolto.org/en/focus-areas/food-smart-cities

PART ONE

OVERVIEW

1

WHAT IS URBAN AND PERI-URBAN AGRICULTURE?

1.1 Definitions

1.1.1 Characteristics

Food production in and around cities has been present as long as histories have recorded cities. However, "urban agriculture" as an expression and a concept came into common use relatively recently and began to take hold during the 1990s.[15] While there is no universally agreed-upon definition of urban and peri-urban agriculture (UPA), a great variety of agriculture practices are covered within and surrounding the boundaries of cities,[16] which compete for resources (land, water, energy, labour) and serve other purposes to satisfy the requirements of the urban population. Important UPA sectors include horticulture, livestock, fodder and milk production, aquaculture and forestry. Also included are non-wood forest products, as well as ecological services provided by agriculture, fisheries and forestry, therefore, the term UPA should be understood to be inclusive unless otherwise specified.

One of the most frequently cited definitions of UPA (Mougeot, 2000) integrates many of these elements:

> "Urban agriculture is located within (intra-urban) or on the fringe (peri-urban) of a town, a city or a metropolis, and grows or raises, processes and distributes a diversity of food and non-food products, (re-) uses largely human and material resources, products and services found in and around that urban area, and in turn supplies human and material resources, products and services largely to that urban area."

[15] The term "urban agriculture" was used occasionally prior to 1990, but in the 1990s, the term became more common and a global awareness of the concept coalesced.

[16] Multiple terms have been used in different ways by various people in sundry publications. So, "urban agriculture" is sometimes meant to include peri-urban areas, other times not. Some use "peri-urban" as opposed to "urban," while others use the term in contrast to "intra-urban." In this book, we use "urban and peri-urban agriculture." Some publications use "urban agriculture" with the same meaning – we maintain this term when quotations containing the words are used, as in Box 1.

BOX 1

Key elements of urban agriculture

According to Quon (1999) and Smit, Ratta and Nasr (2001), the following key elements may be included in definitions of urban agriculture (UA):

Location: The definition should specify the location UA can occur, and provide clear criteria about how to identify the urban or peri-urban area.

Activities: The definition should specify the types of activities included under UA (e.g. production of food or non-food items, and more specifically, production of plants versus animals, and gathering versus production).

Landownership, legality: The definition should specify whether UA includes legal (versus illegal) agricultural activities, agriculture on both private and public land, and for private or public use and consumption.

Stage: The definition should specify the stages of production included (e.g. growth and harvesting of products, or also processing, marketing and distribution).

Scale: The definition may specify the scale of activities included (e.g. maximum and minimum area encompassed by the activity).

Purposes of the activity and **types of groups** involved in agricultural production in urban areas, especially important for lower income groups.

Source: Quon (1999), Appendix 1; and Smit, Ratta and Nasr (2001), Ch. 1.

In the last two decades, it has been suggested that the different aspects of UPA need to be analysed to help us arrive at a definition. As part of the Urban Green Train[17] course materials, the following are proposed as core aspects of UPA (Kuhns *et al.*, No date, Module 1, p. 10).

- Crop production, raising animals as well as fish-farming in and around cities.
- Food production as well as non-food production (flowers, trees, pot plants for example).
- Processing and marketing of food and non-food products produced in and around the urban area.
- Use of compost and (treated or untreated) urban wastewater as resources.
- May take place on open land in the city as well in backyards or on rooftops.

Recently a significant effort has been made to investigate UPA more deeply, to this end the European COST Urban Agriculture programme[18], a working group of researchers from across the continent, have been focussing on the question of definition (Lohrberg *et al.*, 2015).

[17] The Urban Green Train project, led by the University of Bologna, seeks to encourage pioneering business-oriented initiatives on urban agriculture. The project is based on knowledge exchange, cooperation and innovation among small and medium enterprises, policy-makers and institutions of higher education. See https://site.unibo.it/urbangreentrain/en.

[18] For more information see http://www.urban-agriculture-europe.org/

Belgium. Horticulture in Leuven

1.1.2 Definitions

Over the years attempts have been made to define UPA, which have emphasized its dynamic, rather than static, nature and, as a result, definitions need to recognize that UPA is constantly evolving. The concept is dynamic and comprises a variety of farming systems, ranging from subsistence production and processing at the household level to fully commercialized agriculture.

Innovative trends continue to emerge at both ends of the spectrum across the UPA panorama. UPA exists within heterogeneous resource situations, e.g. where there are scarce as well as abundant land and/or water resources and under a range of policy and institutional environments that can be prohibitive or supportive to its existence and development.

As UPA takes various forms in different cities, it is best defined locally (Kuhns *et al.*, No date, Module 1, pp. 9-10). For the sake of this sourcebook, a definition is sought that can assist practitioners and city actors, notably urban decision-makers and planners, so they can share a common meaning and cope with the rich field of different expressions inherent in UPA.

Here two definitions are offered, one is concise and limited to the essence of UPA and the other is longer, which encompasses a more comprehensive coverage of what is meant when referring to UPA. These definitions are inspired by those shared in this chapter, and others that have been suggested over the past three decades.

BOX 2

Short and long definitions

Short definition:

Urban and peri-urban agriculture can be defined as the production of food and other outputs and related processes, taking place on land and other spaces within cities and surrounding regions.

Long definition:

Urban and peri-urban agriculture can be defined as practices that yield food and other outputs from agricultural production and related processes (transformation, distribution, marketing, recycling...), taking place on land and other spaces within cities and surrounding regions, involving urban and peri-urban actors, communities, methods, places, policies, institutions, systems, ecologies and economies, largely using and regenerating local resources to meet the changing needs of local populations while serving multiple goals and functions.

1.1.3 Urban agriculture, peri-urban agriculture, rural agriculture

Overtime, the question related to the "urban" in UPA has been subject to confusion, debate and different interpretations and delimitation. The term is often presented in contrast to what it is not. The distinctions can be stated as a polar divide (A versus B) or as a gradual continuum (range from A to B). Moreover, this contrast takes two principal forms: an external distinction (urban/rural) and an internal (intra-urban/peri-urban)[19]. These two types of distinction will be addressed in succession.

Frequently, UPA is described in opposition to rural agriculture. UPA is defined by typical characteristics that are commonly found – and implicitly or explicitly, are not found or found less often in rural agriculture. The central characteristics in the way "urban" is defined in relation to agriculture – as well as "rural" have varied considerably between authors. For Smit, Nasr and Ratta (2001), urban is used broadly to encompass the entire area a city's sphere of influence (social, ecological, and economic) comes to bear daily and directly on its population. For Mougeot (2000), the most important distinguishing feature of UPA is that it is an integral part of the urban economic, social and ecological system, using urban resources (land, labour, urban organic wastes, water), and is strongly influenced by urban conditions (policies, competition for land, urban markets and prices). Table 1 provides an overview of the main differences and common features of rural agriculture and UPA.

TABLE 1 **Agriculture in rural and urban situations**

	RURAL AGRICULTURE	URBAN AND PERI-URBAN AGRICULTURE
Farm types	Conventional; farms comprising interdependent subunits	Unconventional; partly mobile; partly without soil; more specialized independent units acting in cluster/chains
Livelihood	Faming is a primary livelihood; farmers engaged full-time	Farming is often a secondary livelihood; farmers often work part-time only
Farmer type	Usually "born farmers"; strong traditional knowledge	Some are "beginners": urban citizens engaging in agriculture by necessity or by choice (entrepreneurs); others are recent migrants with weak traditional knowledge
Products	Mainly staple crops; cattle, sheep	Perishable products, especially green vegetables, dairy products, poultry and pigs, mushrooms, ornamental plants, herbs, fish, etc.
Cropping calendar	Seasonal periods	Crops grown year-round (irrigated)
Production factors	Low land price; lower cost of labour; high cost of commercial inputs; variable cost of water	High land price, land scarcity; higher costs of labour; lower costs of commercial inputs; high cost of clean water; availability of low-cost organic wastes and wastewater
Farmer organization	Often already in place and more easy to accomplish since farmers share the same social background	Often lacking and more difficult to accomplish since farmers are dispersed and from greatly varied social backgrounds

[19] Sometimes referred to simply as urban/peri-urban. Both distinctions are commonly made. In this section, to avoid confusion, we use intra-urban instead of peri-urban.

	RURAL AGRICULTURE	URBAN AND PERI-URBAN AGRICULTURE
Social context	Community; most families engaged in farming and share a common social background; more homogeneous; relatively stable; few external stakeholders; farmers are more organized	Urban farmers often undertake activities outside their own neighbourhood. The percentage of households engaged in farming in a neighbourhood is highly variable. Urban farmers vary in socio-cultural backgrounds. Highly dynamic environment with strong fluctuations; many external stakeholders with different interests and contrasting views of UA; farmers are hardly organized
Environmental context	Relatively stable; land and water resources rarely polluted	Fragile; often polluted land and water resources
Availability of research and extension services	More likely (although declining)	Barely available, but individuals may gain direct access to libraries, research organizations, market information, etc.
Availability of credit services	More likely (although possibly for larger farms and mainly for men)	Barely available, but credit services are available for the informal sector and may assist farmers, including women
Market	Distant markets; marketing through chain; low degree of local processing	Closeness to markets; direct marketing to customers possible; higher degree of local processing (including street foods)
Land security	Relatively high	Insecure; often informal use of public land; competitive land uses

Source: De Zeeuw, 2004.

By analysing the distinctions between urban and rural agriculture, the divide between them can be emphasized. In contrast, the relationship between urban and rural, as pertains to agriculture and food can be portrayed in terms of a long and complex gradation.

> "Lengthy discussions on the precise borders between urban, peri-urban and rural systems are not very fruitful; in most cases we will find a continuum from intra to urban and rural agriculture comprising various farming systems."
> (Kuhns *et al.*, No date, p. 12).

The growth of the continuous view is tied to a systemic approach and to the emergence of the concept of city region food systems. The continuous view shifts from an emphasis on the production of food to a broader understanding that goes beyond, considers the chains in the food system as well as a broader spatial understanding that places cities within a regional panorama[20].

The other commonly found distinction that relates to UPA is internal, contrasting agriculture within (intra-urban) or on the fringe (peri-urban) of a town, city or metropolis[21].

(Intra-)urban agriculture takes place within the built-up city. In most cities and towns, vacant and under-utilized land is or can be used for urban agriculture, including areas that are not suited for building (along streams, railroads, under electricity lines); idle public or private land (reserved for future use, speculation, or land awaiting

[20] Other concepts have been suggested in the past couple of decades that contribute to this expanded thinking, including Bohn and Viljoen's *Continuous productive urban landscapes*, de la Salle and Holland's *Agricultural urbanism*, Verzone and Woods' *Food urbanism*, and Petrescu and Petcou's *R-Urban*.

[21] Adding to the confusion is that some authors apply the term "urban agriculture" more narrowly to intra-urban agriculture (as opposed to peri-urban), while others use the term more broadly to include peri-urban agriculture (as opposed to rural).

construction) that can be used in the interim, community land and household areas. Areas cultivated tend to be small and farming systems mainly have a subsistence or recreational nature (backyard gardening and raising animals on household plots or balconies, small-scale gardening on vacant public land) or are highly specialized (e.g. nurseries of ornamental plants in parks, production of herbs and medicinal plants on rooftops[22], production of mushrooms in cellars). While the economic effect of urban agriculture is difficult to measure and may be limited, the effect on food security is often significant.

Peri-urban agriculture takes place in the urban periphery. Peri-urban spaces act as a transitional zone between the inner city and the countryside; they tend to undergo dramatic change over time: land prices rise, there is an influx of people both from rural and intra-urban areas,[23] density increases, multiple land-uses emerge and construction spreads. Such changes impact the original agricultural production systems, which tend to become smaller with more intensive production and there is a shift from staple to more perishable crops and animal production to serve a growing urban market (meat, eggs, milk). Peri-urban agriculture tends to be more intensive (with more use of protected cultivation techniques) and commercially oriented, providing a substantial number of jobs and higher income than urban agriculture. It may also significantly contribute to food security and nutrition.

This sourcebook recognizes that, typically, there is a continuum between the intra-urban and the peri-urban, just as there is between the urban and the rural. Understanding the differences across the continuum from the core of a city to the edge of its hinterland is important for any actors who may impact UPA, from planners to decision-makers, to determine the geographic scope of their interventions and grasp what this may entail for practitioners.

1.2 Typologies

1.2.1 Rationale for identifying urban and peri-urban agriculture types

> “Although the structure of types varies across cultures, the activity of typing frames knowledge and facilitates living within all societies.”
> Franck and Schneekloth (1994, p. 15)

Having analysed different grounds for, and approaches to, defining (intra-)urban and peri-urban agriculture overall, the next step is to break it down into different categories, classes or forms. It is useful to be able to differentiate between different types of UPA and to know the common characteristics within each type. This also serves to help understand the location-specific nature of UPA as well as to provide a basis to construct a typology of UPA systems – a broad classification that can organize knowledge – to distinguish between different forms of UPA and to compare between cities and their regions.

> “Typologies may be an efficient tool in the planning and management of urban agriculture and areas affected by urban agriculture. In order to target policies, schemes, rules and regulations, we need information of which type of urban agriculture we are dealing with; i.e. the spatial location, functional profile, origin, market role, the character of the farmer and the stakeholders involved.[24]”

However, UPA involves many actors, comprises many growing techniques, produces a wide variety of products, takes place in all kinds of places, employs many organizational arrangements, and serves multiple functions. Therefore it is essential to identify the key criteria of the different typologies. Categorization of UPA can be based on a range of features such as location, scale, objective, ownership, crop or animal varieties, land

[22] Rooftops have emerged as an especially important and varied space within urban agriculture – for a panorama of the diversity of rooftop agriculture, see Orsini et al. (2017) and the section on Rooftops in www.carrotcity.org and in Gorgolewski, Komisar and Nasr, (2011).

[23] Pressure on agricultural land in peri-urban areas comes from both directions. Rural migration is a major source of population and economic pressure – but so is the flight of urbanites from city centres that is commonly observed across the globe.

[24] From: www.urban-agriculture-europe.org/mediawiki/index.php?title=Definition_of_Urban_Agriculture&oldid=110

tenure situation, production intensity and so forth (Palmer, Santo and Brent, 2016; Pearson, 2010; Veenhuizen and Danso, 2007). Different UA types would vary in terms of the actors involved, their use of resources, location, functions, technical aspects, development challenges and need for support. A construction of UPA typologies should also consider different production systems as well as input supply, processing and marketing systems linked to urban agriculture.

These building blocks have served as foundations for many typologies over the years. A small selection of typologies can convey a sense of the range of approaches to such constructions, and the different decisions concerning the particular considerations used as the key around which UPA types are defined. The selection demonstrates that "there is not a standardized approach to categorize UPA due to the multiple layers of practices and characteristics featuring specific UPA gardens/farms" (Kuhns *et al.*, No date, Module 1, pp. 56-57). This selection of typologies demonstrates the multiple ways to assemble types of UPA into typologies.

The Smit, Nasr and Ratta book (1996; 2001), which is in effect an assemblage of typologies, starts with a classic use of the who/where/what questions; however, in the "where" chapter the complexity of a seemingly simple question is shown by breaking it down into multiple spatiotemporal dimensions (types of spaces used, duration of use, metropolitan location, land access and tenure). The Ryerson University course on Understanding Urban Agriculture first makes this division based on production systems – increasing gradually in scale and complexity and moving from individual to communal to commercial purposes – then according to types of input and output systems – roughly proceeding along the value chain.

The COST programme establishes a dichotomy between the broad categories of urban farms and urban food gardens, before establishing a typology based heavily on purpose (leisure, therapy, environment, education...), with a few outliers such as allotments (Lohrberg *et al.*, 2015). Building partly on the COST analysis, the Urban Green Train course for entrepreneurial urban agriculture emphasizes "business forms" to create a hybrid typology that mixes multiple characteristics (Kuhns *et al.*, No date, Module 3). Nasr, Komisar and de Zeeuw (2017) provide a "panorama of rooftop agriculture" structured on a two-step hierarchy: the upper layer differentiates projects based on purpose, and within each of the resulting categories, a lower layer identifies specific types that combine locations with other characteristics.

1.2.2 Typologies adopted by this sourcebook

This sourcebook has adopted four broad categories of typologies. These are listed here, and then briefly outlined below[25]. These categories are admittedly very broad, each one encompassing multiple types. Moreover, the four categories are not distinguished completely from each other (some types may overlap for some aspects) and they may not cover all types of UPA. As needed, specific types are mentioned or analysed in the remainder of the book, which the reader can adapt and revise to fit their local context.

- Home-based gardening
- Community-based and other shared gardening
- Commercial crop production, livestock and fisheries
- Institutional food growing

Home-based gardening is usually the most common type in urban and peri-urban areas, although data are lacking especially for this type. Home-based gardening contributes to household food security and nutrition by providing direct access to fresh and nutritious food that can be harvested, prepared and fed to family members. It is usually practiced on small areas in or on the house (balcony, windowsill, cellar, rooftop, and kitchen) as well as around the house (front and backyard, patio). Gardening may be performed with limited economic resources, using locally available planting materials, home composting, climbing plants on trellises or fencing, and indigenous methods of pest control. Thus, at some level, home gardening is a production system that the poor can enter easily. Gardening provides a diversity of fresh food, mainly horticultural

[25] These categories are drawn in particular from the analysis of the Urban Green Train project (Kuhns and Renting, 2017) and the Ryerson University course on Practicing Urban Agriculture.

products, which improve the quantity and quality of nutrients available to the family while saving on the household budget.

Community-based and other shared gardening can be found in different forms around the world. Community gardens and allotments are the most common labels for communal growing spaces in the richer Anglophone countries, with counterparts in cities of the Global North. Communal gardens are often on public, vacant or open land in the city. Land may be along railways and roads, under power lines, on the grounds of community centres, churches, and in public parks and other green areas. Some shared gardens or small plots are also found on rooftops, inside apartment complexes, or in other denser contexts. Food products such as vegetables, fruits, herbs, and occasionally small livestock are produced for home consumption, leisure, health and educational purposes, or within the context of community development programmes. Communal gardens involve poor as well as higher income families, individuals, older people and recent migrants, among others.

Commercial crop production, livestock and fisheries are very common types of UPA around the world. Typically UPA practitioners are involved in horticultural production because of the high demand for fresh vegetables and fruits, and the comparative advantage given the proximity to urban markets. Growers in and around cities typically have access to better infrastructure, technical advice from institutions, market information, and, possibly, financial support. Commercial food producers in urban and peri-urban contexts range from small family-based growers (sometimes just one individual works part-time) to faster growing companies (often in peri-urban areas) that leverage outside financing and operate slightly technical, controlled-environment agriculture operations at multiple sites.

Cultivation practices vary widely, from intensive cultivation of greens and specialty vegetables in a controlled-environment on rooftops or building facades to indoor mushroom production, from large-scale greenhouses focussing on vegetables to aquaponics in light industrial buildings. Some forms of commercial livestock and fisheries are more common in peri-urban areas rather than urban, given the greater availability of land. Livestock producers generally prefer smaller,

The Republic of Indonesia.
Home gardens

Viet Nam.
Community gardens, the Trac Van Cooperative

Paris, France. A sample of commercial urban agriculture. Here different lettuce varieties are cultivated on the outskirts of the capital

short-cycle animal species, such as poultry, rabbits, guinea pigs, as well as mid-sized livestock such as pigs, sheep and goats, although cattle and even buffalo are also raised for meat or dairy production. Urban aquaculture systems can be associated with a multitude of different production locations, species used, environment, and production intensity in rivers, ponds, lakes or canals.

Institutional food growing covers a wide variety of gardens and farms around the world. It includes projects on institutional land belonging to schools, universities, religious bodies, prisons, municipalities and other governments, public authorities, hospitals and clinics, prisons, among others. The projects include gardens for own consumption, therapy, leisure, development of knowledge and skills, and job creation, as well as commercial farms for profit and economic development. A few institutional projects are set up and managed by the institutions themselves; in other cases, institutions provide land and other support (from water to training) to projects that have been established by diverse groups, while in other instances, institutions simply lease the land or offer it for free.

To highlight one subset of institutional food growing, educational gardening covers a particularly wide range of forms. School and university gardens offer an important opportunity for ecological and nutritional education. In these non-traditional learning environments, youth become familiar with healthy and nutritious food, especially fruits and vegetables. Programmes in these gardens teach skills and establish a lifetime hobby that provides exercise, mental stimulation and social interaction. Some schools and universities have teaching farms that incorporate marketing skills and advanced knowledge. Beyond schools and campuses, educational urban agriculture includes extension services for farmers, rehabilitation for troubled youth and former convicts, and intergenerational learning.

Amman, Jordan.
An example of urban animal husbandry shows goats grazing on the citadel in the city centre

These typologies are characterized in this sourcebook by the following criteria:

- Primary scope and function
- Production practices, approaches and products generated
- Land use and management (including access and tenure)
- Water resources use and management
- Labour and financial resources (including infrastructure required)
- Marketing, distribution and use of products (household consumption, sale, processing...)

Table 2 gives an overview of key characteristics of each type of UPA based on the criteria. Chapter 2 and Part III of the Sourcebook analyse the different characteristics in depth, drawing on specific examples from across the globe. Note that the characteristics vary significantly across contexts and may differ greatly from the table for particular countries and cities.

TABLE 2 General characteristics of types of urban and peri-urban agriculture

Criteria types	Primary purposes and functions	Production practices	Land use and management	Water resources use and management	Labour, financial resources	Marketing, distribution
Home-based gardening	• Complementary food supply and nutrition • Leisure • Income-generation, greening	• Conventional agricultural practices in backyards • Microgardening, growing in containers • Agroecological practices	• Creative use of household spaces and surfaces (backyards, rooftops, terraces, etc.)	• Water-saving techniques • Low-cost irrigation practices • Challenges: potential risk of use of unsafe water	• Often practitioners are women • Commonly older practitioners • Financial implications: cost of inputs and supplies	• Self-consumption • Direct sale and to local market for surplus production • Challenges: potential regulatory constraints to food safety)
Community-based and other shared gardening	• Complementary food supply and nutrition • Leisure • Income-generation, greening • Social inclusion, community building	• Conventional agricultural practices in backyards • Microgardening, growing in containers • Agroecological practices	• Vacant land • Public or communal land • Informal or joint ownership	• Shared irrigation equipment • Water-saving techniques • Challenges: potential risk of use of unsafe water	• Often female practitioners • Hired labour • Volunteers Financial implications: shared cost of inputs, supplies and equipment	• Self-consumption • Direct sale and local market with surplus production • Challenges: potential regulatory constraints on food safety)
Commercial crop production, livestock and fisheries	• Income-generation • Livelihoods • Employment	• Innovative intensive agricultural techniques adapted to urban setting • Resource-saving techniques in controlled environments • Protected cultivation	• Government approved land use (rent or purchase) • Own land next to water sources. • Creative use of vertical surfaces (e.g. mechanized hydroponic systems)	• Water-saving techniques and efficient irrigation equipment and practices (e.g. motor pumps, drip irrigation, etc.)	• Hired labour • Seasonal farmers (harvesting particularly, including women, immigrants, refugees, etc.) • Financial implications: costs related to inputs, labour, marketing and possibly labelling	• Wholesale market, local supermarket, etc. • Local and regional marketing and labelling
Institutional food growing	• Institutional food supply • Greening public spaces • Nutrition education • Demonstration, training and capacity-development	• Agroecological practices • Innovative agricultural techniques • Research and experimentation, hands-on learning	• Institutional land as main source of available land for agriculture • Contracts/ lease arrangements • Green infrastructure • Challenges: Institutional regulations constrain access to land, liability, safety requirements	• Water-saving techniques • Low-cost irrigation equipment	• Employees, hired • Experts • Volunteers, students, educators, etc.	• Public catering • Local market • School canteens, etc.

1.2.3 Use of urban and peri-urban typologies

This sourcebook adopts the UPA typologies shown in Table 2 to organize, classify and cluster the different case studies and examples reported in the following chapters.

Having dissected the purposes and principles of UPA typologies and their analyses, by giving examples of how types can be constructed and clustered according to (more or less) coherent principles, this chapter concludes by considering how typologies can be used and how they can be communicated to others.

Beyond the usefulness of organizing knowledge and making sense of where practices fit in space, in society, in the economy, and beyond, typologies can be important for measuring relevance, defining and shaping policies and directing actions. To use one example, indicators for analysing urban agriculture would have to select types that are pertinent to a particular analysis. For instance, social measures may focus on school or community gardens and those for horticultural therapy, whereas economic measures may need to consider different types of indoor farms, production techniques and value-chain practices. In defining or selecting a UPA typology, an analyst would need to keep in mind the main audience targeted for its use (decision-makers, urban planners, practitioners) and tailor different typologies to this audience such as resource allocation and investment, land-use planning and socio-economic development.

Moreover, it is essential to define and differentiate between the different types of UPA so as to shape its future – to capture its potential (e.g. by helping municipal economic development officers to become aware of emerging types of urban food production) as well as to address challenges faced by anyone practicing UPA (by reviewing zoning codes to identify the definition of permitted uses in different zones).

> "Only then, planners, policy-makers, development organizations and others can better identify the type of support measures appropriate for the further development of specific types of urban agriculture. For instance, providing micro-credit may not be the best form of financing for a poor family that undertakes UA at subsistence level, on a plot that is not their own, and that is not capable of repaying a formal loan. On the other hand, a small cooperative composed of farmers aiming for expansion of their UA activities would need forms of financial support that go beyond the provision of free access to seeds or other equipment. Thus, it is necessary to get an in-depth conceptual understanding of these types of UA in order to select the appropriate financing and support mechanisms for each of these types."
>
> (Kuhns *et al.*, No date, Module 1, p. 10)

Typologies are not only useful to researchers, policy-makers and various professional actors – they are also relevant to those who practice UPA. Awareness of being part of a large, varied and multifaceted movement can help place what a practitioner does within a broader universe of practices, locations, motivations, outputs, etc. This can help practitioners feel less isolated, help them to learn from others who share typological characteristics, and to consider how their practice can evolve and diversify by fitting other types. Practitioners can even go about starting their own typology in relation to the local context.

Finally, typologies are not simply useful as mental constructs – their usefulness would be limited if they cannot be communicated to others. Representations of typologies are vital in order to establish shared concepts of UPA, to frame the disparate forms in a larger whole, to convince others of the connections between the different practices, to enable inclusive multistakeholder processes, among others. Representations can include very different techniques: lists, tables, figures, diagrams, artistic sketches, maps and collections of photos.

2

SCOPE AND BENEFITS OF URBAN AND PERI-URBAN AGRICULTURE

A global assessment of UPA in 2014 estimated 266 million urban households are involved in crop production in developing countries, and 68 million ha of land within 20 km of urban centres are under cultivation worldwide (Thebo, Drechsel and Lambin, 2014).

Initially, the recognition of the important role of UPA focused on the global South, where significant levels of the urban population have been long active in food production in and around East African cities (Sanyal, 1986; Lee-Smith *et al.*, 1987; Rakodi, 1988; Sawio, 1993; Foeken, 2006; Cole *et al.*, 2008; Prain, Karanja and Lee-Smith, 2010).

Moreover, the primary focus of this recognition was on the contribution UPA makes to food security and nutrition and its importance during crises. In the past two decades, as the attention being placed on UPA has been growing in both the global South and North, as well as the awareness that the scope of UPA initiatives worldwide is no longer limited to food production for food and nutrition security, but spans the much broader perspective of social, educational economic, environmental functions/objectives that benefit city development and citizens' livelihoods. It has become clear that food production in and around cities has multiple values and benefits.

Chapter 2, briefly overviews some of the key dimensions of UPA and the multiple values and benefits that UPA offers. In particular, the chapter focuses on the opportunities that UPA offers to promote innovative, resilient and resource-efficient production practices and technologies, to contribute to food security and promote healthy diets, to create opportunities for employment and income-generation activities, to foster social inclusion and cohesion, to promote awareness and education of healthy diets and finally to contribute to the urban metabolism and resilience of local food systems through greening the cities and shortening supply chains. Other dimensions that have not been covered in this limited space include aesthetic, therapeutic, recreational, ornamental and other aspects.

Using the SDGs as a framework, it is shown how UPA contributes to global food security linked to SDG 2 for better nutrition; biodiversity and ecosystem services linked to SDG 15, and climate adaption and mitigation linked to SDG 13 for a better environment; poverty alleviation linked to SDG 1 for a better life, and sustainable consumption and production linked to SDG 12 for better production. Existing or potential trade-offs and synergies are highlighted in comparison to industrial farming.

As mentioned before, UPA is central to FAO's current mission to support transformation to more efficient, inclusive, resilient and sustainable agrifood systems, by mainstreaming green innovation under four strategic axes of the FAO Strategic Framework – Better Production, Better Nutrition, a Better Environment and a Better Life[26].

2.1 Better production

UPA is part and parcel of the urban fabric. Attention to UPA increased in recent years in response to a call for the required transformation of the globalized food system to enhance access and availability of nutritious food, re-building of communities, reduction of the carbon footprint, attention to biodiversity and regeneration of urban and peri-urban soils as part of resilience.

Often, UPA has been proposed as a solution to some of these issues, for example by producing food where the population density is highest, reducing transportation costs, connecting people directly to food production and using urban areas efficiently (including areas not suitable for construction or other urban purposes). Growing food in urban and peri-urban areas for human consumption can complement the global food supply for a growing population and address concerns related to global food security. Also, UPA helps meet demands created by trends in urbanization and economic development, such as changing dietary habits and competition for natural resource use (land, water, space, etc.), which require sustainable and resilient production.

Better production is always adapted to an urban setting, the urban market, limited access to land, and its relation to better nutrition, the environment and a better life.

Specific and different production approaches are implied by UPA, as compared to rural agriculture, because production practices are required that optimize the use of scarce resources such as land and water and minimize post-harvest losses thanks to the shorter supply chains.

In this respect, innovative approaches to food or non-food production and distribution can play a key role in promoting sustainable and efficient production in urban and peri-urban areas.

Tanzania.
Green beans harvested fresh from the farm

In particular, a key driver of improved production in urban and peri-urban contexts is technological innovation that can boost production and yields, optimize the use of resources, diversify crops and ensure sustainability.

A variety of innovations can result in better production, such as

- Technological innovation including controlled-environment agriculture; aquaponics, hydroponics, aerofarming, etc. Inclusive of a broad array of digital technologies used in production.
- Resource (land, water, etc.) innovation including zero-acreage framing, wastewater recycling.
- Agronomic and farming innovation contains a broad range of approaches and methods that are adapted to the urban and peri-urban context, including organic and regenerative agriculture and agroecology..
- Social innovation including community-supported agriculture, social farming, school gardening, farmer's markets.

Urban and advanced farming techniques are growing in popularity as a way of contributing to food production and solving a number of the challenges posed by increasing populations, climate instability and food deserts. However, while these technological advances can support the goal of achieving more resilient, productive, and sustainable UPA, to better meet the needs of both urban farmers and consumers, they also come with several challenges.

[26] For more information see www.fao.org/strategic-framework/en

First, there is the risk that innovations will accelerate the concentration of power in the hands of a few profit-driven companies that own and control the technology, thereby, for example, increasing farmers' dependence on these companies for seeds and pest control.

Second, technological advances often come at a high price, either because of their purchase, operations, or maintenance and require their owners to have access to sufficient financial means to sustain them. Furthermore, they often require a steady supply of electricity and access to the Internet, which cannot always be assured.

Third, they may contribute to intensifying the digital divide, as the operations of technology-intensive production systems require skilled workers with technical knowledge, data management skills, and often knowledge of a foreign language if the technology is imported. A large-scale move towards these systems could cause traditional farmers, now made redundant, to lose their jobs. As a result, there is the risk that inequalities could be exacerbated between highly educated groups with access to knowledge and capital and vulnerable groups who could be left behind (Bahn *et al.*, 2021).

And fourth, if dominant, these systems could disrupt local food cultures and harm the transmission of traditional knowledge of UPA. The successful adoption of technological advances, therefore, lies in balancing the economic objectives (productivity, efficiency, food safety, profitability) with the objectives of protecting the environment and promoting social inclusion as in jobs, equality, preserving local food cultures, community-building, climate mitigation, waste management, and the conservation of natural resources among others.

As illustrated, innovation cuts across all aspects of UPA, including production practices and technologies, resource use, socio-economic models of implementation, marketing and distribution, governance and participatory planning, etc. This section, however, provides a general overview of technological aspects of innovation, especially with regard to production techniques and optimising the use of resources such as land and water. Some examples are given but without the ambition of providing an exhaustive and complete picture of existing practices and technologies.

2.1.1 Technological innovation for advanced farming and optimization of resource use

Agriculture in the twenty-first century is strongly influenced by new scientific tools and new technologies that have resulted in a set of powerful technological outcomes with applications in rural and urban situations. The following list cites several common innovative technologies:

- Agronomy and agricultural biotechnology to innovate inputs for crop and animal agriculture such as seeds, pest control, microbiome and animal health.
- Mechanization, robotics and equipment such as on-farm machinery, automation, drones guided by global position systems or global information systems, environmental sensors and growing equipment.
- Farm management software, "Internet of Things" systems with sensing and intervention, which include environmental, farming data capture devices, decision support software, big data analytics and miniaturized portable applications.
- Novel farming systems such as indoor farms, plant factories with controlled environment, aquaculture systems, and grow-out facilities for insects, algae and microbes.

The trend towards rapid urbanization has greatly impacted food systems, which in turn requires food production to become smarter and more intelligent. Thus, UPA contributes to sustainable food systems because of advantages related to the application of new technologies and innovative methods to ensure local food production and diversity.

Examples abound at different stages of the agrifood value chain: the automation of indoor farm machinery permits the fine-tuning and optimization of inputs use, which can increase productivity and reduce the demand for labour. *In situ* sensors can improve the accuracy, and reduce the cost of monitoring crop growth and the quality of land or water. Technologies that improve traceability and digital logistics services can streamline agrifood supply chains, while providing trusted information to consumers.

Digital urban farming can help take full advantage of the fragmented land in the city, meet consumer demands for special food and vegetables, and

contribute to food production and resource utilization, such as water and labour.

Urban areas, where land and water resources may be limited and subject to competing uses, production goals and processes require suitable crops and other commodities be identified as well as production practices that optimize scarce resources. In particular, UPA is characterized by highly insecure land tenure and space limitations. Agricultural areas are often on land where other uses create conflicts requiring state intervention to regulate landownership and stipulate fewer competitive economic activities. City or metropolitan governments do not always perceive that these issues are a priority, which is maybe why they often fail to integrate farming into urban planning.

Innovative methods, accompanied by UPA, are applied to optimize the use of agricultural inputs such as land, water, energy, fertilizers and seeds. In urban and peri-urban contexts, the first two are the most critical and expensive. The ideas associated with the concept of a circular economy (to minimize waste and pollution, keep products and materials in use and regenerate natural systems), the organic production techniques and the paradigm of localized, small-scale food systems are a few of the approaches that fit well with the objective of integrating UPA into local planning.

Other examples of technological innovations in farming are integrated agricultural systems, permaculture, agroecology, biodynamic agriculture, growing on rooftops, in containers and cellars, vertical farming, reuse techniques of wastewater, exploitation of biomass from cultivated areas. For example, Zero-acreage farming (ZFarming), including vertical farming, is one of the methods used to meet natural resource challenges. ZFarming refers to all production of food on or in buildings with zero-acreage of extra land needed; it includes open-air rooftop farming, rooftop greenhouses, indoor farming and other forms. By using idle and spare space to grow vegetables, the demand for local food consumption can, to a certain extent, be met.

As a common form of ZFarming in developed countries, vertical farming refers to food production in vertically stacked "land" in a controlled environment that provides suitable light, water, nutrients and heat adjusted by electronic sensors (Esposito, Tse, Soufani, 2017). Vertical farming can produce fresh, chemical-free, soil-free and nutritious food locally and efficiently, by applying cutting-edge sustainable technologies, reducing excess pesticides and using foliar and/or root zone fertilizer sprays that contain micronutrients.

The rapid development of innovations, particularly digital technologies, and their potential to transform UPA is increasing, but requires specific attention to ensure smallholder producers are included in digital networks and the opening up of new opportunities. In addition, technological innovations often present critical challenges because of the high cost of adoption, especially for small farmers in developing countries. Nevertheless, innovation does not necessarily imply high-tech and expensive technologies; it can involve simple and affordable techniques, practices and materials.

Various innovative practices, both high and low-tech, are described in more detail in section 3.1 with examples from around the world.

Honduras.
Farmers learn to use digital tools

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2.2 Better nutrition

In every region where food and nutrition security is an issue for the urban poor, UPA has been one of the strategies employed to improve the availability and accessibility of fresh nutritious food for urban households (FAO, 2011). Also, UPA is recognized for its role in education. Through initiatives such as school gardens and campus farm programmes, UPA creates an environment where youth in cities can improve their food literacy and learn about agriculture, thereby gaining knowledge, interest and respect for food production and the activities of food producers.

2.2.1 Improving access to fresh and healthy food

Often, and on a daily basis, UPA contributes to household food and nutrition security by providing direct access to fresh and nutritious food that can be harvested, prepared, and fed to family members. Even the very poor, landless or near landless can cultivate small plots on homesteads, vacant lots, roadsides, edges of a field, or in containers. Individuals can garden with limited economic resources, using locally available planting materials, green manures, "live" fencing and indigenous methods of pest control. Thus, gardening at or near home is a production system that the poor can enter easily. A diversity of fresh food is provided, mainly horticultural products, which improve the quantity and quality of nutrients available to the family.

Home gardens in different parts of the world supply a substantial portion of vegetables and fruits (including secondary staples such as plantains, cassava, taro and sweet potato), medicinal plants and herbs. Home gardens may increase food intake and quality. For example poor urban families involved in farming eat more fresh vegetables than other families in the same income category.

Recent studies have corroborated the impacts of food production and related functions in and around cities. In **Managua, Nicaragua**, the implementation of the Growing Greener Cities Programme, which supports participants in UPA activities, led to an average increase of 60 percent in vegetable consumption for participating households, up to 100 g/person/day. In **Tegucigalpa, Honduras**, the average daily fruit and vegetable consumption of participating households increased to 2.4 times the level prior to the adoption of UPA by these households, reaching 260 g/person/day (FAO, 2014a). In **Copperbelt province, Zambia**, 67 percent of households achieved food security by practicing UPA accompanied by other strategies and 63 percent met their basic livelihood needs (Smart, Nel and Binns, 2015). In **Cagayan de Oro, the Philippines**, 75 percent of the poor urban families who participated in the city's allotment garden initiative doubled their vegetable consumption and increased their income by 20 percent. The positive outcome of the allotment gardens led the city to mainstream the concept into overall city planning and development (Tixier and Bon, 2006).

2.2.2 Nutrition education and diet

Recognized for its role in education, UPA is part of initiatives such as school gardens and campus farm programmes that can mean younger generations in cities can improve their food literacy and learn about agriculture. They can expand their knowledge, spark an interest in and respect for food production and learn about the lives of producers. Potentially, experiences related to UPA, can attract more young people into the agrifood sector, implying not only further innovations in this sector, but also greater integration resulting in healthier, more just, and more sustainable food sources in future urban lifestyles. In turn UPA can contribute to more sustainable and healthier cities in a highly industrialized world.

A successful example of a school garden programme is implemented by the Kitchen Garden Foundation in **Australia**, motivated by the founder's awareness of the country's growing childhood obesity problem in 2004. As of 2018, the Foundation has provided food education services to more than 1 950 early childhood centres, and primary and secondary schools across Australia. The Foundation engages children and their families, connects communities and positively influences local food cultures (Stephanie Alexander Kitchen Garden Foundation, 2018).

In the **United Kingdom**, upon realizing that children lack a basic knowledge of food and agriculture, and the increasingly serious threat of undernourishment, the National Department of Education proposed cooking, gardening and

Hanoi, Viet Nam.
Children in a school cantee

food education be included in the National Curriculum from September 2014[27]. It was also suggested that pupils be taught practical knowledge, skills and crafts by working in the fields. In **Leeds**, a network called the Leeds Edible Schools Sustainability Network was established to bring together more than 40 organizations involved with sustainable local food. The network established a baseline dataset on existing school practices, discovered emerging strategies and approaches, and developed a set of tools for schools to improve their performance in food and agriculture education (Renting, van Veenhuizen and Schans, 2014).

In 2015, **Antananarivo, the Republic of Madagascar**, launched an "Urban Agriculture Programme" to promote the installation of micro-vegetable gardens in the city's low-income neighbourhoods. These gardens link 21 school canteens to improve food security and nutrition and to popularize urban agriculture practices among students and their respective families (FAO, 2018c).

In recent years, teaching gardens have spread quickly at universities, from small student projects to larger campus farms supported by administrators and research grants. In **Amherst, United States of America**, the participatory permaculture garden at the University of Massachusetts brings together teachers and students to jointly create and operate an edible campus garden based on a university course[28].

Beyond formal teaching institutions, such as schools and universities, other actors provide education by growing food and a range of other means. Botanical gardens are a good example of institutions that have recently taken on an increasingly educational role growing food in urban areas. In **Philadelphia, the United States of America**, the Pennsylvania Horticultural Society[29] creates a pop-up garden each year to educate the public about UPA. The project provides a publicly accessible garden in an inner-city space for one gardening season, offering information materials and workshops. Local restaurants use produce from the garden (Renting, van Veenhuizen and Schans, 2014).

Civil society organizations also play an important role in teaching and training the public about food grown in urban areas. A wide range of organizations is active in this regard. In **Chicago, United States of America**, Growing Home[30] provides vocational training programmes for young people that cover theory and practice from production to consumption and nutrition (Renting, van Veenhuizen and Schans, 2014).

2.3 A better environment and resilience

2.3.1 Promoting green infrastructure, biodiversity and resource reuse

The environment is an integral part of city planning where physical and green infrastructure is designed in parallel. From an environmental perspective, the most direct contribution of UPA is through the expansion and/or preservation of green areas that create a healthy living environment for urban dwellers while enhancing the potential for pollination and biodiversity conservation in and around cities. Safe water is an essential resource for UPA and can be obtained by protecting waterways and taking measures to avoid upstream pollution. Urban forestry also plays an important role in climate mitigation.

Indonesia. Eating out at a local market

©Rikoto/Jimmy Kets

[27] For more information see www.schoolfoodplan.com

[28] For more information see https://scholarworks.umass.edu/permaculture/

[29] For more information see www.pennsylvaniahorticulturalsociety.org

[30] For more information see www.growinghomeinc.org

Increasingly, UPA is being recognized as an important strategy for climate change adaptation and mitigation, and as a way to create opportunities to build farmers' resilience to climate change. The World Meteorological Organization (WMO) has suggested that urban agriculture (particularly protected cultivation) is a necessary response to climate change and to build more resilient cities[31]. Similarly, the United Nations High Level Task Force on the Global Food Crisis identified UPA as a key strategy to alleviate urban food insecurity and construct more resilient cities (Stewart *et al.*, 2013). The Asian Cities Climate Change Resilience Network, which brings together a number of international organizations to develop adequate strategies and action plans for city-level adaptation to climate change, has included UPA as an important strategy to improve the resilience of cities – or those able to respond to, resist and recover from the conditions imposed by a changing climate (Rumbaitis-del Rio, 2009).

By establishing short supply chains, UPA reduces the cost and pollution caused by the long-distance transportation of food items. The proximity of UPA sites to urban facilities makes it easier to recycle urban waste and synergize energy use, which contributes to sustainable food production, provided good agricultural practices are adopted. Peri-urban agricultural areas can also serve as buffer zones for cities in the case of extreme weather events or natural disasters. Together, these elements contribute to improving the sustainability and resilience of the ecological environment of cities.

As illustrated by the Blue-Green City[32] approach, UPA is an important component of green infrastructure. Its aim is to recreate a naturally oriented water cycle, contributing to the amenity of the city by bringing together water management and green infrastructure. In **Gorakhpur, India**, where approximately 25 percent of the total peri-urban area is flood prone, and most areas suffer from severe waterlogging for two to three months every year, peri-urban agriculture has been used as a flood buffer, while also contributing to local food supply and diversifying urban livelihoods (Renting, van Veenhuizen and Schans, 2014).

In **Quito, Ecuador**, where UPA has a long tradition, urban agriculture has contributed to conserving green spaces in the city and preserving biodiversity, most gardens have 43 horticultural species (Erwin *et al.*, 2022). In **Bangkok, Thailand**, the Siam Green Sky project, created by Chulalongkorn University as an urban agriculture learning centre atop a multi-storey shopping centre, also helps slow the water flow when there is a heavy downpour, thus enhancing the efficiency of drainage in the area[33]. The heat in the building, where the farm is set up, is reduced by 3 to 4 degrees. In **Daegu, the Republic of Korea**, similarly, a rice paddy pilot project, launched by the city government in 2012, has not only created additional green space in the city but also cooled the urban climate by reducing the geothermal heat (FAO, 2018a).

Nicaragua.
Waste recycling campaign near lake Apanas

Thailand. Siam Green Sky, a rooftop combines educational purposes with environmental features – including stormwater catchment and filtration

[31] United Nations Agency calls for urban agriculture: WMO press release 7 December 2007

[32] For more information see https://www.interregeurope.eu/bluegreencity/

[33] For more information see www.ryerson.ca/carrotcity/board_pages/community/siam_green_sky.html

In recent decades, some cities have started to adopt greener, more sustainable and more resilient models of urban development. Cities are investing in forests, wetlands and other green spaces – "green infrastructure" – to tackle urban issues previously addressed by engineered solutions that often involved concrete, asphalt and steel.

Phoenix, the United States of America, , the largest city in Arizona, is the centre of the "Valley of the Sun" metropolitan area, which covers about 38 000 km^2 area, including 26 cities and towns, and is home to more than 4.5 million people. Partnering with neighbouring communities to share ideas and plan for the future is a significant component of the effort to increase the tree canopy and reduce urban heat. In 2010, Phoenix was the first city in the Valley of the Sun to establish a tree-canopy goal: 25 percent of its territory by 2030, compared with approximately 12 percent in 2018. Such an aggressive increase requires public and private cooperation, and Phoenix is set to provide the example, not only for other nearby cities and towns but also for businesses and private landowners (FAO, 2018a).

In 2004, the Government of **China** launched the "Forest City Programme", a national initiative to increase tree cover in and around urban areas to improve the living conditions for urban dwellers in cities. In this framework, in 2012, **Beijing** initiated the largest afforestation programme in its history. With a vision of "two rings, three belts, nine wedges and multiple corridors", more than 54 million trees were planted in four years on approximately 70 000 ha. By the end of the afforestation programme, there were 23 forested areas on more than 667 ha and another 210 forested areas covered more than 67 ha. Currently, forests cover 25.6 percent of the city plain, an increase of 42 percent (FAO, 2018a).

In **Seattle, United States of America**, the "Beacon Food Forest" was established in 2009 as a community-driven garden project. It combines aspects of native habitat rehabilitation and edible forest gardening by promoting the use of a gardening technique that mimics a woodland ecosystem. Fruit and nut trees make up the upper level, and berry shrubs, edible perennials and annuals make up the lower levels. Starting as a project for a permaculture design course, the Beacon Food Forest was established on land owned by Seattle Public Utilities, as part of the city's P-Patch programme. Hundreds of people participate in all aspects of the project's vision, design and construction of the food forest. Community volunteers are responsible for the ongoing stewardship and maintenance of the garden[34].

Near Luxor, Egypt. Mulberry trees (*Morus alba* L.) planted on desert land irrigated by treated sewage water. These trees are used for silkworm production and also serve as windbreaks

[34] For more information see https://seattle.curbed.com/2019/1/28/18196269/beacon-food-forest-urban-agriculture and see https://www.edibleseattle.com/explore/road-trip/arboreal-agriculture/

Indonesia. Forest near a city – JAMBI coffee

Encouraging the more efficient use of natural resources can reduce vulnerability and increase farmers' resilience by reducing the pressure on scarce resources and optimizing the use of inputs (i.e. fertilizers). The use of recycled or re-used wastewater can help reduce the demand for fresh water and the discharge of wastewater into rivers, canals and other surface water sources, reducing pollution (Buechler, Mekala and Keraita, 2006). Diverting solid organic waste from landfills by composting is one of the simplest ways to prevent emissions of methane and to reduce groundwater pollution from leachates in landfills. Reuse of wastewater and composting of organic wastes can also help reduce the mining of finite mineral resources and energy expended to produce artificial fertilizer, while lowering the cost of public waste management. Organic wastes can be employed to generate energy, either by incineration to produce electricity, by capturing methane from composting sites for biogas or by making briquettes for household use (de Zeeuw, Van Veenhuizen and Dubbeling, 2011).

Quelimane, Mozambique is prone to flooding, partly because over cultivation has contributed to the degradation of protective coastal vegetation and soils. A municipally supported waste composting system managed by the city, farmers and community organizations has linked agricultural productivity through methods of organic food production with biodiversity conservation to buffer severe and frequent flooding related to climate change (FAO, 2018a).

2.3.2 Contributing to food system resilience

Resilience is the ability of individuals, households, communities, cities, institutions, systems and societies to prevent, anticipate, absorb, adapt and transform positively, efficiently and effectively when faced with a wide range of risks, while maintaining an acceptable level of functioning without compromising long-term prospects for sustainable development, peace and security, human rights and well-being for all (Webinar: United Nations common guidance on helping build resilient societies, 2020).

In the context of food systems, resilience is the capacity over time of a food system and its units at multiple levels to prevent, anticipate, absorb, adapt and to transform various and unforeseen disturbances and to provide sufficient, adequate and accessible food to all at all times. It is complementary and essential to sustainability (adapted from Tendall *et al.*, 2015). At the heart of the concept is the capacity of agro-ecosystems, farming communities,

households or individuals to maintain or enhance system productivity by preventing, anticipating, absorbing, adapting and transforming.

The resilience of a farming system builds largely on the five capacities found in the United Nations common guidance on resilience: preventive to reduce existing and future risks; anticipative to act early; absorptive to be able to bounce back; adaptive to be open to incremental adjustments; and transformative be able to make fundamental changes to the system. The need to strengthen the five capacities of farming systems has recently become more urgent with the COVID-19 pandemic. Therefore, UPA comprises a multifaceted solution to improving the resilience and sustainability of food systems in the face of multiple shocks and stresses.

One contribution UPA can make to improve the resilience of cities is by reducing the urban heat island effect whereby cities experience warmer temperatures than areas nearby because of how city surfaces reflect, absorb and hold heat. When placed strategically, urban gardens contribute to improved infiltration and retention of water in soils and mitigate flash flooding while making living conditions in the city more appealing. High tech UPA practices such as hydroponics or vertical farming can also lead to the more optimal use of scarce resources such as water and soil (FAO, 2020a).

Bringing production areas closer to cities can contribute to lowering the pressure on agricultural systems that border natural ecosystems (forest, wetlands, grasslands, etc.), which play a critical role in the conservation of biodiversity, mitigation of climate change and the provision of environmental services on which all types of life depend. Recent discussions about the emergence of zoonotic diseases have demonstrated the importance of protecting natural ecosystems from land use changes so as to maintain them as a buffer against disease (FAO, 2020c).

Since the start of this decade, the world has been fighting the COVID-19 pandemic that has gripped the planet. Although the impact of COVID-19 is felt worldwide, countries with a prevalence of resource-poor smallholder farmers, significant yield gaps, and institutions that are ill-equipped to coherently respond are the most vulnerable to the effects of the pandemic (FAO, 2020d).

A qualitative analysis of various city case studies carried out by FAO in September 2020 (FAO. 2020a) indicated that cities already engaged in developing UPA could ensure the supply of fresh food during the pandemic and meet the needs of the most vulnerable residents. The main message arising from the analysis is that cities with suitable socio-economic and agroclimatic conditions should adopt policies and programmes to empower local producers to grow food and promote short food chains to improve citizens' access food, without shutting off national and global supplies (FAO, 2020a).

FAO's global survey of COVID-19 suggests that, on average, villages and small towns (5 000 to 25 000 inhabitants) are less affected by restrictive measures than cities (more than 500 000 inhabitants), supposedly because they are nearer production areas and shorter supply chains (FAO, 2020b). As a result of shortages, panic buying and other disruptions, prices for major food commodities rose in many cities worldwide, as indicated by 60 percent of respondents overall in the survey. Price increases are especially reported by cities in low and low-and-middle income countries (FAO, 2020b).

Countries and cities dependent on the importation of food and agricultural inputs, such as small island states, are particularly vulnerable (FAO, 2020c). Challenges related to limited diversification of supply chains and dependence on imports and long complex chains are exacerbated in cities where linkages are limited and there is little cooperation with surrounding rural hinterlands where the food commodities consumed in the city may be grown or processed (Blay-Palmer *et al.*, 2020). These examples indicate the value of creating shorter value chains where food is produced closer to where it will be consumed.

In **Quito, Ecuador**, urban gardens can produce 1.35 million kg of food every year, 57 percent of which is consumed by producer households and 43 percent is sold through short supply chains (FAO, 2020b). In **Medellin, Colombia**, the municipal programme of urban and peri-urban gardens helped mobilize 20 tonnes of food in the first two weeks of lockdown because groups of food vendors were active in the neighbourhoods (FAO, 2020b). Supporting indigenous and smallholder communities to increase food

production can help them guarantee their food sovereignty and help them adapt to climate change and to other shocks and stresses (FAO, 2020b).

In **Nantes, France**, the "Nourishing Landscapes" project was initiated to cultivate vegetables in urban areas so as to provide free food to 1 000 poor households. Production sites are scattered over 11 districts throughout the city. Entirely organic agricultural practices are employed by a total of 250 urban gardeners who harvested approximately 25 tonnes of vegetables between July and October 2020 (FAO, 2020b).

In **Davao, the Philippines**, the city's "Buyback, Repack and Distribute" programme was launched during COVID-19 to benefit the livelihoods of urban producers who had difficulties selling and distributing their produce, and to ease access to food for low-income families whose income had been severely affected during the lockdown. Through the programme, the city government bought products from local small farmers at higher than normal farmgate selling prices, then repacked and distributed these fresh food products to the most vulnerable families. The initiative greatly benefited 12 000 families in Barangay Tibungco, the programme's pilot area. More than 10 tonnes of vegetables were purchased and distributed to citizens.

2.4 Better life

With UPA gardeners can save on their household food budget and increase their income by selling the surplus yield. It also enables commercial farmers to earn a living and to hire additional help, contributing both to the formal and informal economy of the city region. From a social perspective, UPA facilitates the inclusion of vulnerable groups and enhances social cohesion between people from different cultures and generations. Furthermore, UPA can improve life for both farmers and consumers through agritourism.

Nicaragua. Agritourism site

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Urban and peri-urban agriculture improves the nutrition and livelihoods of poor families

©FAO/Giuseppe Bizzarri

2.4.1 Livelihoods, income-generation and employment

The entire UPA value chain – from inputs to waste – contributes to a lively agrifood economy in urban and peri-urban areas, generates job opportunities and stimulates local economic development. In addition, urban horticulture, in particular, is key to improving the productivity of land, generating employment, strengthening farmers and entrepreneurs' economic status, and enhancing exports while substituting for imports. In many countries, new opportunities emerge as increased per capita income combined with rapid urbanization, lead to a change in consumers' preferences. Consumers increasingly demand high-value products, such as vegetables, fruits, meat, dairy and processed food, produced close to where they live.

In **Spain**, UPA has become a strategy that fosters the local economy and improves employment in times of crisis. In 2014, The Network of AgroEcological Reserve Territories, which was jointly founded by a group of municipalities, supports new farmers' self-employment by providing training, access to land and local markets, and leveraging local resources for UPA (Renting, van Veenhuizen and Schans, 2014). In Iraq, the Lemon Tree Trust launched UPA initiatives in refugee camps to bring economic benefits to displaced communities by employing refugees, encouraging entrepreneurship and providing training. The gardens, which have the benefit of being close to local markets and customers, ensure that displaced households can earn an income by growing and selling vegetables (Adam-Bradford *et al.*, 2016).

In **Mumbai, India**, " scheme substantially fosters employment and reduces economic deprivation among the urban poor, particularly slum dwellers and migrants, as land for UPA is prioritized for vulnerable groups, so they can generate additional income (Vazhacharickal et al., 2013). In Quito, Ecuador, UPA produce means families save from USD 40 to 62 per month, and contributes, on average, USD 175 per month to their income (Vazhacharickal *et al.*, 2013). In **Quito, Ecuador**, UPA produce means families save from USD 40 to 62 per month, and contributes, on average, USD 175 per month to their income (Erwin *et al.*, 2022). In **Lima, Peru**, UPA is the main source of income for many of the urban poor, such as settlers from rural areas and the temporarily employed (FAO, 2014a).

2.4.2 Social inclusion and cohesion

From a social perspective, UPA facilitates the inclusion of vulnerable groups and enhances social cohesion between people from different cultures and generations. Long-established UPA practices such as allotments and community gardens, as well as the more recent agritourism and inter-cultural gardens, provide both a recreational space that strengthens connections between families and friends and builds a sense of community among neighbours. Residents of concrete buildings are able to connect with nature and learn something about agriculture in the field.

Rosario, Argentina is a city with a long tradition of promoting UPA. "Making the Edible Landscape" is a project that was implemented between 2004 and 2006. During the project communal food growing spaces were designed

Hanoi, Viet Nam.
A woman takes her produce to market

Prinzessinnengarten, Berlin.
A café and meeting place has been created in the garden

with the simultaneous objectives of encouraging physical activity, meeting others, and increasing social cohesion (Dubbeling, van Veenhuizen and Halliday, 2014). The city of **Groningen, the Netherlands**, has promoted UPA and community gardening since 2009 as a way to encourage citizen participation in public green areas. In the "Edible City" project, citizens organize into groups and establish collective vegetable or herb gardens with support from the municipality (Koot, 2014). Similarly, the Princesses' Garden project in **Berlin, Germany**, creates a welcoming and participatory space for the public to share their knowledge of food. A do it yourself space was created that became a forum for the exchange of ideas and cooperation, the public was welcomed to participate in the gardening and agricultural workshops, and large dinners held with guest chefs, artistic installations and international exchanges[35].

Another benefit of UPA, especially for practitioners from vulnerable groups, is the inner peace and comfort that comes when connected to the community and society through collective gardening activities. The Can Pinyol Community Gardens project in **Barcelona, Spain**, designed social allotments for the disadvantaged, the unemployed, or those suffering from disabilities and mental disorders. Its purpose is to leverage the power of collective gardening to build a sense of community and improve participants' self-confidence (MADRE, 2018).

In a similar fashion, the innovative "accessible garden" in **Lisbon, Portuga**l, is designed for the mentally and physically disabled and forms part of a park, which can be accessed by wheelchair. Feelings of isolation can also be found among farmers who produce for anonymous, distant markets. The development of short-chain direct-sale mechanisms can counter this isolation by creating a stronger sense of connection, as clearly shown in the case study of **Leuven, Belgium**, (Erwin *et al.*, 2022).

In **Chicago, United States of America**, the social enterprise Growing Home[36], which works in an underserved community, where there is a high rate of poverty and unemployment has used UPA as a catalyst for change, to inspire healthy living, and create economic opportunities and community empowerment. The farm has changed the lives of hundreds of workers, and thousands of their family members by providing paid on-the-job experience and job-readiness training for people facing barriers to employment and supporting them to overcomer issues such as criminal records, medical needs, child-care and housing.

The concept of intercultural gardens, which originated in 1996 in **Göttingen, Germany**, was promoted by a group of female refugees from Bosnia and Herzegovina. Intercultural community gardens mostly target marginalized groups from diverse cultural backgrounds, creating a space for migrants and refugees to communicate and integrate into society (Moulin-Doos, 2013; Müller, 2007). In regions of conflict such as the Near East, UPA has been employed to awaken positive feelings and provide a mental outlet, as described by Iraqi and Syrian refugees and isolated Palestinian growers.

Chicago, USA.
Farm operated by Growing Home to train former prisoners and other local residents in skills development and social reintegration

[35] For more information see www.ryerson.ca/carrotcity/board_pages/community/prinzessinnengarten.html

[36] For more information see http://growinghomeinc.org/

In recent years, “care farming” has been hailed as a response to concerns about public health expenditure and the efficacy of social services (Di Iacovo and O’Connor, 2009). In a multifunctional fashion, care farming combines agricultural production with health related, educational and social services (Hassink *et al.*, 2020b). The sector covers a wide range of approaches. Some focus primarily on agricultural production and others on care and educational services. Target groups include participants with various needs and difficulties, who often struggle to succeed in the traditional labour market. Their involvement in agricultural activities depends highly on their needs and capacities. In the **Netherlands**, which is one of the pioneering countries in care farming, the sector has become professionalized with strong regional organizations and a steady growth in revenues, generating new employment opportunities (Hassink *et al.*, 2020a).

Part I illustrates the diversity and multi-functional aspects of UPA, highlighting the diverse benefits for a broad range of actors.

Part II illustrates the details of different practices required to implement UPA, including the challenges and actions needed for its support.

Indonesia.
Food stalls and customers on a street

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PART TWO

PRACTICE AND SUPPORT OF URBAN AND PERI-URBAN AGRICULTURE

As highlighted in the previous sections, UPA is an important strategy employed to build the resilience of a city's food supply, reduce poverty, increase employment, improve nutritional outcomes, and mitigate the environmental degradation of urban spaces. While farmers have not waited for external support to start their production and marketing activities in cities, decision-makers and urban professionals may wonder how they can best support their efforts and encourage the development of UPA on their territory.
Part II explores how different aspects of UPA are put into practice, the challenges faced, and how key urban actors can support and incentivize the uptake of UPA practices and address related problems.

The practise of UPA is extremely diverse and largely anchored in local socio-ecological conditions. While this sourcebook intends to provide overall guidance, and describe a large assortment of practices and initiatives, it does not pretend to be exhaustive, or to be a practical handbook for implementation. Building on the real-life experiences of practitioners around the globe, Part II covers topics related to production practices, land tenure, management of soil and water resources, labour and finances, and finally marketing and distribution.
Each chapter follows the same structure: common practices, challenges and interventions. Additional information about the cases mentioned can be found in the UPA Matrix that accompanies this sourcebook and in the original sources of information compiled in the References.

3

PRODUCTION PRACTICES AND APPROACHES

Production practices for UPA can range from a simple pot on a balcony to an automated system of control in a large greenhouse. This chapter describes and discusses various production practices and approaches to different types of UPA and provides examples from cities and regions around the world. Many practices are long established; others are based on recent innovations or transfer of knowledge from elsewhere. Whether new or old, a number of challenges may be encountered during the implementation or transmission of a practise. This chapter provides an overview of some of these challenges and cites a few actions that cities can take to deal with them.

West Bank and Gaza Strip.
Salad greens, cabbage and spinach grown in a garden on an urban rooftop.

©FAO/Marco Longari

3.1 Practices

There are different typologies of UPA gardens/farms depending on the availability and quality of resources: land, water, labour and capital; the local climate and access to technologies, adapted to the particular production and agronomic operations. Practices and approaches differ significantly depending on the type of commodity, whether high-value or staple crops, livestock or fisheries. Selection of crops grown or livestock raised for UPA is affected by both subjective and objective factors. Building on the evaluation of local environmental conditions and the availability of varieties, growers' goals in terms of timeline, profit and other aspects, also need to be considered.

In general, UPA producers prefer **horticultural crops**, based on their higher value and shorter turnaround. For example, in **China**, both small-scale home gardens and large-scale commercial farms predominantly grow vegetables and fruits such as cucumber, eggplant and Chinese long bean (Luehr *et al.* 2020). In **Hanoi, Viet Nam**, an estimated 70 percent of urban production and supply of leafy vegetables can be found within 20 km of the urban centre (Moustier and Danso, 2006). In many areas in Africa, vegetables such as lettuce, cabbage and tomatoes are common, and are mainly produced on commercial farms in dry seasons (Andres and Lebailly, 2011; Bellwood-Howard *et al.*, 2015). In **Tegucigalpa, Honduras**, up to 30 different species of fruit trees, vegetables and medicinal plants are grown in family gardens; six basic crops include radish, coriander, lettuce, beetroot, carrot and cucumber. In **Antiqua and Barbuda**, gardens contain both traditional local vegetables: eggplant, cucumbers, okra, thyme and chives and imported crops such as tomatoes, carrots, sweet peppers, onions and cabbage.

Cereal crops are less common in UPA, but they may be present on peri-urban farms. In **Africa**, maize and other staple crops such as sweet potato, groundnut, cassava, and plantain are the main choices of UPA producers (Bellwood-Howard *et al.*, 2015; Chaminuka and Dube 2017; D'Alessandro, Hanson and Kararach, 2018; Mackay, 2018; Mireri, 2013; World Bank, 2013). In Asia, the rice-based farming system is a typical peri-urban agriculture type. In peri-urban **Hanoi, Viet Nam**, more than 50 percent of areas are devoted to cereals; particularly rice cultivation (Moustier, 2007). In **Nepal**, the dominant crops in Kathmandu Valley across five municipalities are paddy and maize, with millet, wheat, barley and others also grown in the valley (Dixit *et al.*, 2014).

TABLE 3 Summary of practices for typical typologies (adapted from analysis of various sources)

URBAN AND PERI-URBAN TYPE	PRODUCTS	GROUND-BASED CROP PRODUCTION	ZERO-ACREAGE FARMING
Home-based gardening	Horticultural crops, livestock, aquaculture	Conventional growing, conservation agriculture, organic growing, microgardening, micro-livestock	Rooftop gardening, micro-livestock, hydroponics
Community-based and other shared gardening	Horticultural crops, cereal crops, livestock, aquaculture	Conventional growing, conservation agriculture, organic growing, microgardening, greenhouses and net-houses, micro-livestock	Rooftop gardening, micro-livestock
Commercial crop production, livestock and fisheries	Horticultural crops, cereal crops, livestock, aquaculture	Conventional farming, conservation agriculture, organic farming, greenhouses and net-houses	Vertical farming, rooftop farming, hydroponics, aquaponics, livestock
Institutional food growing	Horticultural crops, cereal crops, livestock, aquaculture	Conventional farming, conservation agriculture, organic farming, microgardening, greenhouses and net-houses	Rooftop farming, vertical farming, hydroponics, aquaponics, livestock

Egypt. Crops growing on the outskirts of Fayoume

Some peri-urban **livestock** farms keep poultry, goats, sheep, and cattle for commercial reasons (Mireri, 2013; World Bank, 2013). Keeping small livestock is common in many poorer urban and peri-urban areas, including raising various poultry and small animals such as rabbits and guinea pigs for home consumption as well as for sale. **Aquaculture** systems are popular in Southeast Asian countries, and are present in cities in other regions.

In a few cities, it was found that crop cultivation is more commonly practiced by low and medium-income farmers, while high-income farmers are more likely to be involved in keeping livestock and rearing fish, because of the higher investment and infrastructure requirements (Dossa, Buerkert and Schlecht, 2011; Padgham, Jabbour and Dietrich, 2015). However, in some countries, UPA farmers switched from staples to vegetable crops and higher value products such as flowers, mainly because of higher prices and profit, demand for niche crops, and increasingly insecure land tenure (Lee, Binns and Dixon, 2010; Pauleit, El Wafa and Pribadi, 2019). Nonetheless, cultivation of vegetables and flowers need higher investment and require more labour, as these crops are more prone to risk than rice cultivation.

Some common approaches and systems found in urban and peri-urban areas are sketched out in the remainder of this section. Given the great diversity of UPA, this overview will not be comprehensive. It serves only to highlight this diversity and suggest examples of practices across different settings in urban areas and their surroundings. We start with some land-based crop production practices then shift to practices that are atop, inside, or even under buildings (sometimes known-collectively as Z-Farming). While we concentrate on crop production, indoor production includes various edible insects, and the final type of practice (aquaponics) includes fish production.

3.1.1 Conventional practices

The green spaces in and around cities have allowed citizens to develop agricultural production activities, mostly of vegetables and herbs (but also micro-livestock, fruits and berries), to improve access to nutritious food for the family, and often to increase the possibility of earning a small income by selling the surplus. In one typical practice, residents may transform part of a backyard by digging the soil, creating furrows, applying a little organic fertilizer (perhaps homemade compost), planting seedlings, applying water (often with a bucket or watering can), to produce tomatoes, cucumbers, onions and mint. This is one example among many of conventional domestic agriculture.

Conventional practices are not only found in the home, nor are they only employed to produce food for household consumption. Over the years, urban farmers have developed a set of skills that allows them to produce edible, and other outputs

West Bank and Gaza Strip. A Palestinian farmer tends the garden in her backyard

©FAO/Marco Longari

that are in demand in the markets, by employing cost-efficient methods, and ensuring the best use of available resources and inputs. Land is utilized beside railways and airports, on the banks of streamlets and brooks, in waterlogged and swampy areas or on slopes too steep to build. The most skilled urban farmers prepare the land forming raised, meticulously tilled, perfect geometrical rows for cultivation. Whenever available, organic matter is incorporated directly into the soil during tilling.

Usually the practices are simple. What is required is to find a vacant space, prepare the land or garden beds, and apply water, mulch, compost, as well as other inputs, with little investment. For example, food is grown in raised beds or containers, and simple compost is applied made up of kitchen, yard (leaves, grass) and paper waste, put together in a pile to capture nitrogen and other essentials for plants. Based on local conditions, water is applied either from collected rainwater, from underground or the river nearby. Pest and disease control can be learned and applied by trial and error, guided by neighbours, or by searching how-to books on the Internet.

Ground-based crop production

For years urban and peri-urban farmers have worked to efficiently cultivate high-demand crops, making the best use of available resources and inputs either planting into soil or on top of the ground in containers. Citizens have demonstrated to those in government that any "idle" land in cities can become a place worth using to grow food or raise animals.

Agroecological and organic soil-based practices

Organic farming is common in UPA for sustainable production, recycling of urban waste and safe operations for urban farmers. Typical organic practices include using organic fertilizers and applying minimum pesticides. Homegrown biopesticides and mechanical protection are often a valuable alternative to using chemical inputs in a dense urban environment.

Manure and urban waste composting is common to improve soil fertility, instead of using chemical fertilizers. In **Bangladesh**, an FAO project from 2015 to 2017 set up rooftop gardens and school gardens, where vermicomposting of kitchen waste was applied. Project beneficiaries continued their activities after the programme ended (Uddin, 2016). In **Si Sa Ket Province, Thailand**, organic flowers and vegetables are grown such as morning glory and cabbage using animal manure, compost, black chaff, rice husk and fermented plants. Mulch is used, made from straw or dried leaves (FAO, 2013). **Cuba** developed the *organoponic*[37] system, in which soil is mixed with organic matter such as composted animal manure and residuals from the sugar production chain, normally at a volume ratio of 1:1. The productivity of this system turns out to be high, yielding up to 20 kg/m^2 as recorded in 2014 (FAO 2014a). An estimated half of Havana's fruits and vegetables are from organoponic gardens in the city (Orsini *et al.*, 2013).

Biological control methods, together with good agricultural practices, are normally the alternative option to applying large amounts of pesticides for pest and disease control. In **Beijing, China**, biopesticides such as *chucongju* (extracted from wild chamomile), *liansu* and *hasimumeijun* are used at the Shared Harvest peri-urban farm (Buckley, 2012). In **Shanghai, China**, fermented manure is used to control pests in rooftop garden programmes, together with technologies such as automatic irrigation, cycling purification and anti-ultraviolet plastic containers to ensure the garden ecology is preserved (Carrot City: Gorgolewski, Komisar and Nasr, 2011). In **El Alto**, Bolivia, wild lupines and capsicums are used to control aphids and whiteflies, respectively. In **Managua, Nicaragua**, lime and ashes are added to the soil before sowing seeds and applied to leaves during plant growth. Grass hedges are

[37] *Organopónicos* is a Cuban invention. The term was coined to distinguish it from other intensive, high-yielding horticulture production systems, such as hydroponics, which grows plants on water and inert substrates (FAO 2014a).

grown around the gardens and cooking oil is used as sticky traps to control whiteflies. In **Rosario, Argentina**, producers use compost substrate beds and carry out mulching and crop rotation to manage pests and diseases without using synthetic pesticides or fertilizer. In **Havana, Cuba**, six centres in the city supply bio-pesticides and biological control agents to farmers, who have been trained to analyse and correctly respond to phytosanitary problems (FAO 2014a).

3.1.2 Container-based microgardening

Microgardening is a popular UPA technique, where extremely small areas are used to grow food and other useful crops, typically at home, but sometimes in other locations. Usually, this technique employs a variety of containers, sometimes hanging or on buildings (discussed below), but also often on land. Practitioners of UPA welcome microgardening because it requires a small area of land and minimal investment. Poorer residents tend to cultivate microgardens for their own use, and small-scale producers in urban areas cultivate land to contribute to their livelihood. In one survey in **Dakar**, half of farmers living in the urban area were microgardeners (Ba, Sakho and Aubry, 2014). Microgardening is often well suited to refugee camps, and other displaced populations, because of the limited space and the temporary situation (Adam-Bradford *et al.*, 2016).

A range of containers can be used for microgardening such as hanging containers, tubes, baskets, plastic bottles, boxes and barrels. On the ground, gardening can use recycled tires, empty cans or bottles, or custom products – especially growbags (Carrot City, 2014). For example, in **Tegucigalpa, Honduras**, old tyres are the preferred containers, as they are considered more productive and convenient for irrigation (FAO 2014a). A protocol of common methods used to turn old tyres into crop cultivation containers has been developed by the TECA platform (FAO, 2019b). A municipal programme in **Managua, Nicaragua** supports the use of various container-growing techniques through training sites (Carrot City, 2014). A manual was developed in Sri Lanka to encourage the use of low/no-space agriculture for micro-family business (Ranasinghe, 2009). In **Ethiopia**, techniques such as barrel gardening were developed to obtain the highest production in the very limited gardening spaces available to each family (Getachew, 2003).

Dakar, Senegal.
Urban farmers at a horticultural microgarden training centre and nursery

Coraile, Haiti. filling a tyre with earth to plant vegetables at an urban agriculture centre in a camp for the internally displaced, where people have been living in tents since an earthquake in January 2010.

Managua, Nicaragua.
Display illustrates techniques using containers at a training centre

In **India**, an innovative growing bag was created where a particular ratio of soil, organic residues and compost is mixed together in polyethylene bags as a growing substrate. The technique is cost-effective, easily replicable and saves a

considerable amount of water as well (Doshi, Doshi and Shah, 2003). In **Philadelphia, United States of America**, Greensgrow Farms[38] cultivates organically by relying on healthy soils and compost as nutrient/fertilizer. The compost is made on-site and accelerated with the help of solar energy (Berges, 2014). Microgardening on small areas has always contributed to the food security and nutrition of poorer countries at the household level. In Kibera, a densely populated part of **Nairobi, Kenya**, households use sack gardens made from local sisal fibres to grow onions and spinach to avoid blocking alleyways (World Bank, 2013). In **Kampala, Uganda**, locals stack wooden crates around a central composting chamber and use old plastic water bottles to create precise drip-irrigation system to grow kale. In **Dakar, Senegal**, FAO helped galvanize microgardens as a food and nutrition strategy for poor households vulnerable to malnutrition. Today the city, with the participation of thousands of middle-class families, runs the programme, which relies on one square metre structures made of coconut fibres for soil-less cultivation[39].

3.1.3 Protected cultivation: greenhouses and net-houses

Under the umbrella of protected cultivation systems, commonly known as controlled environment agriculture, different types of structures and combinations are employed as covering such as plastic and netting, to grow crops under partial or totally protected conditions. Greenhouses are commonly used for UPA – the larger are often found in peri-urban settings, the smaller are increasingly erected in urban areas, as part of a building as illustrated in the photographs.

Greenhouses can be covered in plastic, or combined with nets while net-houses are only covered with insect-proof or shade net, or a combination of both. There is a wide range of technologies and costs, from low-cost wooden or bamboo greenhouse frames to fully automated high-tech greenhouses. Greenhouses and net-houses are particularly well adapted to UPA, as it is possible to grow crops year-round with increased productivity and efficiency in the use of soil, water, nutrients, sunlight as well as protecting high-value and nutritious crops from pests and diseases. Greenhouses minimize the use of pesticides and increase food safety where land and water is limited. Additionally the systems create the opportunity to include adapted technologies and practices such as growing crops without soil, including hydroponics, aeroponics, aquaponics, microgreens or substrate-based techniques, in addition to the efficient use of biological control agents, recycling of nutrient solutions and drip irrigation.

Senegal. Lettuce grown in a microgarden on a roof terrace, where the floating system is used (soil-less culture)

Low-cost mud-brick greenhouses, used to produce vegetables, have successfully been adopted by farmers in **El Alto, Bolivia**, a small city on a plateau that rises 4 000 m above the city of La Paz, where, even on a sunny summer day, the average temperature rarely exceeds 13 °C.

However, inside the greenhouses, gardeners work in temperatures of around 30 °C, which create ideal growing conditions for lettuce, Swiss chard, spinach, tomatoes, rosemary, coriander and strawberries. In fact, the region's low and irregular rainfall, average nighttime temperature at near zero and year-round frost make it virtually impossible to grow many garden plants without greenhouses.

3.1.4 Zero-acreage farming

Zero-acreage farming (ZFarming), as mentioned in section 2.1.1, typically refers to the production of food in buildings without using any additional land, typically in buildings. Open-air rooftop farming, rooftop greenhouses, indoor farming and other

[38] For more information see www.greensgrow.org/urban-farm/

[39] For more information see www.fao.org/fao-stories/article/en/c/1276274/

Honduras. Indoor farming where hydroponic systems are used in protected infrastructure

Egypt. A project beneficiary tends a rooftop vegetable garden

forms of agriculture in a controlled environment are incorporated into buildings. ZFarming also includes small-scale gardening on balconies, terraces and other limited spaces that millions of people have long used to grow food, herbs, medicinals and other products. ZFarming can employ either low or high technology, depending on the specific context and the means available, and can be practiced by fast-growing enterprises or individuals. While ZFarming is sometimes found in peri-urban zones, it is particularly associated with dense urban areas. Some of the most common forms of ZFarming are described briefly following.

Rooftop farming can be extremely varied, as illustrated in the book Carrot City (Gorgolewski, Komisar and Nasr, 2011) and Rooftop Urban Agriculture (Orsini et al., 2017). In **Dhaka and Chittagong, Bangladesh**, a high proportion of residents who are involved in rooftop farming were observed to use recycled containers such as half plastic drums, plastic buckets and earthen/ plastic pots for cultivation (Uddin, 2016). In **Singapore**, controlled environment agriculture, including rooftop farming, is widely encouraged and common across the country. Commercial rooftop farms include Comcrop, Singapore's first commercial rooftop farm, which uses hydroponics and no pesticides, and Sky Greens, the world's first low-carbon and hydraulic driven vertical farm (Rodrigues, 2019; Sky Greens, No date). In Rotterdam, the Netherlands, old buildings are used for food production, such as RotterZwam,[40] which grows mushrooms and operates a coffee bar in a former swimming pool. In North America, Brooklyn Grange Rooftop Farms in **New York City, United States of America** and Lufa Farms in **Montreal, Canada** are two rooftop farm pioneers that use soil-based and hydroponic systems respectively; both started their commercial operation after 2010 and have continued to expand their businesses (Brooklyn Grange, No date; Lufa Farms, 2020).

Indoor and vertical farming with venture capital investment in indoor vertical farming is gaining strong traction as food security; food quality and scarce resources arise as the main challenges to the global agrifood system. The number of attempts to build or integrate vertical farming continues to increase, many use LED lighting, hydroponics or aeroponics, and use systems to control and monitor plant nutrition and the growing environment. A few farms employ renewable energy, almost all vertical farms save a large amount of water as compared to conventional farming (Armanda Guinée and Tukker, 2019; Agritecture, No date). However, there are still a number of constraints to engaging in this capital-intensive industry, either related to business or technology, such as the high cost of investment in facilities, elevated cost of daily energy consumption, limited crop varieties that can be grown in the vertical farms, shortage of qualified employees who can trouble-shoot the systems, as well as the politics of UPA and public acceptance (Despommier, 2018).

Beyond rooftop greenhouses, an emerging form of indoor farming takes place inside buildings. Most often, these are older, former industrial structures that have been adapted for agricultural use. These range from vertical crop production

[40] For more information see www.urbangreentrain.mammutfilm.it/inventory/pdf/ROTTERZWAM%20full%20case.pdf

in all its variety (hydroponics, aquaculture, etc.) such as mushroom cultivation, raising edible insects including crickets and mealworms.

In addition to inside buildings, indoor agriculture can take place below ground. In one case, Growing Underground, **London, United Kingdom**, transformed tunnels, built in the 1940s as shelter for London families during the Second World War, into a carbon neutral underground farm. With the help of a complex irrigation, ventilation and lighting system microgreens, herbs, and salad greens grow year-round beneath the busy city streets of London. The founders plan to expand the farm to utilize the entire 2.5 acres (about 1.2 ha) of unused tunnel space. Vegetables produced by Growing Underground are available for purchase in markets across London.

Hydroponics and soil-less culture cover a range of methods used to grow agricultural crops without using soil. Instead of soil, various inert growing media, also called substrates, are used. These media provide plant support and retain moisture. Irrigation systems are integrated within these media, thereby introducing a nutrient solution to the plants' root zones, which provides all the necessary nutrients for plant growth. The most common method of soil-less culture is hydroponics, which includes growing plants either on a substrate or bare roots in an aqueous medium.

Instead of cultivating crops in soil, a basic hydroponic system can be used to deliver liquid nutrients mixed in water directly to the plant roots. The world's most popular hydroponic system is a drip irrigation system. Rock wool is used as the substrate, and the nutrient solution is directly applied to the plant roots. This system is used to grow fruit and vegetables such as tomato, sweet pepper and cucumber. Another popular hydroponic system uses nutrient film to produce fast-growing crops such as lettuce and basil. In this case, a stream of nutrient solution is re-circulated past the plant roots through culture channels (Rodríguez-Delfín *et al.*, 2004). Another prevalent hydroponic system employs a floating root system that partially soaks the roots in the nutrient solution. However, with this system, it is difficult to control root oxygenation and diseases may be transmitted by vector eggs laid in the cultivation tank (Orsini *et al.*, 2013).

West Bank and Gaza Strip.
A Palestinian family tends to a hydroponic garden and fish farm on the roof of their house

Compared to traditional soil-based cultivation, it has been reported that hydroponic cultivation can take up 80 percent less space, and consume 70 percent less water (Kalantari *et al.*, 2017; Lim and Kishnani, 2010), while the growing speed and yield of crops cultivated with hydroponics are greatly enhanced as compared to those grown in soil (Kalantari *et al.*, 2017). In addition, as the substrate weighs far less than soil-based, the technique is suitable for weight-sensitive farming forms such as rooftop gardening.

In richer countries, hydroponics is often combined with high-tech farming forms of ZFarming to achieve intensive production. In poorer regions, where resources are limited, simplified hydroponic systems have been developed to fit the local context. For instance, in **Peru**, nutrient film technique systems were developed using local materials for channels to replace the rigid PVC used in developed countries (Rodríguez-Delfín *et al.*, 2004). The simplified hydroponic systems are quite common in many Latin American countries among which **Brazil** and **Mexico** are prominent with an estimated hydroponics growing area of 1 000 ha and 400 ha respectively as of 2012 (Rodríguez-Delfín, 2012; Tabares, 2003). In **Trujillo (Peru)**, Orsini *et al.* (2010) estimated the annual yield of lettuce, using simplified hydroponic systems, could reach 51.36 kg/m^2 and the investment could be returned within one year, while for radish and leaf beet the yield was 38.4 kg/m^2 and 21.6 kg/m^2 annually, with the time of investment return being is two to three years.

Aquaponics integrates recirculating aquaculture and hydroponics in one production system. Aquaponics uses fish (tilapia being the most common) to generate nitrate-rich plant food. Fish produce ammonia-rich excreta in the tank, the water is filtered and pumped into an inert medium that contains plants (typically leafy

BOX 3

Surakarta, Indonesia - Hydroponics as an energy efficient practice

In Surakarta, hydroponic cultivation is especially popular among urban youth. All farmers interviewed by Rikolto used the technology to grow leafy green vegetables; they appreciated its various advantages, as it is energy efficient, relatively easy to use, fast harvesting, and possible on limited land. The farmers in Rikolto's study, who practice hydroponics, only use natural pesticides or even none. The area they cultivate ranges from 17 to 2 068 m2. There are many hydroponic groups in urban areas, which provide hydroponic training packages at affordable prices of Indonesian rupiah 100 000 to 150 000/person (USD 6 to 10) and assist with the implementation of training results. Performing a profitability analysis of different urban, peri-urban models in Surakarta, hydroponics resulted as being the most profitable (Erwin *et al.*, 2022).

greens and herbs such as lettuce and basil). Fish wastes are removed from the water, first with a mechanical filter, which removes solid waste and then a biofilter processes the dissolved waste. The biofilter provides a place for bacteria to convert ammonia, which is toxic to fish, into nitrate, a more accessible nutrient for plants, thus cleaning the water in the process. Then, the clean water is cycled back into the fish tank to restart the symbiotic process. Fish, such as perch or catfish, can also ensure that the method provides two sources of food. In this "nitrification" process, as the water travels through plant grow beds, the plants uptake nitrate and other nutrients, and finally the purified water returns to the fish tank. This process allows the fish, plants, and bacteria to thrive symbiotically and to work together to create a healthy system (FAO, 2014a).

A typical modern aquaponics structure includes a network of pipes connecting a fish tank, a water pump, and a plant bed where vegetables are grown in gravel through which water is pumped. In **AeroFarms, New Jersey, United States of America**, with rows upon rows of growing trays 80 feet long and stacked 40 feet (about 12 m) towards the ceiling, the farm's growing room is specially regulated to minimize contamination and provide a stable, consistent environment for crops to grow. The showcase aquaponics system in Sanyuan farm, in **Beijing, China**, which was completed in October 2019, is 20 m long and 4 m wide. Each growing season is expected to produce 1 500 kg of fish and 6 000 kg of vegetables (30 to 40 varieties of vegetable and 8 to 10 varieties of fish). As no arable land is occupied, the cost of the integrated equipment is one-eighth of the cost for the same industry, and the labour involved is three per mu (1 ha = 15 mu), with easy operation and management.

3.2 Challenges

While all the practices mentioned above can improve farmers' livelihoods, many lack the resources for their implementation. Additionally, various farmers who have access to technologies, lack the knowledge required to use them in the way they were intended, which often harms the farmers' health or their environment.

3.2.1 Lack of access to appropriate agricultural inputs

Access to qualified agricultural inputs is a problem for many UPA practitioners. In Africa, UPA farmers interviewed in various studies claimed their UPA activities are constrained by lack of quality seeds, pesticides and fertilizers; some farmers discontinued their gardens for this reason (Mwakiwa et al., 2018; Nordhagen, Thiam and Sow, 2019). As a result of the unavailability of certified seeds for improved crop varieties, most African vegetable producers either use their saved seeds or whatever they can find in local supply shops (FAO, 2012). However, saved seeds can present the risk of inbreeding, low germination rates and diseases that result in low yields; commercial seeds in shops are often of dubious origin or quality (FAO, 2012).

Those who raise livestock in urban and peri-urban areas also face lack of inputs, including poultry, micro-livestock, aquaculture and aquaponics. Padgham, Jabbour and Dietrich (2015) claim the livestock sector faces pressure from the increasing cost of animal feed, constriction of grazing land and lack of governmental support.

3.2.2 Non-sustainable farming practices and inadequate training

Non-sustainable farming practices are common problems in UPA, just as they are in rural agriculture, but here the impacts of such practices can be greater. The reasons behind the poor uptake of sustainable farming practices are varied, and context-specific, but often depend on a range of attributes such as limited resources (finance, time, labour), entrenched habits, a lack of knowledge of the benefits of sustainable practices, gender inequalities, educational level and land tenure rights (Tey *et al.*, 2017).

Pest and disease control is a potentially hazardous part of UPA, not only because of the materials used, but also because of the close proximity to the surrounding population and potential pollution of the environment. If there are problems, urban farmers often have easy access to vendors who offer ready-to-use pesticides and insecticides, and who they can depend on for advice on how to apply products correctly to protect their crops.

In **Africa**, poultry manure is a favourite fertilizer and could be an effective way to dispose of animal waste, but studies in **Cameroon** and **Côte d'Ivoire** reported that insufficiently decomposed animal waste is common, which can affect plant growth and contaminate produce (FAO, 2012). Furthermore, the uncontrolled use of synthetic pesticides in many African market gardens, purchased through informal supply channels, pose an increased risk to health and the environment. In fact, in poorer countries, market-oriented farms in peri-urban areas are more likely to use pesticides intensively rather than engage in an integrated pest management (IPM) approach (Orsini *et al.*, 2013). The danger of using pesticides in dense settings impacts not only those who apply them but also the agricultural products, the soil where they are grown and the underlying watertable.

A case study of five peri-urban farms along the Carnaval creek in **La Plata, Argentina** reported that pesticides were used at all tested sites, which negatively impacted aquatic environments near the production areas (Mac Loughlin, Peluso and Marino, 2017). Moreover, chemical pesticides and fertilizers are often applied at rates that are far higher than necessary to improve productivity, because the right quantity is not known. This leads to the farmer's health, the soil and water being negatively impacted, given the high dosage applied, as shown by two studies of practices in coastal Lebanon (El-Moujabber *et al.*, 2004; Zurayk, Samad and Talhouk, 2004). Problems related to uninformed practices can also be found in microgardening. In **Dhaka** and **Chittagong, Bangladesh**, lack of knowledge of compost, fertilizer and pest management in the container system was found to hinder producers (Uddin, 2016).

"Sharing good practices" is the most cited reason for joining a producer network in the six case studies prepared for this sourcebook, highlighting the demand for more knowledge of farming practices. While a minimum level of training and extension activities are usually available in most cities, the scale and scope are often incommensurate with the needs of local UPA farmers.

3.3 Actions to promote urban and peri-urban agriculture

Many actors working in urban areas cooperate to find solutions to production challenges. National and local institutions offer agricultural inputs and support education projects and NGOs develop programmes to increase farmers' knowledge. Agricultural extension services create classes to teach farmers the inputs to use to increase soil fertility and protect plants from pests and how to protect themselves when using these products. Farmers' organizations also have an important place in supporting improved production practices and informing farmers.

3.3.1 Access to appropriate agricultural inputs

By promoting food waste recycling and composting, a municipality can serve two objectives. On the one hand, the impact of waste on the environment is reduced; on the other it increases the availability of low-cost fertilizers to UPA farmers. In **New York, United States**

of American, the Grow NYC (New York City) Compost programme established residential Food Scrap Drop-off sites. Once the food waste is composted, it is distributed free to community gardens, urban farms, neighbourhood parks, street tree beds, and members of the public (Grow NYC, 2020). The city of **Paris, France** has implemented support systems since 2010, assisting in the establishment of collective composters near buildings, and neighbourhood composters for registered households. Manuals on how to properly carry out the exercise are given to participating buildings, institutions and households (Ville de Paris, 2020).

In **Chicago, United States of America**, The Urban Canopy commercial farm regularly runs compost collection from registered members, including individual households and businesses such as restaurants and multi-unit buildings. Members drop their organic waste in the containers provided, which are then picked up and sent for processing and composting. The finished compost is used on the farm as well as for members' gardening activities (The Urban Canopy, 2020).

Policy-makers can also assist with the distribution of inputs, such as seeds. In the Pacific Small Island Developing States, support was provided for UPA during the COVID-19 pandemic, through **distribution of agricultural inputs** and planting materials. For example, in Fiji, the Ministry of Agriculture introduced the Home Gardening Programme and Farm Support Package, which provided gardening seed packages to households in urban and peri-urban areas, which boosted the production of short-term crops. In Samoa, the Ministry of Agriculture and Fisheries purchased seeds for fruits, vegetables and other short-cycle crops and distributed them to farmers and families, including town areas. In **Tuvalu**, the government consigned seedlings in support of home gardens. In Vanuatu, backyard gardening was promoted through the "COVID-19 Food Security Response Plan" and root crops and vegetables seedlings were donated to local households (Sherzad, 2020).

Havana, Cuba, May 2013. A laboratory where organic compost is analysed at Vivero Alamar the peri-urban agriculture cooperative

BOX 4

Arusha, Tanzania - Business licenses for agricultural input companies

Many farmers in and around Arusha do not have the necessary equipment, irrigation, adequate seeds, fertilizers or pesticides. Because of a lack of knowledge, pesticide use is often excessive, which has serious implications for food safety. To increase the accessibility of inputs for urban farmers, Arusha's city council gave business licenses to 45 agricultural input companies to operate in the city, part of the city's five-year plan. These agricultural input companies also provide extension services to farmers. Their Input Company Extension officers work closely with municipal extension officers to promote efficient and safe use of chemicals.

This means that, compared to other cities in the Rikolto survey, Arusha has the highest frequency of farmers who access technical services, 95 percent of respondents. Most are advised on agricultural best practices and food safety when applying chemicals. The agro-inputs most frequently procured are seeds, pesticides, vaccines for livestock and animal feed. Respondents have welcomed the increased availability of inputs. However, it should be noted that this technical advice comes with the marketing of company products. While increased access to inputs and technical advice is beneficial to agricultural productivity, the privatization of extension services may be cause for concern (Erwin *et al.*, 2022).

Meanwhile, in **Victoria, British Colombia**, Canada, the City Council directed staff in the parks department to convert part of the nurseries and greenhouses, used for flowers, for seedlings to be distributed to residents for food production (van der Zwan, 2020). **Neapoli-Sykies, Greece** offers agricultural inputs along with small plots for free to vulnerable households so they can produce fresh food and save on the household budget (MADRE, 2018).

3.3.2 Promoting training for sustainable farming practices

Another way to encourage UPA farmers to adopt certain production practice is to actively promote them in communication campaigns or to make them financially attractive. In **China**, ecological and organic production is promoted across UPA farms in different cities. It is crucial that zero use of chemicals and fertilizers is advocated to improve food quality and sustainable environments (Luehr *et al.*, 2020). In **Chicago, United States of America**, the social enterprise Growing Home[41] brought the organic certification label to urban agriculture, thus guaranteeing zero use of mineral fertilizers and chemical pesticides (Growing Home, No date). In Paris, France, joining and creating shared gardens can be easily arranged and assistance found through a governmental system for urban gardening, Programme Main Verte (Carrot City, 2014; Ville de Paris, 2020).

In North America, support for rooftop gardening is also reflected in the programmes run by a few cities. For example, **Portland, United States of America** started its Eco-roof Incentive Programme in 2008 to address stormwater management problems by subsidizing the creation of rooftop green space (The City of Portland, No date). Similarly, in **Toronto, Canada**, a programme enabled the creation of a number of productive rooftops – a more effective instrument than the City's better-known Green Roof Bylaw, which has not been favourable to urban agriculture projects (City of Toronto, 2009).

Furthermore, for many local authorities the priority is to ensure the safety of UPA produce. In **Flanders, Belgium**, all farmers who use chemical pesticides are required to attend food safety training once a year to guarantee proper application. In **Arusha, Tanzania**, the City Council partnered with local civil society organizations, the Tanzanian Horticulture Association, the Tropical Pesticides Research Institute, a local farmer network, and others to launch the Arusha Food Safety Initiative

Paris, France. Le Poireau Agile, one of the gardens receiving support (including materials and shed) from the Programme Main Verte in Paris

Toronto, Canada. Carrot Green Roof, one of the rooftop projects that received funding from the City of Toronto's Eco-Roof Incentive Program

[41] For more information see www.growinghomeinc.org

(Rikolto, 2019). Based on an analysis of the main food safety risks in the horticultural value chain, six multi-stakeholder working groups were created to work out a local food safety standard, a participatory guarantee system, safe food production, consumer awareness of food safety risks, the development of safe food businesses, logistics and infrastructure. In **Quito, Ecuador**, on-farm production of organic inputs has reduced operational expenses and chemical contamination, in large part as a result of Participatory Urban Agriculture Programme (AGRUPAR), the municipality's urban agriculture programme, which has led to the widespread uptake of organic or agroecological practices among urban farmers.

Extension services play a crucial role in fostering the adoption by UPA farmers of the latest innovations in productivity or sustainability. Capacity-building activities can be organized by public services such as for AGRUPAR in Quito, by private companies, as in Arusha where input suppliers or a farmer organization train farmers to use agrochemicals safely.

Agricultural training can help increase farmers' knowledge. Many organizations offer business training to help farmers improve how they advertise and sell food. In Latin American countries, the FAO Growing Greener Cities Programme supports local governments in UPA projects that provide agricultural inputs, facilities, and training to local producers. For example, in **Managua, Nicaragua**, demonstration and training centres have been established and 13 000 young workers have been trained to help project participants with practical activities (Carrot City, No date). In **Tegucigalpa, Honduras**, households interested in initiating home gardens are trained at demonstration training centres once a week, 72 percent of which are headed by women.

In **El Alto, Bolivia**, where the year-round cold weather considerably limits the capacity of UPA, FAO together with the municipal government established 1 187 family greenhouses across nine districts in the city between 2004 and 2008 (as mentioned earlier in this chapter). The project also set up three demonstration and training centres, where workshops teach participants

Managua, Nicaragua.
One of the capacity development and technology adoption centres

Sucre, Bolivia: Construction of a simple earthen greenhouse, supported by Sucre municipality and FAO

basic gardening skills (FAO 2014a). This project has, in turn, encouraged other Bolivian cities, including the capital **Sucre**, to promote UPA and construct greenhouses for low-income families (Carrot City, 2014). In **Gorakhpur, India**, the World Health Organization (WHO) installed weather stations. Farmers receive information on wind, temperature, rainfall and humidity via short-message service on their mobiles. In this way farmers can schedule irrigation and harvesting (Mani, Singh and Wajih, 2014). Handy, how-to resources are available such as a vegetable gardening guide by the World Vegetable Center[42] and an Urban Agriculture Manual by the University of Wisconsin-Madison[43].

[42] For more information see https://avrdc.org/grow-vegetables?utm_source=FRESH%21+The+World+Vegetable+Center+Newsletter&utm_campaign=cd37314d7f-EMAIL_CAMPAIGN_2020_05_07_07_24&utm_medium=email&utm_term=0_a50c268aac-cd37314d7f-154464581

[43] For more information see https://urbanagriculture.horticulture.wisc.edu/

4

LAND MANAGEMENT

Of all the resources an urban farmer should have access to, land (and other surfaces) may be the most crucial and the most difficult to acquire. Increasing urbanization threatens UPA because there are multiple competing uses of land. Chapter 4 describes the various types and examples of UPA that illustrate issues linked to land and tenure management. In particular, land resource requirements for various types of UPA is discussed, the main challenges related to land are presented, and how cities around the world are developing innovative interventions to support land use for UPA is reviewed.

4.1 Practices

Land resources used for UPA vary depending on the type of farm or garden, territorial location, local context, and other variables. Table 4 provides an overview of the general characteristics associated with four commonly found types. The first three are analysed after Table 4.

TABLE 4 Summary of land resources used for typical typologies (adapted from analysis of various sources)

Urban and peri-urban agriculture type	Urban/ peri-urban	Location	Scale/Size	Tenure/Ownership
Home-based gardening	Urban, peri-urban	Backyard, patios, rooftops and balconies; public vacant land in the neighbourhood	Small	Privately owned or unclear ownership
Community-based and other shared gardening	Urban, peri-urban	Public vacant land, etc.	Small to medium	Owned by a community group, an organization, a municipality, a public of parastatal entity, or land trust; allocated to individuals or groups
Commercial crop production, livestock and fisheries	Peri-urban	Alongside water sources, not far from central market	Small to large	Privately owned, borrowed or rented
Institutional food growing	Urban, peri-urban	Schools, universities, municipalities and other governments, public authorities, etc.	Medium to large	Owned by institutions

4.1.1 Home gardening on household land

A major form of UPA, residential gardens or home gardens, is common to both urban and peri-urban areas. Gardens are mostly cultivated by local residents on private land in backyards, on patios, rooftops and balconies, or on idle public land beside riverbanks, roadsides, railways and undeveloped or abandoned areas (Vazhacharickal *et al.*, 2013; Luehr *et al.*, 2020).

The area used for these gardens is often small, although it varies across countries and cities. In **Antigua and Barbuda**, a backyard gardening programme in 2008 estimated a range of 1 to 10 m^2 for the home gardens involved (FAO 2014b). In **Lima, Peru**, home garden plots were estimated to be as small as 4 m^2 (FAO 2014a). In **Chicago, United States of America**, the size of most home gardens ranges from 20 m^2 to 49 m^2, while gardens in vacant lots can exceed 100 m2 (Taylor and Lovell, 2012). In **Nanjing, China**, residential garden plots range from 0.5 m^2 to 100 m^2 in core districts such as Gulou and Qinhuai districts, and from 100 m^2 to 1 300 m^2 in new urban areas such as Qixia district (Luehr *et al.*, 2020). In Africa, the average area covered by home gardens in residential areas is around 10 to 100 m^2 in **Ghana** (Mackay, 2018), while in some cities in **Zambia** home gardens can cover up to 900 m^2 (Smart, Nel and Binns, 2015).

Gardeners usually own the land for most on-plot residential gardens, while off-plot land cultivation in public areas sometimes takes place outside the bounds of clear ownership or against regulations, as in the case of "guerrilla gardens" (Visoni and Nagib, 2019). In **Nanjing, China**, for example, since 2013, a by-law prohibits growing food in public green spaces in residential neighbourhoods. Nevertheless a few individuals still cultivate vegetables in undeveloped urban districts and other public vacant space (Si and Scott, 2016).

4.1.2 Public or community-owned land for community gardening

As introduced in section 1.2.2, community gardens and allotments, which are typical types of UPA are located on public or community-owned land, are primarily used to grow food, but also for leisure, therapy, or for sale. A community garden is any area of land that is cultivated by a group of people. It can be urban, suburban, or rural. It can be one community plot, or many individual plots, and be located at a school, hospital, church, or on other public land.

Community gardens and allotments can have different purposes, sometimes simultaneously: some prioritize leisure and social and recreational services, while others primarily address the food security needs of members, and may focus strongly on commercial aspects and profit from sale of produce. Nevertheless, community gardens may differ from the commercial farms discussed below because of land ownership and how they function. Urban allotment gardens are often organized into associations to facilitate decision-making. Allotment gardeners are, therefore, generally requested to pay a small fee to use the plot and to attend specific association duties (Orsini *et al.*, 2020). Ultimately, the differences between community gardens, allotments and other forms of communal gardens are often blurred and vary considerably between countries and even between gardens (Nasr, 2021).

The area of land varies depending on the context. In **Lima, Peru**, community gardens cover up to 1 000 m^2 (FAO 2014a). In the **Philippines**, the land parcels allocated to allotment gardens span about 200 to 400 m^2 (Hamilton *et al.* 2014; Tixier and Bon 2006). In **London, United Kingdom of Great Britain and Northern Ireland**, allotment plots usually cover 253 m^2 for historical reasons and are rented by users at an average cost of GBP 50 to 60 per year (Greater London Authority, 2006). Talude in Lisbon, Portugal is an autonomously constructed neighbourhood, built by Cabo Verdeans in the 1970s. About 130 plots are cultivated on a large area of land ranging from 175 to 200 m^2, where further development is planned (Cabannes and Raposo, 2013). These plots are much larger than the average 20 m^2 for backyard gardens (*quintais*) in the city. Vale de Chelas, also in **Lisbon, Portugal** is probably the largest cultivated urban park in Portugal, covering about 15 ha of which 6.5 ha are gardens.

Community gardens or allotments may be owned and managed by a community group, an organization, a municipality, or land trust (Brown and Carter, 2003), with subdivided land plots are allocated to and cultivated by individuals. There are three types of land tenure system in **London, United Kingdom of Great Britain and Northern Ireland** includes three types: statutory allotment, which is borough land acquired by a council for the specific intent of

gardening; temporary allotment, on council land is allocated for other uses with little protection from disposal; and allotments on privately owned land, which also receive little protection if being sold (Greater London Authority, 2006).

Generally, to acquire a community garden/ allotment plot, a formal application is required, which may take time to be approved (Bendt, Barthel and Colding, 2013; Mok *et al.*, 2014). In contrast, there are other types of community gardens such as **Germany's** public-access community gardens, which are open to everyone at all times and the immediate participation of the public is welcomed requiring minimal written regulations (Bendt, Barthel and Colding, 2013). Intercultural gardens are also common in Germany, which specifically focus on the connectivity between different cultures, with an emphasis on immigrants (Müller, 2007).

4.1.3 Privately-owned land for commercial farming

As introduced in section 1.2.2, most farms and market gardens engaged in UPA are on privately owned land in suburban and peri-urban areas, often alongside water sources and with access to markets. In most cases, farms are at a distance from city centres because the land is densely utilized and expensive. Exceptions are notable, such as vertical farming employing hydroponics and aquaponics, rooftop greenhouses and plant factories, found mostly in high-income countries and cities. These innovative urban farming techniques require intense capital investment and advanced technologies to ensure sustainable production and farm operations. They are increasingly found on the rooftops of older, usually industrial, as well as newer buildings, both centrally and on the periphery.

Ground-based commercial farms and market gardens are often large. In **Ghana**, market gardens and large poultry farms occupy an average area that exceeds 1 000 m^2 (Mackay, 2018). In **Zambia**, off-plot farms average 3.8 ha (Smart, Nel and Binns, 2015). In **Chinese cities** such as Shanghai, Yangling or Beijing, peri-urban farms range from 3 to over 200 ha (Yang, Cai and Sliuzas, 2010). In **Lima, Peru**, peri-urban farms cover up to 600 ha, however farms are usually rented out per plot; 60 percent of holdings average less than 1 ha and 43 percent, less than 0.1 ha (FAO 2014a).

Berlin, Germany.
Intercultural garden in Görlitzer Park

Large-scale farms are privately owned, borrowed or rented. In a report on Gamkalle in **Niamey**, the largest market garden area in **Niger**, 54 percent of gardeners own their land because it was inherited, 28 percent rent, 10 percent purchased the land and 8 percent borrowed the land. However, various complications caused insecure land tenure, whereby sometimes the local authorities evict gardeners without compensation. (Andres and Lebailly, 2011). In **Dakar, Senegal**, most commercial respondents in our UPA study cultivate between 1 and 3 ha and own the land they cultivate, although some rent from friends, family or private individuals. Often, the land is inherited from parents (Erwin *et al.*, 2022). The situation is similar in **Tegucigalpa, Honduras** where most commercial farmers own and manage their land themselves. Most respondents inherited both their land and the farming business from their parents (Erwin *et al.*, 2022).

4.2 Challenges

4.2.1 Availability of land

A fundamental challenge to UPA is the limited space available for food production especially in urban areas. In most countries around the world, ongoing urban expansion is causing a continuing trend of conversion of land from agricultural to non-agricultural, which threatens both urban and peri-urban agriculture. In **Chennai, India,** the urban area is rapidly expanding into peri-urban farmland. This changing situation is common throughout India (Nambi *et al.*, 2014). In **Hanoi, Viet Nam**, peri-urban cultivated land is being pushed further and further away from the city centre, while urban land for food production is being squeezed by significant pressure (Lee, Binns and Dixon, 2010).

This phenomenon of diminishing land for peri-urban agricultural land is also seen in high-income countries from Australia to North America and Europe (McEldowney, 2017; Mok *et al.*, 2014).

Conversion of land to urban use is commonplace in both urban and peri-urban areas, as a result of two simultaneous flows in opposite directions. Migration flows from rural areas to cities increase the pressure on land, particularly because of the construction of informal housing in poorer countries. At the same time, the movement of the urban population, particularly the richer, from towns and cities to the nearby countryside has been raised as significantly impacting the land as well as agricultural activities in peri-urban areas, because of the reduced availability of both land and farm labour (McEldowney, 2017).

4.2.2 Accessibility of land

The main problems faced by UPA producers are partly derived from limited land and insecure tenure, regardless of the type of UPA practiced (Bellwood-Howard *et al.*, 2015; FAO, 2012; Lynch *et al.*, 2013; Mwakiwa *et al.*, 2018; Tefera, 2010; World Bank, 2013). In **Lubumbashi, Democratic Republic of the Congo** for example, most smallholder farmers used to grow their crops on vacant lots, without permits or land titles from municipal authorities. This not only affected farmers' livelihoods, but was also a potential threat to the environment. Farmers who fear eviction are not motivated to invest in management practices to improve the land, such as maintaining soil fertility and preventing erosion (FAO, 2010). The intense uncertainty also makes it more likely that UPA farmers prioritize short-cycle seasonal crops, leading to reduced diversity of crops and nutrients in their produce.

Urban planning actors do not always recognize the role played by urban agriculture in cities, and impede access to land for various sectors. Planning support to improve access to land for UPA is still limited or unavailable. Policies, guidelines or incentives are still relatively rare that would promote access to plots, where appropriate cultivation techniques can be developed, such as rooftop, vertical or microgardening.

4.2.3 Soil and land quality

Even where land or other space is available and accessible, this does not mean it can be used. Soil safety as well as quality can mean agricultural activity would be unwise, unproductive, dangerous and forbidden. Given the existence of widespread heavy metal soil contamination in post-industrial cities, poor soil quality can further impede urban agriculture activities and profitability (Hunold *et al.*, 2017). Even if the soil is safe to use, it may be compacted or devoid of nutrients, discouraging investment in that land.

As a result, raised beds filled with imported clean soil are often used to grow food in cities, specifically where it is unsafe to cultivate in the ground. In **Philadelphia, United States of America**, where there were many vacant lots, it took several seasons to build up qualified soil before produce could be grown, making it more of a challenge to plan and finance UPA initiatives.

4.3 Actions to support land management

4.3.1 Securing availability of land

Many governments and other actors are aware of the disappearance of agricultural land and are attempting to regulate the preservation and exploitation of available resources through various approaches. In many cases, municipalities own a portion of city land and can decide on its purpose. In other cases, non-profit or private organizations can purchase land and make it available to urban farmers. Even when land is privately owned, governments can take action to encourage private owners to lease their plots to UPA farmers.

Zoning

One of the challenges identified above is the rapid disappearance of agricultural land because of urbanization. To counter this trend, it is vital that cities employ zoning, so land uses can be regulated and activities initiated that favour UPA, whether by creating special zoning categories, or more often, by integrating UPA into the existing zones. At the same time, existing zoning regulations, along with their enforcement by city staff, are often major obstacles to the development of UPA. As a result, the careful introduction of new zoning approaches, such as green belts or special zoning categories, along with reassessment of existing zoning constraints (such as prohibiting the keeping of small livestock) are now recognized as critical to the future of UPA.

In **Bangkok, Thailand,** the Bangkok Comprehensive Plan, introduced in 2013, (Bangkok Metropolitan Administration, 2013.) designed green belts to protect agricultural land for the city (BMA, 2013). The main purposes were to preserve the food production zone on the periphery of the city and to protect the inner-city from flooding since the agricultural zone can help absorb stormwater (Fakkhong and Suwanmaneepong, 2015). In **Philadelphia, United States of America,** a new Zoning Code was passed by the City Council in 2012 to establish urban agriculture as a land use category, and to define four subcategories: animal husbandry; community gardens; market or community-supported farms; and horticulture nurseries or greenhouses. This zoning change resulted in fewer restrictions to the establishment of community gardens and market farms and greatly facilitated UPA activities in the city (Hunold et al., 2017).

There are many other benefits to zoning plans besides food production. In 2012, **Daegu, Republic of Korea** launched an urban rice paddy pilot project to create additional green and cooling spaces in the city. The project reduced the temperature by 15 °C on concrete roads surrounded by paddy plots compared to others. The initiative also successfully engaged citizens in agriculture and contributed to intensifying social interactions (Forster *et al.*, 2015). In **Beijing, China**, a zoning plan reserves substantial peri-urban areas for developing recreational agriculture, which encompasses sustainable agricultural production, recreational services, nature conservation, eco-education and the preservation of cultural heritage. A large number of public investments have been made to facilitate this type of peri-urban agriculture, which is managed by either village cooperatives or private investors (de Zeeuw, van Veenhuizen and Dubbeling, 2011).

Victoria, Canada amended its by-laws to permit gardening on public land on the green strips between the street and sidewalk in residential areas. An increase in residents gardening is believed to have contributed to the city's objective of creating healthy and diverse ecosystems, enhancing community connection and healthy living. A set of guidelines assist citizens to garden confidently and responsibly, and recommendations are included on how to avoid and manage potential soil contamination, a common concern when gardening on land in the city (City of Victoria, No date).

BOX 5

Dakar, Senegal - Municipal planning to preserve green spaces

Dakar is faced with unique challenges related to land because a significant part of the city occupies a peninsula. According to 2008 data, 35 percent of land in the Dakar region was cultivated, and 30 percent was vacant or bush. However, in the last 10 years, the population has increased by over one million resulting in loss of agricultural land at an average rate of 60 ha per year. In an attempt to prevent these losses, the municipality launched the Dakar Urban Development Plan in 2016. In this plan, the municipality agrees to limit urban growth and preserve forests and green spaces. While this plan does not explicitly prioritize urban agriculture, it has led the mayor of Rufisque (a department within the Dakar region) to reserve 2 330 ha for urban and peri-urban agriculture. Additionally, a major agricultural area along the Atlantic coast is zoned to prohibit building, though this can be difficult to enforce, since national level projects (such as highways) can supersede municipal land-use agreements. This makes alignment with national regulations essential. A good example is the Mbao Forest, which is administered by the Federal Department of Environment, where land is allocated to several farmer cooperatives, granting them more security in their land tenure. The municipality has supported five market gardeners' groups in this region by building capacity for market gardening, providing support with inputs (seeds and fertilizers) and water control at the plot (Erwin *et al.*, 2022).

Land banks

Municipalities can rent land directly to urban farmers, using different mechanisms, and a number of cities, such as **Rosario, Argentina**, have long used such mechanisms. Several aspects are key to the successful use of a land bank for UPA: land registration, guarantee of ownership by the local government, acting as broker with landowners for temporary use, and land banking by the municipality itself.

In **Philadelphia, United States of America**, the first on-ground urban agriculture programme, since the establishment of the Food Policy Council in 2011, was the Farm Philly Programme set up by the Department of Parks and Recreation, which owns and maintains a large amount of public land. So far, the programme has supported over 60 urban agriculture projects on Philadelphia Parks and Recreation land, including orchards, horticultural production, educational gardens, community gardens and market farms (Miller, 2018). In 2013, the Philadelphia Land Bank Law prioritized urban agriculture as a community beneficial use on vacant land (Hunold *et al.*, 2017).

This method of land banking is not unique to governments. In **Belgium**, a non-profit organization called "De Landgenoten" finds, buys, and manages land suitable for organic agriculture and then rents the land to organic farmers in need of land (De Landgenoten, No date).

Financial stimuli

A municipality can also increase the availability of land by granting tax waivers to property owners who rent land to UPA farmers. In **Brazil**, the 2003 national Zero Hunger policy supported the allocation of urban public spaces for agriculture and the reduction of land use taxes (da Silva, Del Grossi and de Fraça, 2011). In the **United States of America**, some cities such as San Francisco, and states like California, have put in place tax advantages for land used for urban agriculture. In **Japan**, the Productive Green Land Act includes tax incentives for landowners in exchange for not developing their land in an effort to promote urban agriculture and other green areas, which has contributed to the provision of environmental benefits to cities.

4.3.2 Improve accessibility of land

Even if land is available for UPA, producers can still struggle to access this land. There are various actions stakeholders can take to improve accessibility.

Land database

Municipalities and NGOs can facilitate contacts between landowners and producers by creating a land database. Many work through web-based platforms. One of the most famous was Landshare, which was launched in **London, United Kingdom** in 2009, to connect those with land to share it with those who needed it to produce food, both parties ultimately shared their harvest (Landshare, 2012 in Wood, 2020). Unfortunately, despite 75 000 users being registered to grow their own food, the website closed in 2016, seemingly because of conflicting priorities between publicity and the quality of services offered by the platform (Wood, 2020). Similarly, in **New York City, United States of America**, "596 Acres" emerged as an influential organization for mapping and advocating use of vacant or unclaimed land, however, it closed as an organization in 2018, but maintains its tools and website online [44].

Over the past decade, land-sharing platforms have continued to develop. Edinburgh Garden Partners in **Edinburgh, United Kingdom of Great Britain and Northern Ireland** connects more than 60 gardens throughout the city with volunteer producers. In **Philadelphia, United States of America**, the Garden Justice Legal Initiative's "Grounded in Philly" project, started by The Public Interest Law Center, has been providing information about finding vacant land for community use in urban agriculture since 2013[45].

One way to tackle the issue of soil safety and quality of appropriate land available for potential urban agriculture land is to develop an inventory of land combined with a history of use of the property (Hendrickson and Porth, 2012). In this way, urban farmers will be able to recognize and avoid potential soil contamination issues.

[44] For more information see https://596acres.org/ and https://livinglotsnyc.org/

[45] For more information see https://groundedinphilly.org/

Securing long-term use

As identified above, one of the challenges faced by UPA farmers is insecure land tenure. To ensure long-term use of land, municipalities can lease vacant municipal land to farmers for a fixed period. A good example can be found in **Baltimore, United States of America**, which has turned the city's vacant land from a liability into an asset and achieved economic, social and environmental goals. In 2012, the mayor developed the Homegrown Baltimore Initiative: Grow Local, Buy Local, Eat Local. The "Grow Local" part of the initiative created a land leasing initiative to promote five-year lease agreements to farm city-owned vacant land and the building code was changed to permit season-extending hoop houses (Baltimore Office of Sustainability, 2013). The city also established animal husbandry regulations that permit chickens, rabbits, bees and miniature goats to be raised (Baltimore City Health Department, 2013).

NGOs or private companies can also engage in these initiatives. In the **Mumbai Metropolitan Region, India**, since 1975 the Indian Railway has rented vacant land near tracks and stations to employees and encouraged them to cultivate vegetables (Vazhacharickal *et al.*, 2013).

Another solution can be found in Community Land Trusts, a mechanism of land use and stewardship on behalf of local communities. CLTs retain permanent land ownership while leasing the land to various users for a range of purposes. CLTs provide urban agriculture farmers secure land access through various land tenure arrangements. CLTs also provide support with management, technical assistance or other services. For example, the Athens Land Trust in **Georgia, United States of America** is involved in soil preparation, input provision and training workshops. In some cases, CLTs indirectly support UPA by including gardening or orchard spaces in their housing plans and designs (RUAF, 2013). **Providence, United States of America** has become well known for its Southside Community Land Trust, which, over four decades, has managed to assemble extensive areas based on the CLT model to be used for urban agriculture. It is the only trust of this type in North America that is devoted to urban agriculture (Brown and Deming Brush, 2018).

In **Leuven, Belgium**, a community-supported agriculture (CSA) farm has a rental agreement with the municipality where a part of their payment takes the form of ecosystem services. The CSA and the city calculate the estimated value of the positive environmental contributions on city land and reduce the rental price accordingly (Erwin *et al.*, 2022). In the city of **Tokyo, Japan**, with a population of 14 million inhabitants, as a result of the Productive Green Land Act, the city hosts approximately 4 000 ha of farmland in urban areas (Harada *et al.*, 2021).

Providence, Rhode Island, USA. Urban farm on land owned by the Southside Community Land Trust in Providence

Leuven, Belgium. Community supported agriculture member harvesting spinach

BOX 6

Quito, Ecuador - Increasing self-sufficiency of vulnerable groups in Quito through better access to land

The Quito Metropolitan District is in the northern highlands. The city altitude ranges from 500 to 4 780 m above sea level and hosts seventeen types of ecosystem. As a consequence, large areas of the city are unsuitable for gardening. Most farmers occupy small plots between 500 and 1 000 m^2. Mostly, home gardens cover less than 500 m^2. In order to support the development of urban agriculture and provide land for gardeners, the city implements the AGRUPAR project. This project grants some public land to community gardeners, specifically to vulnerable groups such as women (84 percent) and older people (27 percent), where they grow vegetables for home consumption and can sell the surplus. When space is limited, AGRUPAR promotes alternatives such as vertical gardens, and microgardening in recycled containers, such as bottles, boxes and tyres (FAO, 2014b). Currently, AGRUPAR members occupy 63.72 ha of land in the city, amounting to 1 400 gardens. After being administered by the Economic Promotion Agency of Quito (ConQuito) between 2005 and 2010, AGRUPAR now has its own budget for self-management. This budget, however, remains small, comprising only 0.2 percent of the budget for the Metropolitan District of Quito (Erwin *et al.*, 2022).

Usability of land

To grow healthy food, you need healthy soil. Municipalities, universities or non-profit organizations can test soil to help farmers assess toxin levels and determine if the land is suitable to start production or if additional measures are required. To ensure soil quality for urban farming, **Cleveland, United States of America** works with the Ohio State University to test the soil before farming takes place on the plot. **Baltimore, United States of America**, approved a soil safety policy to assist growers assess and mitigate urban soil contamination (RUAF, 2016).

In **Leuven, Belgium** inhabitants can request land from the city to start a community garden. Before approving the application, the soil in the allotments is tested to determine its viability and safety, paid for through the municipal budget (Erwin, 2020).

The city of **Burlington, United States of America** investigated brownfields as potential sites for greenhouses, and published guidelines and webinars on how to garden safely in brownfields (Hendrickson and Porth, 2012). In **Philadelphia, United States of America**, for many years, the Northern Liberties neighbourhood was the only zip code in Philadelphia that did not have a community green space because of contamination from several tanneries. In order to reuse the site, the Environmental Protection Agency (EPA) provided soil testing and other technical assistance to ensure the site was safe for reuse as a park and community garden. The park opened in 1996 and includes 37 garden plots, a composting area, an herb and butterfly garden, a children's playground, open spaces for community events, art and sculpture. The park is at the centre of a revitalized community, surrounded by new residential and commercial redevelopments (EPA, 2011).

Soil testing, which is not cheap, is not always necessary for undertaking urban agriculture in built-up areas. No history may be kept of soil contamination in many city areas, therefore citizens, groups or organizations often hesitate to use land because of this uncertainty. The City of **Toronto, Canada** sought to address this limiting factor by developing a Soil Assessment Guide that helps with the decision-making process. The Guide informs on how to decide whether to cultivate with confidence without a need for testing, or to cultivate above the

ground using raised beds and other techniques given the likelihood of contamination. Soil testing is undertaken only where soil conditions are uncertain (City of Toronto, 2017).

In 2016, a research programme named Risks in Urban Farms, Assessment and Management (REFUGE) was launched at AgroParisTech, **France**, to create a methodology to assess and manage health risks linked to the concentration of trace metals in urban farm soils. This programme created two decision-making tools for municipalities and for urban farms: a guide to determine the level of contamination in urban soils and to evaluate the associated risks, and a health control plan that brings management measures to reduce these risks on urban farms (Aubry and Manouchehri, 2019).

Paris, France. Raised beds on the roof of AgroParisTech, are part of experiments on soil pollution and fertility on urban rooftops

BOX 7

Rosario, Argentina - The Green Circuit

Before 2002, Rosario's economic situation seemed disastrous. Many of the city's steel, chemical and paper factories had closed, leaving many unemployed. As a result, around 60 percent of the population had an income below the poverty line, and many did not have access to healthy food. Meanwhile, a study by the city's university calculated that 36 percent of the municipal area was vacant space. In 1997, a Municipal Land Bank was created by the city to connect urban producers to landowners who owned land that could be used for urban farming (Municipality of Rosario, 1997). However, as there was a lack of capital and funding much of this land lay fallow (FAO, 2014a).

Realizing something had to be done, the city set up The Municipal Organic Agriculture Development Programme in 2002. Among other actions, this programme waved property tax for private or public landowners on land used for organic urban agriculture (Municipality of Rosario 2002). Other programmes soon followed. In 2004, The Programme for Garden Parks permitted the conversion of vacant lots into garden parks to create a natural pathway through the city (Municipality of Rosario, 2004; RUAF and the University of Buffalo, 2004). Then the Metropolitan Strategic Plan of 2008–2018 supported urban and peri-urban agriculture by building a "green circuit" that passed across and around the city, which includes home gardens, community gardens, commercial vegetable gardens, orchards and multi-functional garden parks.

Data collected in 2014 showed that more than 30 ha of land was included in the green circuit for growing crops. This land was allocated to nearby low-income residents free of charge; in return they guaranteed continuous production employing agroecological practices. For example, the green corridor along the railway line was divided into four fenced plots with a total area of 2 ha, cultivated by the residents and school children from surrounding areas. Group productive gardens to produce vegetables and aromatic plants were, on average, 2 ha divided into plots from 500 to 1 000 m^2, each plot cultivated by one gardener/family (FAO, 2014a).

5

WATER MANAGEMENT

This chapter addresses various sources of water and irrigation systems used by UPA. In many contexts, water is often a critical resource, and the quality and availability varies based on location and type of UPA. Challenges arise when water is not sufficiently available or accessible, if the quality is inadequate, or if drainage systems fail. However, if managed well, agricultural activities can positively affect urban water management, as improved irrigation methods can save water and alternative water collection sources can cut back on the water used for agricultural and treated for domestic consumption. Urban green spaces allow for better drainage of rainwater, preventing floods and landslides (Arena, Genco and Mazzola, 2000). Chapter 5, therefore, deals with existing policies and projects regarding water saving, re-use and safe use.

5.1 Practices

Water for UPA can come from various sources, e.g. rainwater, groundwater, surface water, or wastewater. Many different methods can be used to apply water, including watering cans, drip irrigation and pumps that can contribute to the cost of water used.

TABLE 5 **Summary of water resources used for typical typologies (adapted from analysis of various sources)**

URBAN AND PERI-URBAN TYPE	WATER SOURCE	IRRIGATION SYSTEM	COST
Home-based gardening	Rainwater, groundwater, surface water, wastewater	Watering can, bucket, treadle pumps, low pressure drip/sprinkler irrigation	Low
Community-based and other shared gardening	Permanent water courses/ surface water, groundwater	Small-scale low pressure drip/sprinkler irrigation, bucket, shared motor pumps	Low
Commercial crop production, livestock and fisheries	Municipal water systems (piped water)	Small to large scale drip, sprinkler irrigation, motor pumps	High to medium
Institutional food growing	All the above	Various, including watering can, bucket, treadle pumps, low pressure drip/sprinkler irrigation	High to low

5.1.1 Access to water sources

In **Lima, Peru** there is almost no annual precipitation (around 25 mm per year). Water is mainly sourced from surface water and filtration of underground water (Merzthal and Bustamante, 2008). In **Bejing, China**, the availability of surface and groundwater is decreasing rapidly, forcing governments and farmers to seek new sources such as the reuse of wastewater (Wenhua and Jianming, 2008).

Overall, the quantity and quality of available water varies dramatically, as well as the varieties grown and types of UPA. In general, UPA uses four types of water sources: **rainwater** and **groundwater**, usually drawn from wells; **permanent water courses/surface water** such as streams, rivers, ponds, shallows; **municipal water systems** (piped water); **wastewater** originating from either contaminated surface water or greywater from the home.

Rainwater and groundwater are key sources of crop irrigation in cities where sufficient rain falls and the replenishment of the watertable is stable. However, additional irrigation is often necessary for vegetable production, even during the rainy season, so farmers store rainwater and use it as complementary irrigation. For example, in **Kampala, Uganda**, irrigation for UPA relies on rainwater during the rainy seasons, which is harvested by farmers to cope with water scarcity in dry seasons.

By capturing the runoff, rainwater harvesting can not only complement the water supply, but also reduce urban flooding in rainy seasons and improve the quality and quantity of existing groundwater aquifers (Sabiiti *et al.*, 2014). In **Nicaragua**, irrigation water is sufficient in wet seasons, and rooftop storage tanks are used for cultivation during the dry season, which saves the clean and ample water that fell during the wet seasons (FAO, 2014a). Even in cities where there is plentiful rainfall, as in **Leuven, Belgium**, while most farmers rely on seasonal rains, a few supplement rainfall with a back-up irrigation system, mostly surface irrigation using groundwater (Erwin *et al.*, 2022).

In many areas, most water for UPA irrigation is sourced from **surface water**. In **Lima, Peru**, where rainfall is non-existent, river water irrigates 12 680 ha belonging to 7 610 farmers, while other areas rely on wastewater irrigation (World Bank, 2013).

In **Rome, Italy**, generally, residential gardens use municipal water supplies: others extract water from wells, canals and rivers (Lupia and Pulighe, 2015). While the latter is common, some of these activities are illegal, because municipal water supplies are always costly. In **Chennai, India**, most of the water supply comes from Red Hills and Chembarambakkam lakes. It is normal practice to bore wells and use irrigation tanks to combine groundwater and surface water for irrigation in peri-urban areas (Nambi *et al.*, 2014).

Piped water is more commonly used in urban areas in high-income countries. In the metropolitan area of **Perth, Australia**, 40 percent of the urban water supply is used for agricultural irrigation, but this practice is banned during periods of drought (Dhakal *et al.*, 2015). In **Africa**, in the few countries that have included horticulture as part of urban development, irrigation and drainage systems have been installed for market gardens. Few cities use piped water because of its distance from gardening areas or its high price when used for irrigation (FAO, 2012).

Wastewater irrigation, in many instances, is preferred because it contains rich nutrients at low cost, especially in Africa, the Caribbean and Latin America (FAO, 2014a; FAO, 2019c). However, as only a small amount of the total volume of wastewater is filtered, wastewater irrigation can

Honduras.
Wastewater collection – hydroponic system.

be risky. In **Kumasi, Ghana**, vegetable farming takes place in the lowlands, near waterbodies. Most farmers extract irrigation water from streams containing the city's greywater and the effluents from sewage treatment plants. This can pose a health risk to farmers and consumers who eat their vegetables (Drechsel and Keraita, 2014; Keraita *et al.*, 2002). A variety of wastewater-based irrigation systems are in places as diverse as Gaza, Peru, Tunisia and the United Arab Emirates. These systems can be very effective and provide excellent substitutes for other water sources. The systems can deal with volumes of wastewater but can be fragile if not well designed and maintained.

Irrigation systems

A variety of small-scale irrigation systems are used by UPA that can save on the water used. The systems should be adapted to the local circumstances, as even low-cost technologies can increase the efficiency of water use. **Antananarivo, Madagascar** is located in a drought-affected area. In 2009, drip-irrigation and micro-irrigation systems, used in the dry season, were installed during an FAO project. One of the benefits of drip irrigation is that the kits can be assembled easily from recycled, local materials such as porous ceramic containers or pipes with holes (Aubry *et al.*, 2012).

Specific production practices can also be employed to save water. Where conditions are marginal, simple hydroponics can facilitate plant growth and, at the same time, recycle water, so that only a fraction of the amount of water is used in field agriculture. Lufa Farms, a company that produces a range of crops in several rooftop hydroponic greenhouses in **Montreal, Canada** uses a filtered, closed loop irrigation system, which recirculates all the irrigation water and nutrients and uses rain and meltwater to supplement the system (Lufa Farms, 2020). Hydroponics is increasingly employed in high-investment projects around the world. In a number of countries low-income urban residents practise a simplified version.

5.2 Challenges

Many UPA farmers face challenges related to water. Roughly, these challenges can be divided into three main categories: lack of (access to) water, lack of drainage systems and issues with water quality.

5.2.1 Water scarcity

Water scarcity is a predominant constraint throughout the year in desert areas, but also significant in dry seasons in other regions. In **Juba, South Sudan**, farmers cultivating along the Nile River and those in peri-urban areas have minimal problems with water. However, for others nearby, access to irrigation water is a challenge because there is no piped water system and very few public boreholes for household use (FAO, 2016). In **Managua, Nicaragua** water availability depends on the season. During the rainy season, May to November, rainwater is sufficient to meet the needs of farmers. However, during the dry season, many households lack water, as they are not connected to the municipal water supply (FAO, 2014c). In **Chennai, India**, UPA is further threatened by reduced water supplies for agriculture, as domestic use is prioritized in cities and the water may be contaminated by industrial waste (Nambi *et al.*, 2014).

As the above examples show, there are issues at stake besides the scarcity of water itself. Lack of access to piped water means that, even where water is available, the supply may not reach areas where farming or gardening takes place. Where piped water is available, the high price, targeted for domestic use, often limits the amount of water for plants. Boring wells is often restricted, and when it does take place, it can have a significant negative impact on the aquifer, including increasing salinity, which is a common problem in coastal urban areas. Even when water is available for cultivation, there may be issues with the quality of water and its regular availability – sometimes, repeating power cuts means the supply of water for plants becomes unreliable. Thus, in many cities and countries around the world, water scarcity is a major and multifaceted problem.

BOX 8

Dakar, Senegal - High water prices

In a dry climate, such as in Dakar, where the average yearly rainfall is decreasing because of climate change, access to water is the greatest constraint to urban and peri-urban agriculture (UPA). All commercial farmers in our case study have either sprinkler or surface irrigation systems that draw from the municipal water supply. The initial investment for these irrigation systems averages USD 1 484.

Furthermore, more than half of the operating costs for UPA go towards water tariffs. On average, commercial farmers spend USD 4 900 per year on water. This is the situation, despite government measures to reduce water tariffs and standardize billing for market gardeners. This has helped reduce the competition between citizens and farmers for water provision through better management of the water supply. However, the policy for water, while it has proven beneficial, is not coordinated with UPA-specific policies. This causes the water that is available to farmers to fluctuate intensely with changes in quotas during the dry season and service interruptions. An additional constraint is the prohibition (through consumer protection laws) of the use of wastewater on land used for horticulture (Erwin *et al.*, 2022).

5.2.2 Problems with water quality

It is foreseen that climate change will lead to an increased incidence of coastal flooding and storm surges. This will pose a challenge to food production, since both productive agricultural regions and urbanized areas are often located on low-lying land close to the coast (Wong *et al.*, 2014). In **Greater Lincolnshire, United Kingdom of Great Britain and Northern Ireland** two-thirds of land falls within the Environment Agency's model for coastal flood regions. This model was developed by Gould, Adams and Vivanco (2020) and demonstrates that a single breached sea wall could lead to losses of up to USD 25 million. Flooding often pollutes agricultural areas in addition to having further material impacts on human settlements. This is evident whenever hurricanes impact the United States of America, among others – for example, in 2012 Hurricane Sandy damaged many low-lying community gardens and urban farms.

Another problem found in many peri-urban coastal areas, where agriculture and expanding human settlements interact, is the tapping of more and deeper wells to maintain access to water for irrigation as domestic use takes precedence, and existing water infrastructure, for example canals, is not maintained or is abandoned. In many regions, such as the long coastal stretch of **Lebanon**, salt water is invading the aquifers as the watertable is lowered (El-Moujabber *et al.*, 2004).

Without proper drainage management systems in place, stormwater coming from farms can carry pollutants to local waterways (Richards *et al.*, 2013), thus impacting potable water as well as that used by UPA. In **Des Moines, United States of America**, over half a million people get their water supply from the Raccoon River. As a result of agricultural runoff, the river contains a high level of nitrate and total trihalomethanes, which increases the risk of developing certain forms of cancer if found in drinking water. However, the city struggles to keep the nitrate and total trihalomethanes levels in the water below the legal limits (Rundquist, 2018).

Irrigated vegetable farming in **urban and peri-urban Ghana** clearly falls under the "informal" or "emerging" smallholder category. In the 40 km radius around Kumasi alone, an estimated 12 700 households irrigate at least 11 900 ha in the dry season; about twice the area cropped under formal irrigation throughout Ghana (Cornish and Lawrence, 2001). Informal irrigation, however, goes beyond urban and peri-urban vegetable production and includes, for example, the use of shallow groundwater, as in the Upper East and Keta area, irrigation around small reservoirs and along the Volta River (Namara *et al.*, 2010).

In spite of its size and importance, these forms of irrigated vegetable farming do not yet receive the support they need from policy-makers and irrigation institutions. For instance, since its

inauguration the Ghana Irrigation Development Authority has focussed solely on conventional or formal irrigation schemes, until in 2010 the new National Irrigation Policy, Strategies and Regulatory Measures extended the mandate of the Authority. Still, it will take time before official extension staff and farmers' training programmes contemplate the needs of informal irrigators (Drechsel and Keraita, 2014).

5.2.3 Contamination from wastewater

Contamination of water used in UPA may pose potential health risks to both producers and consumers. Risks are most often related to the use of untreated wastewater, but may also be related to the use of water contaminated by other sources such as industrial pollution, runoff of chemicals into drains from domestic and commercial use, or overuse of fertilizers and pesticides in agriculture.

In many cities across low and middle-income countries, effluent flows through open drains, canals or sewers into natural water bodies or onto irrigated land. Less frequently, effluents go to functioning treatment plants. As on-site sanitation systems prevail in many low-income countries, the wastewater flowing to fields or treatment plants will be predominantly greywater, contaminated by septic tank overflow, illegal connections or open defecation (Evans, *et al.*, 2013). In **Gorakhpur, India**, the city's waste and sewage is dumped in peri-urban areas, where it contaminates groundwater (Mani, Singh and Wajih, 2014).

5.3 Actions to support water management

To deal with the challenges mentioned above, careful planning in support of UPA is required, based on clear regulation of access to water, filtration and runoff. All stakeholders need to be engaged in the planning process, including public authorities, the private sector and civil society.

5.3.1 Addressing water scarcity

The first step in preventing water scarcity is to reduce water consumption. In **El Alto, Bolivia**, mulching helped reduce water consumption from 5 to 3 litres/m^2. Localized irrigation using plastic bottles applied during the root development stage was found to reduce water consumption to 2 litres/m^2. Some growers were even able to reduce to 1 litre/m^2 per day and obtained good yields thanks to good management of the water cycle in the greenhouses (FAO, 2014c).

Additionally, stakeholders can invest in instruments that recuperate rain and stormwater that would otherwise be lost. The City of **Roanoke, United States of America** analysed the potential of the city's rooftop rainwater harvesting capacity, it was estimated that approximately 440 000 m^3/year of water could be harvested from rooftops adjacent to the UPA gardens/ farms to meet the irrigation demand. Not only

Managua, Nicaragua. Tank to store rainwater, installed by the municipality

New York, USA. Rainwater collection system installed by GrowNYC in a community garden

can the demand from municipal water supplies be reduced, so that the energy used for these supplies is saved, but the city's stormwater runoff could also be mitigated to prevent flooding (Parece, Lumpkin and Campbell, 2016).

With support from FAO, **Managua, Nicaragua** installed rainwater storage tanks around the city. The tank can contain 5 000 litres occupying 10 m^2, each projected to capture 10 000 litres of water per year. The tank is equipped with a system to drain off impurities and contains two layers of high-tech plastic resin to prevent the formation of algae and bacteria (FAO, 2014a). In **New York City, United States of America**, Green Thumb, a publicly funded community gardening programme[46], promoted an adaptable rainwater collection system to reduce water consumption in the city. Besides saving water, the initiative also saves on the open spaces required to access water by using the omnipresent roof areas (Renting, van Veenhuizen, and Schans, 2014). In **Tegucigalpa, Honduras**, UPA growers use disposable containers for localized irrigation and tanks or barrels for water storage. In some places, 300-litre wells are used to store filtered rain or greywater.

As mentioned above, many UPA farmers use piped water; various means can be used to minimize the impact of such usage. Municipalities can monitor water use, such as in **San Francisco, United States of America**, where the city provided USD 100 000 to install water meters for community gardens and areas zoned for urban agriculture. As piped water is often expensive to use, **Milwaukee, Madison and Cleveland, United States of America**, worked with water utilities to improve access to water by adjusting usage rates for urban gardens and farms (Hendrickson and Porth, 2012).

In **Dakar, Senegal; Luanda, Angola; Managua, Nicaragua; and Guatemala City, Guatemala**, water resources are limited, and water is supplied by harvesting rainwater from roofs, gutters, and storage and treatment tanks. Thus, FAO implemented a project to train youth and their parents on urban horticulture technologies, water quality, and health and nutrition education to improve diets (FAO, 2011). In areas where rainfall is limited and/or piped water is not easily accessible, reuse of greywater can save the day – as will be discussed next.

BOX 9

Tegucigalpa, Honduras - City support for water reservoirs

Tegucigalpa has a tropical climate, with an average rainfall of 1 000 mm per year from May to November and a dry season from December to April. Water shortages are common with frequent interruptions in municipal water service. Ninety percent of people interviewed for the case study had drip or sprinkler irrigation systems connected to community reservoirs or springs. The average cost of a commercial farm irrigation system is around USD 811. Since this cost is hard to bear for farmers and community gardeners, the municipality supports the construction of irrigation systems both financially and technically. These community reservoirs can generally service up to ten producers. According to the study, the municipal government provided machinery and funding to construct ten reservoirs in a neighbourhood of 500 families, which has led to a more balanced use of water. While recycled and treated wastewater is the most viable water source for urban and peri-urban agriculture, only 5 percent of respondents recycle wastewater, and only for home gardens. For this the artisanal technology of filtering through gravel filled tires was employed. Only the agricultural University El Zamorano, which is fairly far from Tegucigalpa, has a commercial scale wastewater treatment system (Erwin *et al.*, 2022).

[46] For more information see https://greenthumb.nycgovparks.org/

5.3.2 Reducing water contamination

When properly used, the nutrient loads in wastewater can stimulate crop growth and reduce the need for mineral fertilization (Karg and Drechsel, 2018). To reduce the potential health risks that can be caused by the use of contaminated water, it is suggested wastewater be used only for irrigation of a limited range of crops such as paddy, maize, and potatoes rather than other crops that are eaten raw or half cooked (Kihila, Mtei and Njau, 2014). FAO (2019c) published a training handbook for UPA farmers in Africa on the safe use of wastewater. Concrete on-farm recommendations are provided, including use of drip and furrow irrigation to minimize the contact between water and the edible parts of vegetables. Sedimentation ponds can be used to reduce disease contamination, and use of clean water to wash harvested vegetables.

If it is not possible to use wastewater safely, it may be possible to treat the water for reuse. When this is not feasible, education, extension and collaboration are important to prevent health risks. In **Tegucigalpa, Honduras**, kitchen greywater is filtered through old tyres filled with gravel and charcoal. The setting-up costs are around USD 25 and the technique is used widely in several urban districts of Tegucigalpa. **Lima, Peru**, has suffered serious water contamination in the past, as most human and industrial waste was dumped directly into rivers and canals. In 2013, thanks to the national government's investment in waste treatment plants and underground pipeline systems, urban wastewater can safely be used for crop irrigation, while solid waste can be used as organic fertilizer, thus benefitting UPA food production (FAO, 2012). **Melbourne, Australia** has established and upgraded wastewater treatment plants for years, and supplies high-quality reclaimed water to neighbouring market gardens. In 2011, the two largest plants in Melbourne supply 61 million litres and 30 million litres of high-quality irrigation water to approximately 170 and 80 customers per day, respectively. Greywater reuse is common in residential gardens at the household level, either by bucketing the greywater onto gardens or use of formal fixed systems (Barker, Faggian and Hamilton 2011).

However, use of this technique requires water filtration. A number of techniques, at different scales, employ simple systems of greywater filtration and reuse for agriculture, particularly household gardens. These techniques have been in use in the Near East since 2007 (Mcilwaine and Redwood, 2010), but a key challenge is to replicate and scale up these practices.

BOX 10

Decreasing food contamination in Ghana

Many cities in Ghana struggle with food safety issues because contaminated water is used during production and in markets. While water treatment can add to the cost, a study by Seeger and Löwenstein (2018) stated that consumers in Tamale (Ghana) are willing to pay a higher price for certified safe food (in Karg and Drechsel, 2018).

In Accra, Kumasi and Tamale, the International Water Management Institute and the Resource Centre for Rural Agriculture and Food Systems Foundation partnered with local scientists and urban vegetable farmers to test and implement interventions to reduce vegetable contamination from polluted water. Initially, the project sought alternative safer water sources, which did not show much potential. More successful interventions included sedimentation ponds, simple filtration techniques and improved irrigation practices as well as post-harvest measures such as improved methods to wash vegetable (Hope *et al.*, 2008).

5.3.3 Protecting water quality

A community-based programme was initiated to improve the quality of life in **Philadelphia, United States of America** by increasing the area of forests and other green spaces to reduce stormwater flows. The Green City, Clean Waters plan was launched by the Philadelphia Water Department in 2011 as the first large-scale programme of its kind in the United States of America. The plan was driven by a "triple bottom line" analysis that showed how investments in green infrastructure at a watershed scale could meet state and federal regulations for reducing stormwater runoff and sewer overflows at lower cost and with greater public benefit than engineered solutions. In October 2017, the city celebrated completion of its first 1 000 greened acres (404 ha), capable of treating 103 million litres of stormwater. The city, therefore, is well on the way to achieving the goal of more than 5 000 greened acres (2 023 ha) by 2036. When completed, the installation of this green infrastructure will reduce the volume of stormwater and overflow pollution entering city waterways by 85 percent (FAO, 2018a)

The City of **Paris, France**, promotes the development of organic farming practices in the water catchment areas used to supply water to Parisians. *Eau de Paris*, the public company in charge of the capital's drinking water has acquired over 570 ha of agricultural land to preserve the environment and water quality. In 2018, almost 470 ha were made available to 26 farmers in exchange for their adoption of production practices that protect water quality, especially from nitrates and pesticide contamination. This action was part of the Plan for the Development of Sustainable Food in the city (E.G., 2018; Forster *et al.*, 2015). In 2020, the city announced a new subsidy regime that had been developed with and for farmers in Paris' water catchment areas. The objective is to encourage farmers to reduce the use of pesticides and fertilizer so as to improve the quality of tap water. The new system is expected to benefit 200 farms, and has a budget of EUR 47 million over 10 years and follows the logic of "payment for ecosystem services" (Environment Magazine, 2020).

In **Lima, Peru**, the world's second most-populated desert city after Cairo, a programme to afforest mountainsides was initiated in 2015 to reduce landslides and storm risk for vulnerable communities. Implemented by the Center for Studies and Disaster Prevention, with support from the United States Agency for International Development and the Office of Foreign Disaster Assistance, the risk-reduction programme planted 300 native seedlings in the El Volante II and El Volante III settlements in the south district where 94 families live. Techniques such as the application of hydrogel to help retain water, composting and drip irrigation are employed to ensure high rates of seedling survival and growth. Two years after the first steps were taken towards afforestation, the Ecological Forest Park project, known as Boca de Sapo ("Toad Mouth"), is gaining strength. An area of 14 ha has been designated for the park, which includes trails, viewing points and family recreation spaces. By the end of 2017, a total of 3 000 native trees had been planted and a drip irrigation system installed using treated wastewater. Through this project, local citizens have learned that afforestation can help reduce the risk of disasters because slopes are stabilized, rock falls are controlled or prevented, mud and sediments formed during heavy rains are retained, informal settlement is restricted and the environment is improved (FAO, 2018a).

6

FINANCING AND LABOUR

The cost of starting and managing an urban or peri-urban farm strongly varies depending on the size, location and purpose of the farm. For many commercially oriented UPA farmers this cost may be too high to bear without the support of a credit or public institution. The labour intensity that characterizes horticultural production, including vegetables, often requires farmers to hire employees to support them with the work, meaning UPA farming also has great job creation potential, especially for (young) entrepreneurs (International Labour Organization [ILO], 2013). UPA can often serve as an additional source of income to help overcome poverty and food insecurity for urban dwellers, who cultivate crops or raise livestock on a small-scale for household or community needs.

The availability of financial or human resources to support these activities can result in achieving a greater positive economic impact. Section 6.1 discusses finance and labour-related practices, challenges and interventions, which are illustrated with examples from different regions and cities.

6.1 Finance and labour practices

In order to be maintained and developed UPA needs investment of money and labour, which varies depending on the different types. Table 6 explains the basic requirements of investment.

TABLE 6 Summary of financing and labour resources used for typical typologies (adapted from analysis of various sources)

URBAN AND PERI-URBAN TYPE	INVESTMENT NEEDS	FUNDING/CREDIT ACCESS	LABOUR REQUIREMENT AND ORGANIZATION
Home-based gardening	Low	Low	Family members, part time work
Community-based and other shared gardening	Middle	Low	Community members, mostly part time work
Commercial crop production, livestock and fisheries	High	High	Professional farmers, full time work
Institutional food growing	Low/high	High	Non-professional/professional farmers, part/full time work

Solo, Indonesia. Gede market stall

6.1.1 Investment needs

What investment and costs need to be met to initiate and run a UPA scheme? This is a recurrent question that arises with UPA; and is as relevant to rural agriculture. To formulate an answer to this question, Hunold *et al.* (2017) surveyed 20 city market farms in **Philadelphia, United States of America** ranging from 0.02 to 16.19 ha. The study demonstrated an average capital investment of USD 270 000/ha. The main costs were for land (USD 225 000/ha), raised beds for high-quality soil and equipment. Where farms do not have a supply of city water to their lots, a combination of rainfall and rainwater catchment systems are used, which also require capital expenditures (Hunold *et al.*, 2017).

In **Arusha, Tanzania**, operational costs for UPA tend to be much higher than for investment. It seems that loans are often spent on operational expenses such as for seeds or to control pests and diseases. The most common sources of financial assistance are farmer organizations (Erwin *et al.*, 2022). In **Mumbai, India**, the cost of renting land, on average is USD 309 per ha/per year (Vazhacharickal *et al.*, 2013) while in **Surakarta, Indonesia**, it is around USD 400 per ha/per year (Erwin *et al.*, 2022).

6.1.2 Funding/credit access

In their study, Hunold *et al.* (2017) concluded that the financial sustainability of UPA operations would be improved if:

> *"The nonmarket benefits of urban agriculture [...] are judged to be sufficiently important to justify support for the practice."*

Governments, foundations or NGOs or other schemes, could provide this support as payment for ecosystem services. Based on a three-year study of 17 cities in **Africa, Asia and Latin America**, Cabannes (2012) defined the financing of urban agriculture as being a changing combination of monetary and non-monetary resource mobilization; individual and collective savings; different forms of subsidies; microcredits and conventional loans. Approaches that focus only on credit were argued to be useful to a small number of urban farmers.

In all six case studies carried out for this sourcebook, more than half of respondents did not access credit. However, all respondents who did not access credit claimed this was because there was no need. Most respondents in **Quito** had other income-earning family members who

contributed a minimum of half the household income. Of home gardeners, who mostly cultivate for home consumption, 60 percent had vocational or university degrees and 66 percent held other, full-time jobs (Erwin *et al.*, 2022).

Because of their nutritional, social, economic, environmental and educational value, many UPA initiatives in richer countries tend to receive some form of support from governments and/or NGOs, though this often supports only certain aspects of start-up or operations. In **Leuven, Belgium**, farmers receive provincial support to organize farm tours for schools and businesses. The province is also involved in activities to promote a short chain, including creation of a label for regional products. The Flemish Government offers financial support (average of EUR 1 645/ha) in exchange for certain measures that benefit the environment such as field borders (Erwin *et al.*, 2022). In the refugee camp in **Domiz, Iraq**, Lemon Tree Fund and RUAF support an UPA demonstration garden, which is run by refugees with expertise in agriculture. The project is funded on the basis of a decreasing subsidy, where workers can sell fresh food to pay their salaries (Adam-Bradford *et al.*, 2016).

6.1.3 Labour access and organization

There is no such thing as a typical urban farmer. Producers can be rich or poor, possess many hectares of land or own none, work full-time or on a seasonal, casual or daily basis. However, especially in low and middle-income countries, most urban farmers are most likely women from the lower income bracket, who mostly produce on a small scale (ILO, 2013). A study in **Sri Jayawardanepura Kotte, Sri Lanka**, indicated that the main reason women become involved in urban agriculture is to provide their family with fresh and nutritious food. Value-added production is less popular among women because they lack the knowledge and skills (Gamhewage *et al.*, 2015).

In **Arusha, Tanzania**, 20 percent of the population works in agriculture (The National Bureau of Standards, 2012). While most commercial farmers maintain full-time staff, home gardeners grow food and take part in other activities. During harvest season there is a huge influx of labour to help (Erwin *et al.*, 2022. Overall, across the six Rikolto case studies, a significant portion of UPA farmers' operating expenses goes towards the employment of full-time or seasonal labourers. Though employment varies widely across the six cities, most commercial respondents in all the cities hired labour for some part of the year.

UPA production offers a wide range of employment opportunities for hired, waged labourers. Depending on the type of work and the time available to the business owner and their household, they can decide to employ workers permanently, seasonally, or casually for a few days or for a predefined job. While private individuals may run UPA farms, others may be owned by a cooperative, government or other organization. In **Johannesburg, South Africa**, the Municipality of Johannesburg and the Department of Social Development created "food empowerment zones" comprising large farms. On each farm plots are allocated to farmers through the public agricultural extension centres, in collaboration with private partners. One of the farms hosts over 30 cooperatives (FAO, 2018c). The GrowHaus farm in **Denver, United States of America**, is a non-profit indoor farm run by a diverse group of individuals. When hiring new staff, an effort is made to hire neighbourhood residents who are directly impacted by food injustice (The GrowHaus, 2020).

6.2 Challenges

New urban farmers face many start-up and operating costs (Hunold *et al.*, 2017). Even if access to land and water is assured, a basic investment in soil, seeds, and tools is inevitable for every type of UPA. Larger-scale farms may need, among others, facilities for cooling, transport, sorting and packing and/or composting (Hagey, Rice and Flournoy, 2012), while the smaller may need to gain access to these facilities through cooperatives or by other means. Other significant costs include energy, especially for indoor agriculture, training and of course labour. For many UPA farmers, these investments are too large to make without support. This lack of resources also means that many UPA farmers and their hired helpers are highly vulnerable to risk.

6.2.1 Lack of risk management

Worldwide, UPA is exposed to various forms of pollution and meteorological threats such as floods and heatwaves. In reality, most farmers do not have access to appropriate systems to manage such threats. In a survey of local farmers and policy planners in **Chicago,**

United States of America, one of the main barriers to UPA is insurance coverage. Many urban farmers operate on a small-scale, with low profit margins, which makes it harder to bear the cost of insurance (Block *et al.*, 2011).

Not only are the harvests and livestock produced in cities vulnerable to risks, such as theft, farmers themselves can face biological, physical, chemical, as well as psychosocial threats. Social protection for farmers is insufficient. According to an ILO report (2013), *"agricultural workers are among the least protected in terms of access to basic health services, medical insurance, workers' compensation, long-term disability insurance, survivors' benefits and retirement pensions."* Currently, data are lacking regarding the difference in the risks faced by urban agriculture practitioners and their rural counterparts.

Health risks are most often cited in relation to urban agriculture. A study in **Nakuru Township, Kenya**, established that smallholder dairy farmers are often injured because they work with cattle in confined spaces, are exposed to pesticides without any form of protection and are at risk of several diseases that are transmitted from animals to humans (ILO, 2013). In **Antananarivo, Madagascar**, a research team discovered health risks in cress production, related to the excessive use of pesticides, herbicides and fertilizers (Aubry and Manouchehri, 2019). In addition, poor access to quality advisory services for UPA farmers exacerbates their vulnerable situation (International Fund for Agricultural Development [IFAD], 2015).

6.2.2 Lack of access to credit/financing

Finance has been, and will continue to be, a major constraint to maintaining and scaling up food production schemes in cities (Cabannes, 2012). Small-scale farmers commonly have problems in accessing the required financial services to enable them to carry out their activities such as a revenue-generating business. In particular, their capacity to invest in agriculture is constrained by poor access to seasonal credit and longer-term loans. Their limited savings and deposit facilities, which would help them build up reserves for the future, increases their vulnerability to shocks and unexpected expenditures.

Small margins in their operations mean that many small-scale urban and peri-urban farmers cannot afford full-time employment (Hagey, Rice and Flournoy, 2012). A survey questioning 261 urban gardeners in **Cotonou and Porto-Novo, Benin**, indicated that the absence of financial resources was the second most common constraint to agriculture. Over one-quarter of gardeners lack credit for their agricultural activities, and a similar percentage also lack the collateral to obtain credit (Houessou, van de Louw, and Sonneveld, 2020).

In **Surakarta, Indonesia**, women and youth interviewed for our case study reported collateral requirements often represent insurmountable obstacles to obtaining credit (Erwin *et al.*, 2022). Consistently conclusions were drawn from a 2012 study of small entrepreneurs in water and sanitation in **Benin, Ghana, Kenya and Uganda**, where lack of financing was stated as the main obstacle to up scaling and business growth (RUAF, 2013).

Similar problems can be found in richer countries. In **Philadelphia, United States of America**, access to financing from the private capital market is hardly ever available to urban farms, as it is difficult to secure commercial loans because financial institutions tend to consider urban farming unprofitable. Obtaining grants, on the other hand, was actually very competitive and time-consuming, highlighting the challenges faced by urban farms when attempting to achieve financial sustainability (Hunold *et al.*, 2017).

6.2.3 Lack of social inclusion

Despite great progress in recent years, women still experience significant inequalities related to employment on UPA farms. In **Tegucigalpa, Honduras**, many commercial farmers hire full-time labour. However, women are employed at a much lower rate than men (Erwin et al., 2022). An FAO report found that the level of women's participation in groups varies considerably by country, city and even within cities. In some cities, women share equal rights with men and play equal parts in groups including leadership roles. In others, women are only allowed to take part in women-only groups. Where women's role is restricted, promoting their participation in groups can be difficult as they are often reluctant to say what they think or challenge the views of men in public (FAO, 2007 cited in ILO, 2013).

The case study in **Surakarta, Indonesia**, highlighted deeply entrenched gender equalities when accessing resources for UPA. Traditional land tenure inheritance grants male children two parts compared to one part for female

children. Furthermore, many women feel their labour is marginalized as they are employed less frequently than men across all types of UPA and have reported being paid less than their male counterparts for the same work. These inequalities, though less prevalent in urban areas, still pervade the agricultural sector in Indonesia.

Another social category that can sometimes be underrepresented in UPA, especially in high-income countries, is the low-income group. Research by Guthman, Morris and Allen (2006) highlighted the minimal participation of low-income consumers at farmers' markets and in CSA programmes in **California, United States of America**, despite the effort managers put into improving the affordability of food sold at these venues. With the aim of providing farmers with a regular source of income, farmers' markets are generally set up in higher-income communities, sites where demand already exists (Guthman, 2011) but where the poor have little opportunity of participating.

Evidence also shows that, in comparison with commodity agriculture, direct agricultural markets are more prevalent in countries with higher median incomes (Lyson and Guptill, 2004). Furthermore, a survey of urban farmers revealed that farms with a market orientation were less likely to be located in lower-income neighbourhoods, as compared to farms with social goals targeting economically disadvantaged populations, further highlighting the importance of alignment with food justice (Dimitri, Oberholtzer and Pressman, 2016). Incorporating strategies to improve affordability (e.g. through government entitlement programmes) does little to diversify participation if urban farms remain geographically segregated (Poulsen, 2017).

6.2.4 Migration and unemployment

Rapidly growing towns and cities often operate like magnets for young people who make up roughly one-third of all international migrants. Drawn by city jobs, and the promise of a better life, many youth are on the move both between rural areas and cities and across countries. Young people often perceive traditional agriculture as being at odds with the opportunities offered by technology and mobility. Agriculture is often stigmatized as being backwards and unprofitable. However, the grass isn't always greener in cities where the cost of living is high, food and housing are of poor quality and job opportunities are limited, especially for youth and women. Horticulture and small animal production are leverage points for closed-loop multifaceted sustainable change, responding to the need to train young people for meaningful employment in the face of migration and pressures including climate change (RUAF, 2018).

Citing **China** as an example, an FAO study found that market-oriented agricultural production systems can absorb workers from other urban sectors when needed. Farmland in peri-urban Beijing is owned by village committees, but is primarily cultivated by migrants without local household registration, absorbing a high amount of labour (Yang *et al.*, 2010). However, in general, wage labour is little used in urban agriculture, except for peak activities (ILO, 2013).

In Carnide Valley, **Lisbon, Portugal**, where most gardeners are migrants from north and central Portugal, and 20 percent are immigrants from the Cabo Verde islands, interviews revealed the importance of gardens both for agricultural production and recreation. Most urban farmers are older people (75 percent are over 65 years), illiterate (45 percent) or with basic levels of primary education (45 percent), retired from construction or government service with low qualification levels, and living on less than two minimum wages (between EUR 300 and 700 a month) (Cabannes and Raposo, 2013).

Finally, another challenge is the ability to hire and retain qualified staff. In **Chicago, United States of America**, urban agriculture organizations struggle to find and retain qualified staff. Especially for community garden projects, targeting low-income residents, project staff need both social and technical skills. However, the job is typically low-paid and attracts the young and the recently graduated who have limited or no experience of cultivation (Kaufman and Bailkey, 2000).

6.3 Actions to support financing and labour

Financing for UPA encompasses at least four dimensions: monetary and non-monetary resource mobilization, individual and collective savings, subsidies in different forms, microcredits and conventional loans. Municipalities, NGOs, businesses and farmers' organizations all over the world have developed policies and actions related to each of these dimensions. Besides trying to boost access to finance for UPA activities, many urban initiatives have attempted to develop social protection mechanisms and used UPA as a leverage to provide employment opportunities

for marginalized social groups such as migrants or the low skilled. Some of these options are discussed in the following paragraphs.

6.3.1 Credit

The best-known form of financial support is the provision of credits, which can come from different sources. In some cases farmers will self-organize to establish a shared fund. A good practice can be found in three cities in **Liberia**, NGOs helped develop a model for a Village Savings and Loan Association, wherein 15 to 30 members agree to contribute to a shared fund where they can borrow money and repay the loan with interest following certain rules. This model is a self-managed and self-capitalized microfinance methodology that offers savings, some type of insurance for bad times, and credit services for people without access to formal financial systems and external institutions. Building on the preliminary success, the model was scaled up by creating linkages to more formal sources of capital, such as the Micro Finance Unit at the Central Bank of Liberia to increase the amount of the loans. Regional Village Savings and Loan Association networks were also established to coordinate activities in respective communities/townships (David, 2013).

When commercial institutions are unwilling to provide loans to UPA farmers, NGOs or government agencies can play a role. In **Addis Ababa, Ethiopia; Dar es Salaam, Tanzania; and Kampala, Uganda**, micro-credit schemes and other support from NGOs and government programmes target female-headed households, widows, and older people to help mitigate some of the stresses faced by urban livestock owners, although these efforts have limited impact relative to the scope of the challenges faced (Padgham, Jabbour and Dietrich, 2015).

In some cases, regulatory approaches have been employed at the national level to enable the substantial availability of microfinancing, thus improving urban farmers' access to financial resources. In **India**, to promote access to credit, all banks are required to follow the Reserve Bank of India Rules, which stipulate between 30 and 45 percent of all funds retained by the bank must be issued as loans to the agricultural sector and/or through microfinance programmes to cooperatives, urban joint liability groups or self-help groups (FAO, 2007; ILO, 2013).

BOX 11

Tegucigalpa, Honduras - Farmers become bankers

Many respondents in Tegucigalpa reported they did not access credit, most commonly because they had no need. However, among those that did need credit, the main reason why they did not seek access to credit was because there were no financial institutions in the area. Furthermore, only commercial farmers reported receiving credit. Of these, 50 percent go to banks and 42 percent use micro-finance institutions. Commercial respondents reported, on average, that 80 percent of their household income came from urban and peri-urban agriculture. This income ranges widely, from USD 4 000 to 20 000 annually. The minimum wage in Honduras in 2019 was USD 7 900/year (Erwin *et al.*, 2022).

In 2011, the Food and Agriculture Organization of the United Nations (FAO) supported a project to develop self-managed credit and saving funds. The farmer-members of these credit unions were asked to deposit half the value of the support they received from the FAO project in these funds. To build up additional capital, farmers were required to deposit monthly savings. Additionally, the farmers organized fundraising activities, which improved community self-sufficiency. The credit unions managed USD 5 000 annually for their members and furnished low interest loans from these funds (FAO, 2014b).

BOX 12

Gampaha, Sri Lanka - Financing schemes

In Gampaha, access to finance for agricultural activities was a real challenge. Urban farmers mainly used their own savings and virtually none had access to formal sources of funding, mostly because of poor treatment by formal financial institutions and lack of awareness. Financial institutions had little knowledge of urban and peri-urban agriculture (UPA) and were often unlikely to finance UPA activities because of their perception of farmers as being at high risk of default and lacking collateral. To remedy this situation, Sanasa Cooperative Bank created two finance schemes to support urban and peri-urban producers: a savings scheme to serve as collateral for the loans through a group-level personal guarantee system; a revolving fund scheme, which operates partially as a fixed deposit account bringing financial resources to urban farmers, and partially as a savings and short-term loan device for producers and/or producer groups.

The loans are provided to individuals from well-managed small groups of urban producers to ensure the return of the loans at the group level. Over time, the amount of the loan is increased for non-defaulters. When the peer-pressure system for recovery is not effective, a field-level collector secures recovery of repayments. This innovative system works well to support UPA activities and producers quickly repay the loans. Subsequently, the government took over the technical support and other forms of services (Amerasinghe, Hettige and Wijenayake, 2013).

6.3.2 Public insurance

A common action, to protect farmers against production losses, is to set-up affordable insurance systems. **Shanghai, China**, has set up insurance and security systems for urban farmers, as one of the ten pillars of a comprehensive policy on subsidies. In Minhang district, a public finance institution, Anxin Insurance Cooperation Ltd, subsidized urban farmers to the value of CNY 4.5 million (USD 470 000) in 2009. Fifteen types of insurance were provided for different equipment and crops, breeding of livestock, seed production, agricultural implements and property (Yin, Liu and Cai, 2010 in Cabannes, 2012). In **Beijing, China**, a similar programme was set up in 2007. Insurance was provided to 16 000 households covering 18 types of plants and breeds; 30 percent of the total cost is subsidized (Cabannes, 2012).

As the UPA flag holder in Latin America, Cuba started to promote UPA nationally in 1997; the programme includes the establishment of a network of stakeholders and provides agricultural insurance and loans to urban producers. In **Havana, Cuba**, the city's UPA programme established a network of agricultural supply stores, municipal seed farms, composting units and veterinary clinics. Urban farmers are entitled to agricultural insurance and production loans. All urban farmers have access to agricultural insurance, and to production loans from Havana's Banco Metropolitano (FAO, 2014c).

In the **United States of America**, the new Whole-Farm Revenue Protection programme, piloted in 2016, was designed to protect diversified farms from losses caused by the market or natural disasters such as those related to the climate or environment. As the programme continues its pilot, it is encouraged to consider recordkeeping requirements that result in an actuarially-sound crop insurance programme that meets the needs and capacities of very small diversified producers in urban and rural areas (Rangarajan and Riordan, 2019).

Our School at Blair Grocery in **New Orleans, United States of America** is one of the few farming organizations that have managed to purchase property from the New Orleans Redevelopment Authority. Though Growing Green requires at least USD 1 million in liability insurance, a programme through New Orleans' non-profit Parkway Partners has helped this organization and other members obtain free liability insurance for Growing Green properties (Rangarajan and Riordan, 2019).

6.3.3 Budgeting and taxation

Participatory budgeting is a successful model in which different stakeholders such as NGOs, researchers, local and/or central governments and farmers, are involved in the decision-making process to allocate public resources. Participatory budgeting has been implemented for urban agriculture in **Rosario, Argentina; Porto Alegre, Brazil; and Seville, Spain** (Cabannes, 2012). In 2015, a participatory business project in **Paris, France**, led to an investment of EUR 4 3 million in two projects to create green spaces, including rooftops and urban agriculture (URBACT, 2017).

In 2009, the city of **Chengdu, China**, started a participatory budget programme in answer to three major challenges: the rural-urban divide; villagers' collective land use rights; and security of tenure. In this programme, villages can request a budget to train residents in agriculture (Cabannes and Delgado, 2015).

Municipalities can ease the financial burden of urban farmers by creating special tax credits. In the **United States of America, Baltimore**'s Homegrown Baltimore Initiative passed a tax credit for urban farmers on private land that provides 90 percent abatement on property taxes for five years. This credit has specifically benefited urban farms that are not large enough to meet the five-acre requirement of the state-level farm property tax credits. Baltimore's enabling environment for urban agriculture has encouraged the creation of some 20 production-oriented urban farms (RUAF, 2016).

The Metropolitan Area Planning Council in **Boston, United States of America** has approved legislation to relax permitting requirements and eliminate all limits to agricultural product sales. The administration of food production can be difficult to manage, especially for community gardeners, who often grow food as a side activity. The "Neighborhood Gardens Association" in **Philadelphia, United States of America** manages taxes and insurance for community gardens. Legal support and research into property ownership is also provided to neighbours who want to acquire land for gardening (Goldstein *et al.*, 2011).

6.3.4 Social protection and inclusion

Today, more than 70 percent of the global population is still not covered by social protection. Increasing rates of formal employment in urban agriculture can help distribute the financial and social benefits of UPA, especially among the landless and unemployed. It can also serve as a training opportunity for the next generation of urban farmers, in addition to supporting greater social inclusion and productivity.

In **Rosario, Argentina**, the urban farming programme implements the re-use of vacant urban land for agroecological farming for marginalized sectors of local society, furnishing food security and alternative sources of income to the poor, while also providing public services such as the revitalization of degraded urban plots and the increase of green areas, which play an important role in social inclusion, poverty reduction, promotion of solidarity economy and sustainability policies. (United Cities and Local Governments [UCLG], 2002).

In **Lisbon, Portugal**, the urban gardens established in Talude and Cova da Moura, are in self-built neighbourhoods, where the population practising urban agriculture is essentially of Cabo Verdean origin. The farming process is individual, family based or collective, strong social bonds unite the Cabo Verdean community. According to the interviews, urban agriculture has played, and continues to play, an inclusionary role within the Cabo Verdean community, primarily for newcomers. (Cabannes and Raposo, 2013)

In **Spa Hill Allotments**, **, London, the United Kingdom**, allotments are formally recognized and the rights of urban farmers of foreign origin are the same as those of long-time Londoners. Urban agriculture functions as a space to integrate individuals into the British lifestyle, as well as to recognize collective traditions from countries of origin (Cabannes and Raposo, 2013).

In **Manzini, Eswatini (formerly Swaziland)**, the local government promotes UPA to develop the role of informal safety nets and formal food-based social protection in addressing food insecurity challenges faced by low-income urban households, revealing the considerable food security challenges in the low-income areas of Manzini. At the same time, various forms of community and intra-household food sharing are an important food source for a few poor households in the city (Tevera and Simelane, 2014).

BOX 13

Leuven, Belgium - Government support to social farming

In Leuven it is common for urban and per-urban agriculture (UPA) farmers to hire one or several employees as seasonal labour, given climatic considerations that make for a short growing and harvesting season. In terms of social inclusion, community supported agriculture (CSA) in general has a more inclusive workforce than other urban farms, including women, older people, international migrants, and people with disabilities. One explanation is that very often CSAs work with volunteers, who tend to be diverse.

To stimulate inclusion in UPA, and other farms, the Flemish Government grants subsidies to a social farming project in which farmers employ people in need of care. They can be people with disabilities, but also people recovering from mental illness, teenagers who struggle to stay in school, or refugees. These projects are always implemented in cooperation with a social welfare institution. While the farmers receive a subsidy of more or less EUR 40 a day, most indicate they participate in these programmes out of a need to be socially engaged. In 2004, the farmers union established a support centre that contributes to this programme by providing information and advocacy (Erwin *et al.*, 2022).

Many companies and organizations take special measures to include socially vulnerable groups in their activities. The Greensgrow Farm in **Philadelphia, United States of America**, collaborates in the city's welfare-to-work programme, through which they employ people who have been, or risk being, long-term unemployed. The farm has also created a job training and entrepreneurial programme. In **Oslo, Norway**, a large rooftop farm in the city collaborates with a local high school. During the summer break the farm offers part-time jobs at a union wage. The teenagers are guided in their work by mentors and take part in several workshops, where they can learn important skills for the workplace such as project planning and management (Curtis and Gallis, 2018). The AGRUPAR project in **Quito, Ecuador**, specifically targets women. Gender-differentiated data is also collected on those participating in the programme and/or specific training and a monthly count is made of self-employed women and men in agricultural enterprises (Rodriguez, 2020).

BOX 14

Dakar, Senegal - Microgardens

In Dakar, the combination of strong population growth and rural-to-urban migration has led to the impoverishment of many inhabitants, especially women and older people. In an attempt to support these groups, the Municipality of Dakar, in collaboration with the Food and Agriculture Organization of the United Nations (FAO), launched a microgardening programme. The project "Microgardens of Senegal" encourages beneficiaries (mainly widows and older women) to take part in income-generating activities. During the project evaluation led by FAO, the aspect most cited by beneficiaries as being beneficial was food and nutrition security (43 percent). The health and quality of the products (best taste) was second (36 percent). The fight to address poverty was also cited (14 percent), and encouragement to consume fresh and healthy vegetables (7 percent).

Microgardeners commercialized their products on-site through direct sales. Although the main destination for products remains consumption, 2 percent of sales revenues are invested, and the majority (73 percent) is allocated to household food costs, significantly improving household incomes (Ba, Sakho and Aubry, 2014).

7

COMMERCIALIZATION

In order for urban and peri-urban farmers to become financially viable, they have to be able to deliver their products to consumers (whether individual or institutional) with returns that permit them to make a living and sustain their farm. In **Vancouver, Canada**, for example, the Urban Farming Census found that urban farmers obtain similar returns as rural vegetable farms but their salaries are not yet on par with those of other city jobs (Dorward, Schutzbank and Mullinix, 2013). Stable access to markets, the use of business development services and adequate quality assurance mechanisms can all contribute to setting urban farmers on the path to profitability. Local authorities, the business development sector and community organizations can all lend a hand to ensure entrepreneurially minded UPA farmers can make their activity commercially viable.

As emphasized in the ILO Resource Guide on UPA, by shortening food chains, UPA allows for substantial savings in energy and other post-

Vancouver, Canada. University of British Columbia farm building houses the market, packing and pick-up facilities for community supported agriculture

©Joe Nasr/June Komisar

Arusha, Tanzania. Urban market in Arusha. The owner has run his business as a vegetable vendor for two years

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harvest expenses. Storage and transportation costs are lower than those for rural agriculture thanks to simpler distribution systems and a reduced number of intermediaries (ILO, 2013). However, setting up the logistics for shorter food chains and ensuring all UPA farmers can access the services they need to develop their business remains a challenge. In particular, there is a need to adapt logistics to smaller, specialized farmers working in the urban context, many are new converts to this sector and require support in business training, the establishment of hubs for processing and value chain development among others.

Often UPA practitioners focus on high-value production niche products and short supply chains. In this sense, urban farming business models often differ from those of rural farming where the accent is placed on economies of scale. Differentiation is often a key characteristic of crops, production practices (e.g. hydroponics), processing and marketing strategies that attempt to distinguish themselves from the more "traditional" rural agricultural practices (Skar *et al.*, 2019). Processing and marketing strategies are tied to the capacity of the producers to reach various ultimate users. Chapter 7 explores the different practices, challenges and interventions that support commercialization of UPA produce.

7.1 Practices

Different types of UPA have their own product sales destinations (self-consumption or direct sale) and market channels (i.e. wet market, supermarket, wholesale market, etc.), which are managed by various business models and benefit diverse groups.

Urban farmers use a range of commercial channels: direct sales through farmers' markets; e-commerce; community-supported agriculture farms such as a food production and distribution system, where consumers buy "shares" of a farm's harvest in advance and then receive a portion of the crops; local food distribution platforms that deliver directly to consumers or to businesses; food hubs; wholesalers; and retail outlets from small local shops to supermarkets. It is essential that UPA farmers can access markets so they can generate sufficient income to sustain themselves and invest in farm improvements. Common commercialization practices employed by UPA farmers are reviewed in the following paragraphs.

For most small-scale UPA farmers with home gardens and surplus yield for sale, the most common commercialization channel is **direct sale** of their produce to consumers at local markets or traders through traditional retailing

TABLE 7 Summary of commercialization employed for typical typologies (adapted from analysis of various sources)

Urban and peri-urban agriculture type	Products sales	Market channel	Business models	Beneficiaries
Home-based gardening	Self-consumption, direct sale	Home, wet market	Agritourism	Household
Community-based and other shared gardening	Self-consumption, direct sale	Community wet market, supermarkets, restaurants	Community support agriculture, E-commerce, agritourism	Household, community
Commercial crop production, livestock and fisheries	Direct sale	Consumers, supermarkets, food hub, intermediaries and institutions, restaurants international market	E-commerce, community support agriculture	Farmers' cooperatives, small and medium enterprises
Institutional food growing	Self-consumption, direct sale	Community wet market, restaurant	E-commerce, agritourism	Institutional members

Venezuela. A chalkboard shows the prices of fresh vegetables on sale that day in the outlet next to the urban garden cooperative. The cooperative garden members feed their families with the produce and sell the rest to the general public.

©FAO/Giuseppe Bizzarri

and wholesaling channels. For example, in **Managua, Nicaragua**, 17 percent of households in Ciudad Sandino and 10 percent in Los Laureles Sur sell their surplus to neighbours or at local markets (FAO, 2014a). In **Bangkok, Thailand**, despite the rapid expansion of the modern supermarket system, the traditional wet markets remain the main place to sell vegetables and fruits, especially for smallholder farmers who are unable to meet the bulk requirements set by supermarkets or other intermediate markets (Tsuchiya, Hara, and Thaitakoo 2015).

A study in **Hanoi, Viet Nam**, revealed that 98 percent of respondents from poor districts said they shopped for groceries at (in)formal markets, which account for only 6 percent of total food retail outlets in the local food environment. One explanation could be that supermarkets are, on average, 35 percent more expensive than traditional markets (wet markets or street markets) (Wertheim-Heck, Raneri and Oosterveer, 2019). Street vending such as street food stands, carts and outdoor restaurants is also a desirable channel for small farmers because they require minimal capital investment and space (Tsuchiya, Hara and Thaitakoo, 2015; Vazhacharickal *et al.*, 2013).

Indonesia. Cooking street food

©Rikolto/Jimmy Kets

Senegal. A seed company displays varieties at the International Symposium for Urban and Peri-Urban Horticulture

A beneficial approach that can help small farmers commercialize their products is to join farmer organizations such as **farmer cooperatives**. Generally, farmers organize into cooperatives so they can collectively access farmland, organize production and seek marketing channels. Selling through cooperatives can increase profits and save time (Feifei, Jianming and Gang, 2009). In **Catalonia, Spain**, urban farmers and citizens have come together in the Catalan Integral Cooperative (CIC), which covers the city of Barcelona and other nearby municipalities. Under popular self-management and democratic control, CIC has developed a logistics network to transport and deliver organic food from small producers in Catalonia's peri-urban and rural areas. The Cooperative's Network of Science, Technique and Technology developed specific machines and technologies adapted to the needs of small-scale producers and urban gardeners (Pimbert, 2017).

In **Cuba**, three types of cooperative dominate the management and tenure structures for urban agriculture: the Credit and Service Cooperative where farmers own or lease their land under usufruct rights but share credits, infrastructure, and markets; the Agricultural Production Cooperative formed in the 1970s where farmers share and work on the same plot of land; and the Basic Unit of Cooperative Production formed in the 1990s, which are state-owned farms divided into smaller cooperatives to decentralize management. Production cooperatives represent the economic expression of the agroecological principles of equity, participation, diversity and being multifunctional and resilient, which have contributed to making Cuba one of the most advanced urban agriculture systems in the world based on agroecological principles (Fernandez, 2017).

Urban and peri-urban farmers, who cultivate crops on a larger scale through either community or market gardens/farms, usually sell produce to **intermediaries** and **institutions**. In West Africa, in addition to selling at local markets, a common channel for market gardens is to sell the produce to local market traders at the farmgate (Bellwood-Howard *et al.*, 2015; Drechsel, Adam-Bradford and Raschid-Sally, 2014).

In **Lima, Peru**, farmers utilizing the productive hydroponic systems sell their high-value vegetables to supermarkets or at organic food fairs. In **El Alto, Bolivia**, the high production of backyard greenhouse cultivation means that UPA farmers can approach the expanding urban market by selling their produce to outlets such as restaurants and supermarkets (FAO, 2014a). In **Cuba**, urban farms run educational programmes with elementary schools and supply highly subsidized food to schools, hospitals, retirement homes and other social institutions (Fernandez, 2017).

Urban farms provide a medium level site to pilot advanced technologies that can be applied at a later stage for commercial use. Chongming, Shanghai, **China**, harvested organic rice in 2019 as part of China's first "5G+Smart agricultural machinery" project, which used 5G driverless harvesters, new energy smart tractors and rice transplanting robots. Smart machinery, commanded by the smart management platform, requires one operator and can be controlled from afar to successfully harvest 1 000 acres (about 405 ha) of 5G-linked rice fields on a local farm. For example, the easily controlled, non-polluting tractor can self-drive or be driven remotely, which reduces the cost of labour. The technologies mentioned above have been transferred to large farms in the surrounding areas.

More recently, new models such as **community supported agriculture (CSA)** and agritourism have been established in richer regions, providing innovative supply channels for commercial farms. Community supported agriculture first originated in the United States of America in the 1980s, based on European and Japanese antecedents (McFadden, 2005). In a CSA programme member consumers pay an annual fee and regularly receive a share of the farm's harvest, creating a closer relationship between producers and consumers

through shared risks and benefits (Farmer *et al.*, 2014). This model has expanded greatly since the 1990s across North America, and has quickly spread to other countries with local adaptations. "Urgenci" (Urban-Rural networks: GEnerating New forms of exchanges between Citizens) was formed in 2008 to act as an international network for the CSA model. While CSAs are not specifically urban, they tend to be concentrated close to – and sometimes in – cities, as the clientele is typically made up of urban consumers; thus the CSA is largely a UPA phenomenon.

Agritourism refers to a combination of agriculture and tourism that provides entertainment and services in various agricultural settings. As with CSAs, agritourism is not uniquely urban but is intimately connected with urban populations, thus it is commonly present in the peri-urban context. For example, in **Nanjing and Yangling, China**, peri-urban farms open up opportunities for consumers to engage in the production process, from planting to picking and consuming the harvest, while lodging is provided, and restaurants at the farms improve the agritourism experience (Luehr *et al.*, 2020). A similar concept of combining growing and retailing, is the "Farmery" in **Raleigh, United States of America,** which has created a novel model that combines a retail grocery store, a cafe and indoor agricultural systems, where urban consumers can witness and participate in the growth and harvesting of crops and fish when shopping at the store (Zambello, 2016).

7.2 Challenges

The profitability of urban and peri-urban farming varies widely because of differences in farmers' skills in marketing strategy, as well as the purpose of the farm (e.g. purely commercial or provides for additional education or leisure (Dorward *et al.*, 2013). This section discusses various challenges faced by UPA farmers when it comes to the commercialization of their crops and the resulting profitability of their farms.

7.2.1 Limitations in distribution and logistics

A major hurdle, when bringing local food to consumers in urban centres, is the aggregation and distribution process that requires coordination between many small-scale farms selling different products. This is where local food distribution platforms (LFDP) can step in to take over the logistics of distributing UPA produce to markets. It is no easy task to provide an appropriate range of food items in a timely and accessible manner to busy urban consumers (Erwin, 2020). A 2020 review of local food distribution platforms in Flanders and beyond revealed that the main challenges faced by LFDPs are information asymmetries where the "burden of transparency" falls on producers; product diversification, especially for platforms seeking to mimic the variety of supermarkets; customer dispersion, which entails greater coordination of logistics

BOX 15

Beijing, China - Agritourism

The are two main types of agritourism in **Beijing**: Farmer household-based sightseeing agriculture, which invites participants to engage in simple farm work; and enterprise-based recreational agriculture parks, which provide larger-scale, sophisticated recreational facilities where complex agricultural activities may be observed and experienced.

While the sightseeing agriculture is primarily based on farmland and for "homestays," the park provides off-farm activities and higher-quality accommodation. It often creates finer design and modern functions through larger investments and a higher level of commercialization.

Sightseeing agriculture and the recreational park prevail in peri-urban Beijing. Both types tend to be near bodies of water and mountainous areas to take advantage of the natural scenery. They also tend to be concentrated along expressways to benefit from better access to the city. The rapid development of agritourism is reflected in the increase in their facilities and related jobs.

Source: Zhenshan et al., 2016.

and longer distances travelled (especially for LFDPs following a direct-to-consumer model); inefficiencies in food transportation because of the hospitality industry's shifting demands (i.e. trucks filled to 25 percent of their capacity instead of 75 to 80 percent); and seasonality, whereby demand for UPA produce fluctuates throughout the year with a large dip during the summer holidays.

While there are many options for marketing produce, many urban farmers do not possess the resources to undertake a proper analysis of market demand. As a consequence, they tend to choose industries based on the low entry costs instead of market opportunities, which subsequently leads to quick saturation of certain markets and minimal competition resulting in low returns to the farmer (Dubbeling, Hoekstra and van Veenhuizen, 2010). In **Yangon, Myanmar**, brokers dominate most wholesale markets. UPA farmers lack the time and volumes required to sell at these markets. This leaves UPA farmers with the option of selling to smaller markets, where the prices are often lower, or to work through a broker, who will offer a lower price than the one they would have obtained at the market (O'Shea and Soe, 2010).

Asymmetric information is one of the main problems impacting UPA farmers' benefits. In **India**, a disconnection was observed between informal wholesale and urban retail markets that limited farmers' bargaining power. As a result, the increasing gap between procurement prices and selling prices compromised farmers' profit (Nambi *et al.*, 2014).

7.2.2 Lack of accessible/affordable quality assurance mechanisms

In a world where digital information is largely available and food safety scandals are making headlines, urban citizens, especially in emerging economies, are increasingly concerned about the safety of their food. While trust in the local food vendor is still the dominant form of quality guarantee in many low and middle-income countries, formal evidence of compliance with safety and quality standards is progressively becoming normalized, especially in supermarkets and modern retail outlets.

Produce from UPA can be exposed to various forms of pollution stemming from poor air and soil quality or cultivation methods. In Rosario, Argentina, human health concerns have increased together with increased demand for quality food products. A production survey showed that local produce mostly comes from small-scale farmers who cultivate small areas and generally apply large amounts of agrochemicals. Laboratory analysis shows high levels of bacterial and chemical contamination on produce. Agricultural workers do not often wear personal protective equipment, especially when applying pesticides (Battiston *et al.*, 2017).

In **Hanoi, Viet Nam**, food safety has become a major concern with mounting fears regarding agrochemical contamination of vegetables. The government's response included the modernization and regulation of the food retail system by stimulating the expansion of supermarkets and reducing the number of traditional food markets. The underlying assumption was that consumers would shift from traditional markets to supermarkets to acquire food with a safety guarantee. But that large-scale shift has not taken place because shopping at supermarkets implies buying greater quantities of food that must be stored in a refrigerator, and involves larger transactions of money. Supermarkets account for less than 5 percent of total vegetable sales compared to the dominant "unsafe" traditional wet markets (Wertheim-Heck and Spaargaren, 2016).

Despite the growing demand for quality assurance from formal retail outlets and supermarkets, third-party certifications are often too onerous for small-scale UPA farmers. This is because external audits are expensive, the process is burdensome and bureaucratic, and criteria are often complex for the less professional farmers. Alternatives must be developed to ensure small-scale UPA farmers can provide safety or quality guarantees for their produce and build trust with their consumer base.

7.2.3 Neglect by food market structures

In addition, the UPA sector is often neglected by the food market structures, which makes it difficult for UPA farmers to commercialize their produce. For example, in **Lilongwe and Blantyre, Malawi**, market structures mostly depend on rural agriculture and international markets, rather than on local urban producers (Sarma and Pais, 2011). More work is required to emphasize the value of UPA produce and empower producers to access urban markets. In the **Netherlands** agriculture is largely oriented towards the European Union and world markets, rather than nearby town and city markets. When looking at urban farmers the focus is generally more on their

symbolic function rather than on their capacity to improve access to fresh food (van der Schans, 2010). In **Bukavu, Democratic Republic of the Congo**, rice from Pakistan and other Asian countries is far more popular and visible than local rice produced on the nearby Ruzizi plain.

7.3 Actions to support marketing and distribution

In order to address the various challenges mentioned above, cities around the world are experimenting with new models and approaches to distribute UPA food and ensure quality assurance and business development. Various examples are discussed in the paragraphs below.

7.3.1 Promotion of short chains

Short-chain platforms are an interesting vending channel for UPA farmers. In many cases, farmers obtain a better price for specific product features (i.e. ethical, tasteful, fresh) when selling directly or with fewer intermediaries (Skar *et al.*, 2019). Governments and other organizations can support this development in various ways. In **Baltimore, United States of America**, urban agriculture is promoted through the Homegrown Baltimore Initiative. The city's "Buy and Eat Local" strategies, run through this initiative, have increased the number of farmers' markets that accept and incentivize federal nutrition assistance programmes for vulnerable populations, streamlined the approval processes for farmers' markets and vendors, and developed the Homegrown Baltimore Employee Wellness Community Supported programme. The CSA programme has improved the access and consumption of fresh food for the employees and facilitated the marketing of UPA produce through diverse channels (Baltimore Office of Sustainability, 2013).

In **Piracicaba, Brazil**, the municipality supports the creation of *varejões*, which are markets where producers sell their own products. Currently, about 25 percent of the food sold in Piracicaba is produced within the city's boundaries (Vitorino *et al.*, 2010). Similar markets reserved for UPA producers can be found in other cities, including **Belo Horizonte, Brazil** and **Quito, Ecuador**.

In **Hanoi, Viet Nam**, a few cooperatives have developed an efficient marketing strategy by

Senegal. Workshop for young entrepreneurs

Brazil. A market in central Belo Horizonte, part of the *Direito da Roça* programme of the municipality dedicated to farmers from the city's surroundings

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integrating multiple marketing stages and removing intermediaries, so that food safety concerns and higher prices can be avoided. As a result, these cooperatives gradually became suppliers of supermarkets, holders of market stalls and shops directly connected to consumers, permitting hundreds of farmers to supply their produce to urban consumers and earn maximum returns. The supermarket managers interviewed in the study declared they preferred dealing with farmer groups directly so as to lower the purchasing price and improve quality control by visiting farms.

Farmers' collective action is critical to reducing transaction costs, in relation to promoting quality, by ensuring access to training by the government and by helping build a strong reputation for the group's produce, which is an important factor in consumers' purchasing decisions. Farmers' kinship and neighbour relationships among the farmer groups helps guide their actions and contributes to building trust. Interestingly, one of the major cooperatives involved in the study stopped supplying supermarkets after three years in order to concentrate on market stalls after complaining about supermarkets' demanding payment times (15 days) and the return of unsold produce (Moustier and Loc, 2010).

The COVID-19 pandemic has impacted the marketing of products from UPA across the globe. In **El Alto, Bolivia**, UPA production is crucial to maintaining food supply in populous areas. However, many markets, where most people buy their food, closed. During this period, the municipality and FAO supported UPA farmers to find new ways to access consumers. As a result of their efforts, urban farmers organized safe home-deliveries of fresh fruits and vegetables to urban families (FAO, 2020a).

BOX 16

Leuven, Belgium - Connecting local farmers with supermarkets

Commercial conventional farmers in Belgium usually pursue several options for commercialization. Most UPA respondents sell their products on-site, through collectors, at the national auction BelOrta, on-line or through direct food links; all commercial respondents had multiple sales channels. In the last couple of years many producers have increased their direct food links or even switched entirely to this channel. The main reason is better prices, however, all farmers reported enjoying the social aspects of interacting with consumers.

While farmers receive higher prices for their products, much more is work involved. Many farmers have to organize their own logistics, administration and transport to the selling points. Responding to this challenge, the city of Leuven and Rikolto supported the establishment of the farmers' cooperative "Kort'om Leuven." Kort'om Leuven is a local distribution platform that brings local farm products to businesses, like supermarkets and restaurants. The city granted EUR 40 000 as seed money, becoming a partner in the cooperation. This amount corresponds to one-third of the start-up costs. During the COVID-19 crisis, the city installed a mobile vending machine to promote the brand of Kort'om Leuven and raise awareness of local products. Kort'om already distributes to some smaller, local grocery stores, and is scaling up by supplying to a few supermarkets.

7.3.2 Accessible/affordable quality assurance mechanisms

High costs often mean it is impossible for small-scale farmers to certify their products. However, certification can mean a significant increase in the price they obtain. Furthermore, reliable labels can increase food safety for consumers. National and local authorities could create their own certification or quality assurance systems to make them more accessible. The "**Bhutan** Organic Certification System" was created to assure that food is organic. Trained inspectors from Bhutan's Agriculture and Food Regulatory Authority inspect farmers, groups or cooperatives, analyse synthetic agrochemical residues in the produce, and certify the qualified entities who adopt the established traceability systems (FAO, 2013).

Similarly, participatory guarantee systems (PGS) have recently gained in popularity in a UPA context. Initially developed by the International Federation of Organic Agriculture Movement (IFOAM) to provide organic farmers with a reliable yet affordable system to guarantee their produce, the PGS approach and methodology is increasingly used for non-organic quality standards (e.g. good agricultural practices or agroecological). PGS is a locally based quality assurance model that involves a wide range of stakeholders in certifying quality agricultural products founded on trust, social networks and knowledge exchange, with a lower cost and complexity than third-party certifications (IFOAM, 2008). PGS is practiced globally in over 75 countries.

In **Hanoi, Viet Nam**, an organic PGS system was set up in Thanh Xuan near the airport and has been there for over 10 years. The system is structured on four levels: farmers, farmer groups, cooperative/inter-group, and the Local Coordination Board, each plays a role in the compliance and inspection system. The steps in the certification process involve internal control within each farmer group; cross-checking across farmer groups; review of intergroup reports and random inspections by the Local Coordination Board verifies the quality of organic food, according to the PGS standards, to gain the trust of retailers and customers. The intergroup, which is composed of representatives of farmer groups, local authorities, buyers and sometimes consumers, are strongly connected to local markets in Hanoi and have secured their members a range of regular buyers. As such, a critical role is played in supporting marketing of their products, enabling farmers to generate a stable income over the years (Rikolto and Vietnam National University of Agriculture, 2018).

In **Rosario, Argentina**, the Rosario Green Belt Initiative in the city's peri-urban area seeks to address growing concerns about food safety by stimulating local food production and rewarding horticultural activities based on ethical production practices. The project offers incentives for agroecological conversion processes, quality monitoring and marketing under a provincial collective label guaranteeing that the product is produced according to agroecological principles (Battiston *et al.*, 2017).

7.3.3 Business development services

Business Development Services usually refer to non-financial services that help entrepreneurs, including farmers, improve the performance and competitiveness of their commercial activities. Services are related, for example, to market research and intelligence, business planning, technology development and transfer, marketing, access to quality inputs, product development, quality control, processing and storage infrastructure, lobbying and organizational development, among others. BDS can target both strategic issues: medium to long term, which improve performance, and day-to-day operational (Committee of Donor Agencies for Small Enterprise Development, 2001). BDS are important because they can increase the capacity of UPA farmers to make a profit and sustain their operations overtime, in this way contributing to improved incomes and more investments on the farm. Access to BDS can also enhance access to finance as it is sometimes considered an alternative form of collateral (International Finance Coorporation [IFC], 2006).

In order to increase the competitiveness of UPA farmers and set them on the path to financial sustainability, local organizations, businesses, and governments offer entrepreneurs business development services. Le Serre, in **Bologna, Italy**, hosts a space for start-ups and entrepreneurs and organizes events to teach organic farming techniques in their community garden. The regional government of Emilia Romagna Region granted a subsidy of EUR 499 000 to the project through its programme for business activities 2012–2015 (MADRE, 2018). In **Sao Paulo, Brazil**, "Ciudades sem Fome" (Cities without hunger), a non-profit organization founded in 2004, set up

UPA projects in the city to teach people to manage their own businesses and become financially independent, as well as to improve the diets of adults and children, while making use of neglected public and private areas (Carrot City, 2014).

7.3.4 Public and institutional procurement

While public procurement represents only a minor part of food flows to cities, it can become a transformational driver of UPA production. The home-grown school feeding approach, which links local food producers – often small-scale– with schools' demand for safe and nutritious food has been hailed for its potential to improve the livelihoods of small-scale farmers, while stimulating the adoption of nutrition-sensitive or environmentally-friendly practices and promoting the value of local dietary habits among school children (FAO, 2018c; Cruz, 2020).

An analysis published in the European Union-supported Strength2Food's Strategic Guide for Public Sector Food Procurement showed that in the five European examples investigated, spending procurement budgets locally, by either paying local people and/or buying from local suppliers, yielded the greatest economic return for the local economy. In **Serbia**, the model that benefited local sourcing had a multiplier ratio of 2.46 (meaning that for every EUR 1 spent for school meals budgets, an additional EUR 1.46 was generated in the local economy), compared with a ratio of 1.59 for the Greek model that prioritizes lower costs (Strength2Food, 2021).

Brazil. Small entrepreneurial plots form part of urban farms on land owned by the local electricity company, supported by Cidades sem Fome (Cities without hunger), in Sao Paulo

In **South Africa**, the Department of Agroecology of the Municipality of Ethekwini near Durban, supports new farmers in meeting the food needs of schools in the city. As there is a lack of sufficient and structured local food production, the municipality still relies on wholesale markets, but the potential for the local economy is encouraging.

BOX 17

Arusha, Tanzania - A mobile application for easy commercialization

In Arusha, most urban and peri-urban agriculture farmers commercialize their products through collectors in local markets or through contract farming with private companies. Traders therefore play an important role in bringing local products to market. In order to generate revenues and manage food trading, the city imposes a crop tax on agricultural traders/collectors. However, mostly non-governmental organizations (NGO) and private sector organizations are involved in the professionalization and commercialization of UPA. To facilitate commercialization, the Federation of Horticulture Associations developed a mobile application to collect information relevant to market products and to communicate up-to-date prices, contact points and available markets for commercialization. Another NGO (Organization for International KOoperation and Solidarity) organizes farmers' markets and Arusha City Council provides kiosks for sales at public markets.

The municipality spends the equivalent of EUR 2 million every year to feed 400 000 children in 580 schools (Faucher and Lançon, 2021).

Based on 2018 data from **São Paulo, Brazil**, the Ellen MacArthur Foundation calculated that public procurement alone could generate sufficient demand for 71 500 ha of regenerative cropland, corresponding to 73 percent of the total peri-urban cropland, if the city were to adopt purchasing guidelines favouring local and regenerative production (Ellen MacArthur Foundation, 2019).

In 2018, in **France**, the EGAlim law stipulated that by 2022, public catering establishments must include 50 percent sustainable and quality products, meaning local or organic, with a minimum of 20 percent organic products. As a result, French territories are required to source local products for their public canteens. In Lyon, 55 percent of food served in primary schools is local, followed by 50 percent for Montpellier and Grenoble (Faucher and Lançon, 2021).

Nevertheless, the complexity of public procurement tenders and their numerous requirements often make it difficult for small-scale farmers to respond. Changing public procurement practices will not be sufficient to incentivize UPA production. These measures should be supplemented by public policies that enable farmers to take up their role as suppliers and improve whichever bottlenecks they face throughout the chain (Simón-Rojo *et al.*, 2020). Supporting farmers and their organizations to increase their production, postharvest activities, storage, processing, and improve their managerial, organizational and marketing skills can contribute to their being able to meet the standards set by local governments (FAO, 2018c).

Assomada, Ilha de Santiago, Cabo Verde. "Supermarket of flowers".

PART THREE

CROSS-CUTTING DIMENSIONS

8

CREATING AN ENABLING ENVIRONMENT: GOVERNANCE AND INTEGRATED POLICIES

Luxor, Egypt. Development of afforestation activities in desert land irrigated by treated sewage water and groundwater, part of Development of Peri-Urban Forestry Plan

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8.1 Governing multiple facets

Together with UPA and the various stages of food production are processing, distribution and consumption, which are related to a wide range of urban management areas that are handled by local governments. For example, the food system impacts and is impacted by land use, planning, transport, environmental and waste management, economic development, public health, education, and social and community development. A broad diversity of systems and related actors are involved in UPA: input provision; vegetable production; aquaculture; livestock production; agroforestry; processing; marketing and waste management and resource recovery.

Ensuring the availability, accessibility and affordability of sufficient, quality, appropriate, safe and healthy food requires better understanding and planning of the food system. A key concept, to help with this understanding, is to take a systems approach that acknowledges the multi-functionality of food and UPA, which involves multiple sectors and multiple scales, and takes a flexible, participatory, inclusive approach. UPA is part of this (city region) food system and is key to ensuring its linkages with the complex network of food system actors, processes and relationships (in food production, processing, marketing and consumption) that are directly and indirectly connected with UPA.

Increasingly, cities or city regions are taking the lead and becoming the principal territories for transformation, and although UPA is still unfamiliar territory for many city and regional governments, it is attracting the attention of urban planners and policy-makers across the global South and North. This is the result of the combined effect of several trends (such as diet related diseases; food security, food poverty; greenhouse gas emissions from across the food chain; biodiversity and ecosystem services), while the importance of local access to food became even more apparent in 2020 during the COVID-19 crisis.

City region food systems and UPA contribute to the implementation of Agenda 2030 and the New Urban Agenda, adopted in Quito in October 2016, that emphasizes the need to "strengthen food system planning," which is at the heart of the MUFPP. The Pact promotes a governance framework for local food systems and participatory monitoring and decision-making, and has already been signed by over 200 cities around the world.

Ecuador. Quito Food Charter Assembly

8.2 Multiple stakeholders

Urban governance refers to "the range of political, organizational, and administrative processes through which stakeholders (including citizens and interest groups) articulate their interests, exercise their legal rights, take decisions, meet their obligations, and mediate their differences" (Arena, Genco and Mazzola, 2020).

Urban food governance, then, involves a wide range of actors, including all levels of government, the private sector (for example producers, large supermarket chains and chambers of commerce), civil society organizations (NGOs and community groups), academics, and international donors with food programmes, marketing and distribution networks, traders associations. Interactions between these diverse stakeholders are mediated through a range of formal and informal power, decision-making and regulatory processes.

Effective and sustainable actions affecting UPA can positively impact coordinating policy and planning among these different actors and sectors, and involve the various stakeholders directly in the planning process.

Multi-stakeholder dialogue and interaction is a crucial element in establishing UPA as part of a resilient urban food system. Effective collaboration and coordination across multi-sectors and multi-levels of governance are needed to successfully support UPA. Box 18 sets out the benefits and potential drawbacks of taking a multi-stakeholder approach.

BOX 18

Benefits and challenges of the multi-stakeholder approach

An interactive, multi-stakeholder approach to formulating policy on urban agriculture has – in principle and compared with other approaches – the following benefits:

- Contributes to more participatory governance, public-private partnerships and helps to bridge the gap or overcome distrust between citizen groups and the government.
- Allows for better situation analysis and quality decision-making (through a better understanding of priority issues and the needs of the different stakeholders involved).
- Improves the likelihood of success and sustainability of implementation (through enhanced acceptance and ownership of the policy formulated) (Hemmati, 2002).
- Supports improvement of the problem-solving capacities of the participating institutions.
- Facilitates integration of urban and peri-urban agriculture (UPA) into various government departments and processes, notably urban and land-use planning, but also potentially others, for example school food provision, climate risk mitigation.
- Renders the multi-functional benefits of urban agriculture visible through its contribution to various urban agendas (e.g. food security of families and communities practicing UPA; encouraging physical activity through access to green spaces; combatting impacts of climate change by reducing urban heat islands, etc.).

On the other hand, public participation in decision-making:

- Requires skilled human resources and additional financial means.
- May require more time than other approaches, to allow for required changes in institutional cultures.
- May lead to an undue increase in the influence of some stakeholders (especially if the process is not transparent).

Source: RUAF, 2010

8.2.1 Stakeholder mapping and analysis

The type of stakeholders involved in UPA, and their level of participation in the value chains or in policy development, varies depending on local circumstances. It is often helpful to conduct stakeholder mapping and analysis to identify both direct stakeholders (the urban producers and others in the chain) and indirect stakeholders in UPA: institutions, organizations and networks that have expertise and/or resources that can be mobilized to develop UPA in the city.

In particular, potential target beneficiaries of UPA programmes must be included, such as the low-income population, unemployed women, displaced people or refugees, youth, older people, etc. – bearing in mind intersectionality between these groups (RUAF, 2020). All relevant stakeholders should be associated at all stages of the process, from its inception through to steps involving policy dialogue and action planning (RUAF, 2010; 2016).

Key questions to ask when identifying and analysing the stakeholders involved in UPA are:

- Which institutions/organizations play and can/should play a role in the development of UPA? What is their mandate? Where do they work and with whom?
- What are their views on urban and peri-urban agriculture?
- What type of services do they provide (or could they provide) to urban producers?
- What contributions (human and/or financial) can they provide to the platform and to (current and future) actions?

8.2.2 Multi-stakeholder programme design and implementation:

In **Rosario, Argentina**, a key factor in the success of the city's policies has been the participation of citizen groups in the design and management of green spaces for UPA. For the participatory design of the city's community gardens, multi-stakeholders including architects, urban planners, governments, civil society members, slum inhabitants and urban gardeners were gathered for a bottom-up process of planning, design and management of UPA spaces. Different stakeholders should trust each other and pay attention to others' needs to ensure the balanced participation of various groups (Renting, van Veenhuizen and Schans, 2014).

In **Leuven, Belgium**, a multi-stakeholder approach has been integral to the creation of an integrated city food policy that benefits UPA. A steering committee was created to draft the Food Connects strategy. After the document was drafted and approved, the actual implementation was left to a cross-sectoral group of municipal and provincial departments, NGOs and Leuven Climate Neutral 2030 (Erwin *et al.*, 2022).

8.2.3 Multi-actor platforms

The participation of a wide variety of stakeholders improves the quality of policy and programme design and enhances commitment to implementation. Therefore, it is important to stimulate the direct participation of the (various types of) urban farmers in policy design and action planning as well as to stimulate dialogue and cooperation between public and civil society organizations, through UPA multi-actor platforms, broader food policy councils, and other convening forms. As they engage in the process mapped out above, stakeholders may well develop strong interest in continuing the dialogue and joint planning beyond the end of the programme. An ideal outcome of the process is the establishment of a more permanent governance platform.

In Governador Valadares, Brazil, a Municipal Forum on Urban Agriculture and Food Security was formed. The Forum includes more than 100 representatives (men and women) who were selected by the community. Neighbourhood associations, public schools, university and faculty members, church representatives and governmental secretariats (environment and agriculture, planning, city council representatives) also participate. (RUAF, 2006)

A growing number of cities and regions - in countries in all income brackets, around the world - are forming food policy councils and similar groups known by other names, such as multi-stakeholder food forums/platforms, food policy networks, food boards, food coalitions, food partnerships and food labs (RUAF, 2019, Editorial). In North America, food policy councils and similar platforms that seek to improve the food system through organized public policy action have a history that stretches back over 40 years, and are rapidly spreading elsewhere (RUAF, 2019).

Food policy councils can take a variety of different forms, and are implemented in different ways on various platforms, where their precise role and

mandate varies considerably. Very often, food production is a key theme or action area. In some cases, urban agriculture is the entry point to the formation of a food policy council that takes in the broader perspective of the entire food system.

In **Quito, Ecuador**, AGRUPAR, founded in 2000, was the entry point for the city's participation in the CRFS programme, signatory to the MUFPP, and the formulation of an agrifood policy based on a multi-stakeholder process, the Quito Agrifood Pact. Consequently, a permanent food policy council was planned for the city, to advise the mayor and municipal council in matters concerning sustainability and resilience of the food system (RUAF, 2019).

The food policy council in **Antananarivo, Madagascar**, evolved from a 20-stakeholder platform to scale up the urban agriculture programme, initially established in three neighbourhoods in 2011 by the Antananarivo City Council as a means of improving the livelihoods of urban residents. Following Antananarivo's signing the MUFPP in 2016, the city council decided to broaden the perspective from production to the entire food system. The Antananarivo food policy council was established to orient implementation of commitments under the MUFPP (RUAF, 2019).

In **Canada**, the **Toronto** Food Policy Council has been instrumental in developing urban agriculture in the city since the 1990s. In 2012, the City Council adopted the GrowTo Urban Agriculture Action Plan, compiled by various food and environmental organizations in the city during moderated discussions and action planning sessions. The Action Plan set out a workplan to scale up urban agriculture initiatives across the city, several of which were instituted in subsequent years (Toronto Food Policy Council, 2012).

8.3 Cross-sector, cross-level and cross-city collaboration

The multifunctional character of food makes it a unique convening issue because the food system is heavily implicated in so many public policy arenas. Hence, local governments are beginning to recognize the enormous opportunity provided by a more thoughtful consideration of sustainable UPA and food and its relationship to local community development. Therefore, UPA can be used as a critical lever to achieve other planning goals and strategies.

Ecuador. AGRUPAR supports packaging of produce for local farmers

Belgium. Stakeholder meeting to develop the Leuven food strategy

Toronto, Canada. Flemo Farm, a new project combines community gardens and an incubator belonging to entrepreneurial family farms under power lines. This is one result of the adoption of the GrowTO Urban Agriculture Action Plan

Belgium. Urban food councils

The governance and planning of urban food systems is, however, particularly complex, as these systems generally are not shaped by deliberate political, organizational and administrative processes. As such, the impact of governance and planning of urban food systems is usually unintentional (Pothukuchi and Kaufman, 2000). Urban planners do not lead in developing urban food policies, but nevertheless do play a crucial and integrative role. Often the decision to support UPA, or food, is not consciously reflected in urban planning and design policy, regulation and programming, while many city departments seek to, and some collaborate in achieving sustainability goals.

Local governments can capitalize on synergies between different sectors through an integrated planning approach, which brings together different systems (e.g. infrastructure, energy, buildings etc.) to meet common sustainability goals. Understanding the relationships between the different systems is important, for example, in mapping and vulnerability assessments. Food and UPA are crosscutting issues that involve many different local government departments as well as external partners. Creating integrated policy for resilient (city region) food systems relates directly to various economic, social and environmental health and prosperity goals.

8.3.1 Cross-sector collaboration

Cross-sector collaboration within the local governments is a key component of the successful implementation of policies/initiatives that address multiple policy agendas, considering the cross-disciplinary nature of UPA, and the multiple departments that are always involved in UPA initiatives such as resource, transportation, planning, etc. However, it is often difficult to work well together if not well coordinated, given that each department has its own tasks and goals.

The creation of an institutional home for UPA is important. Conventionally, sector policies have been defined by assuming that agriculture refers to the rural sphere and will be attended to by institutions other than the urban. As a result, urban agriculture continues to receive minimal attention for policy and planning and development support or suffers from conflicting jurisdictions. At the same time, urban farmers are often uncertain as to which department, organization or programme is responsible for them.

In **Rosario, Argentina**, the Urban Agriculture Programme made the effort to coordinate the different departments, contributing to good governance and management of local urban agriculture (Kuhns *et al.*, No date, Module 1). In **Kampala, Uganda**, policies supporting UPA were weakened by conflicting policies in other departments. For example, a crackdown on informal food markets negatively affected the UPA value chain since informal markets are crucial to the marketing of UPA produce (Sabiiti *et al.*, 2014).

Dakar, Senegal, has several different policies that are articulated at various levels and across various policy areas, though there is little coordination between them. This is largely because of the recent decentralization and devolution processes in Senegal, which provides greater autonomy to municipal authorities. The Dakar region has implemented an urban development plan to reduce the growth of the urban built environment and preserve forests and green belts. Rufisque is a municipality in the Dakar Metropolitan Region that has developed a Food Policy Plan, which has reserved 2 330 ha for agriculture and has met with broad community support. Additionally, there is coordination between the municipality, farmer groups and the Federal Department of the Environment that administers the agricultural land in Mbao Forest (Erwin *et al.*, 2022).

Municipal authorities can play a key role in filling this gap by selecting a **leading department or institute** in the field of urban agriculture; often a change will be required in the institutional mandate of that organization. Often a special urban agriculture department, unit or office will need to be created within the leading institution.

Cities can also establish an i**nterdepartmental committee on urban food** production and consumption to facilitate coordination and institutional commitment. Several cities have created a municipal agricultural department.

Following devolution of agriculture to the local level in **Kenya**, in 2013 the Agriculture, Livestock, Fisheries, Forestry and Natural Resources Sector was created within the **Nairobi** City County Government. Prior to this, there was no institutional structure or mandate for agriculture in the city. Moreover, under the 2011 Urban Areas and Cities Act all cities and municipalities provide a framework to regulate urban agriculture. This has resulted in the development of the Nairobi Urban Agriculture Promotion and Regulation Act 2015. (IPES-Food, 2015)

In **Villa María del Triunfo, Lima Peru**, an urban agriculture subdepartment was created under the Department of Economic Development, while at the same time urban agriculture was included as a priority area in the Concerted Economic Development Plan (2001–2010) (Dubbeling, Hoekstra and van Veenuizen, 2010). In 2001, the city of **Rosario, Argentina** made its Secretariat of Social Promotion responsible for the coordination of the new Urban Agriculture Programme. Over the past few years the staff involved has grown from one to several full-time workers. In **Bulawayo, Zimbabwe**, an Interdepartmental Committee on Urban Agriculture was created to coordinate the activities of the various municipal departments active in this field, among them town planning, health and finance. (Martin-Moreau and David Ménascé, 2019).

8.3.2 Cross-level collaboration

Increasingly, UPA is seen as part of the wider food system. This enhances the understanding of the various steps in the food value chains, and deepens the understanding of agriculture in other sectors (forestry, fisheries, etc.). It also increases the understanding of urban – rural relations, and places UPA and food systems within the broader socio–political, economic and technological environment (Cabannes and Marocchino, 2018).

Implementation, including planning of UPA and food related activities, as presented in chapter 4 of this sourcebook takes place, and hence should be considered over multiple spaces and scales, where people, institutions, etc. develop related activities: from household to neighbourhood; town or city;, or metropolitan area;, to district; county; province; to national and regional; and indeed global level. It is important to understand these linkages, and the lack of, cross-level collaboration mechanisms.

Urban food systems are closely linked to their rural hinterland, and urban and rural food systems inter-relate. Because of this rural-urban interdependence, and the role cities play in creating regional sustainability and food security, it is important to think of local food systems at a regional scale. In this sense it is good to view UPA and its governance as part of planning for the city region food systems.

The city of **Almere, the Netherlands**, aims to be an exemplary “Green City” by incorporating the development of four thematic areas in city planning: FEEDing the city (production/UPA); GREENing the city (green areas as crucial assets and for quality of life; ENERGIZing the city (energy efficiency and self-sufficiency); having a HEALTHY city (emphasizing the well-being benefits of healthy local food and green spaces). To upscale its successful regional UPA initiatives, the city is strengthening relations between the city and the countryside at three different levels. At the micro-level, UPA initiatives, such as the City Farm Almere and many community gardens, have strengthened social cohesion among citizens. At the meso-level, stronger connections are sought between the city and urban, peri-urban and rural producers. Some farms have forged direct links with the city and renting out allotments to citizens. The Oosterwold Region created an innovative open planning process for new green housing; citizens can create their own building plans provided that 50 percent of the land is for agricultural use. Finally, at the macro-level, farms in Almere’s agricultural region are strongly linked to world markets (Renting, van Veenhuizen and Schans, 2014).

In Milan, Italy, several initiatives connect the city with surrounding peri-urban areas. In 1990, the city built the first Italian agricultural park, the South Milan Agricultural Park occupies 47 000 ha, which strongly stimulates the development of territorial policies and initiatives for agritourism and land management in peri-urban areas of the city. More recently, local food networks, such as *Mercato della Terra* (Land markets) have been built around the city to connect consumer cooperatives with local organic products. Institutional innovations, such as establishment

of "agricultural districts" in peri-urban areas, have also emerged to support the integration of agricultural, rural and urban food policies (Renting, van Veenhuizen and Schans, 2014).

The Golden Horseshoe Food and Farming Alliance Plan, launched in 2012, and renewed in 2021, is a common framework for ten municipalities within the wider region near T**oronto, Canada**, to coordinate actions to support farming and the food system within the rapidly urbanizing city region. The vision for the Golden Horseshoe is for it to be "globally renowned as a vibrant and sustainable agrifood cluster, characterized by profitable farming operations of all sizes, a thriving hub of food processing and food retail, extensive research capacity, and innovative technology" (Golden Horseshoe Food and Farming Plan, 2020).

Nairobi, Kenya, is one of the leading African cities that have conducted a successful city-national partnership for UPA policy development. It mainly originated as a systematic study of UPA in Kenya in 1985, which found intensive household engagement in UPA, however, there were issues related to land access, tenure, gender patterns and harassment by public officials (Lee-Smith *et al.*, 1987). From the late 1990s to early 2000s, global projects took place in Kenya that promoted UPA, such as Nakuru Municipal Council's Local Agenda 21 and "Greentowns Kenya", which to some extent sensitized the authorities to UPA. In 2004, a network platform for different UPA actors was created in Nairobi to involve farmers from around the city and national government officials. As result, government extension services began to provide farmer training twice a year, this model was also introduced and practiced in Mombasa and Dar es Salaam. From 2013, the Nairobi City County was recognized as the authority for local agriculture; such empowerment made way for urban agriculture policy and legislation, which became the Urban Agriculture Promotion and Regulation Act in 2015.

On the contrary, in **Tamale, Ghana; Dakar, Senegal**; and **Dar es Salaam, Tanzania**, issues related to the poor coordination between different layers of authorities were observed, which greatly diminished the efficiency of a policy that protects the land use for UPA (Padgham *et al.*, 2015).

Kampala, Uganda, illustrates challenges in coordination with the national government when developing policy and legislation for urban agriculture. Urban farming in Kampala was initiated to cope with household food insecurity and malnutrition resulting from the country's insecurity up until the civil war and after (Komakech *et al.*, 2014). The use of public spaces by urban farmers in Kampala was not a sustainable practice for production, however, the national government resisted providing support to urban agriculture because of concerns related to reducing urban demand for rural produce as well as the related health risks. Meanwhile, advocacy promoting policy support for urban agriculture increased in cities throughout Uganda. Finally, the Kampala City Council passed by-laws to recognize and formalize urban agriculture in 2006.

8.3.3 Cross-city collaboration

City authorities and civic society groups can learn much from their counterparts in other cities as long as they appreciate that every urban context is unique. City exchanges can bring new ideas and innovation, accelerate transfer of knowledge, foster joint creation of new knowledge, empower local authorities, and enhance local and international networks.

In 2017, as part of FAO's South-South Cooperation Programme, the City-to-City Initiative promoted the potential of mutual support between local governments. With a focus on improving local food security and nutrition, **Dakar, Senegal**, shared its experience with **Douala, Cameroon**, and **Praia, Cabo Verde**, to create microgardens that brought together vulnerable groups to produce diverse horticulture products in urban spaces. The experience also helped FAO understand how to fine-tune urban South–South Cooperation at the local level, so as to replicate the City-to-City Initiative in other settings (FAO, 2018b).

Belgium. Belgian and Central American farmers exchange information on commercial farming

In 2018, FAO, ICLEI and RUAF supported a meeting involving nine cities from six Eastern and Southern African countries for a City-to-City Food Systems Forum, to support capacity-building and joint learning concerning city-region food systems. As a follow up, more in-depth learning between the **Arusha** City Council and the *Commune Urbaine* d'**Antananarivo, Madagascar**, was organized to focus on the integrated food policy development process taking place in Antananarivo (RUAF, 2019).

8.4 Policy measures

Once municipal authorities understand that urban agriculture can contribute to some of their policy goals, they often seek to facilitate the development of urban agriculture by means of proactive policies and intervention strategies that enhance the socio-economic and nutritional benefits of urban agriculture, while reducing the associated health and environmental risks. In this way, municipal policy-makers and support institutions can contribute substantially to the development of safe and sustainable urban agriculture.

These issues and related policy measures can be categorized under the following three main headings:

Georgia. Urban agriculture farmers tend cabbages grown organically in an allotment outside an industrial town. The allotments were created by the Biological Farmers' Association (an NGO) on wasteland set aside for impoverished families where they have managed to produce surplus for sale at the market

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- Creating a conducive planning environment for urban agriculture and its formal acceptance in urban regulations.
- Delivering adequate support services to enhance the productivity and economic viability of urban agriculture.
- Taking measures to reduce the health and environmental risks associated with urban agriculture.

8.4.1 Creation of a conducive planning and regulatory environment

Several cities and regions, primarily in the global North, but increasingly so in the South have progressed with integrating food into urban planning. In the United States of America, many local governments view food systems as top priority, and incorporate UPA and food into zoning, regulations. This varies from green spaces, community gardens, and land banks (Chapter 4), to the planning of multi-scalar food systems that cover the entire food system (actors, sectors, scales) and include key aspects such as infrastructure. A whole range of tools and methods have been designed, and are being implemented. The new tools include mapping (of food assets, land, green, or food retail); spatial indicators; food charters; community participatory planning (see above); land regulations, land zoning and land uses; and a final set of monitoring tool (food deprivation maps, as used in **Bristol, United Kingdom**) (Cabannes, and Marocchino, 2018).

In **Belo Horizonte, Brazil**, a planned city, already has access to food as part of urban planning, involving popular restaurants, covered markets, food stores, food distribution centres, and food banks, while inclusion is monitored and planned using tools such as the urban life quality index (Cabannes and Marocchino, 2018)

Urban planning is at the core of city and regional governance and provides one of the most critical leverage points for affecting shifts towards more resilient food and agriculture systems. Urban planning refers to the coordination of municipal departments and community stakeholders in achieving common sustainability goals through the development of policies, design, and programming to achieve common economic, social and environmental sustainability goals.

Formal acceptance of urban agriculture, as legitimate urban land use is a crucial first step towards effective regulation and facilitation of the development of urban agriculture. Existing policies and by-laws for urban agriculture (as well as sector policies that include norms and regulations on issues related to health, the environment, etc.) will need to be reviewed in order to identify and subsequently remove (unsubstantiated) legal restrictions that may exist.

Another essential step is to include urban agriculture as a separate land-use category in land-use plans and change existing zoning categories to include urban agriculture (see discussions of urban planning elsewhere in this book). A second important step is the creation of an institutional home for urban agriculture, as mentioned above.

Several cities, such as **Havana, Cuba; Nairobi, Kenya and Kampala, Uganda**, have revised their by- laws and regulations to replace colonial by-laws and international sanitation standards that were seen to be excessive, unenforceable or inappropriate to local conditions. "Our by-laws were out-dated," admits Winnie Makumbi, Kampala City Minister of Social Improvement, Community Development and Antiquities. "They failed to recognize that many residents derive their livelihoods from urban farming. We realized it was up to us as political leaders to initiate the policy changes that would support urban farming practices" (Martin-Moreau and Ménascé, 2019).

The municipal government in **Belo Horizonte, Brazil** has promoted urban agriculture since the establishment of the Food Security Programme in 1993, which became a model policy for the development of the national Zero Hunger Programme in 2003 (Gopel, 2009). In 2008, the city developed an Action Plan for Urban Agriculture that established a dialogue between government and non-government organizations. A law was passed to establish a policy for urban agriculture, the Master Land Use Plan was reviewed and a framework substantially to support national and international organizations in helping with farmers' UPA practices (RUAF, 2011).

Zoning, in itself, is not sufficient to maintain green open spaces. Maintenance of these areas strongly depends on the political will of the local authorities and the practical, technical and financial support provided to urban farmers, and the development of sustainable and multi-functional agriculture in these green belts. Land is a very important resource for urban agriculture and its availability, accessibility and suitability for agriculture should be of particular concern to those who want to promote urban farming as a strategy for social inclusion, enhanced food security, poverty reduction and local economic development.

City governments can facilitate urban farmers' access to available urban open spaces in various ways, besides regulatory approaches, as illustrated in chapter 4 (land mapping, temporary leasing, providing economic incentives and technical support to particular groups of citizens to take action, establishing (allotment) gardens on privately owned land, etc.). Municipal and other authorities can facilitate the combination of urban farming with other municipal functions. Farmers may provide recreational services to urban citizens, receive youth groups to provide ecological education, act as co-managers of parks, and their land may also be used as water storage areas, nature reserves, fire break zones, flood zones, etc.

La **Paz, Bolivia** adopted a new law in 2018 to allow citizens to use public land for urban agriculture on a temporary basis, as long as they adhere to certain conditions regarding access and environmental stewardship. The intention is to improve the urban environment and biodiversity by making disused public spaces productive, while enabling families to produce their own food to boost household food security (Halliday *et al.*, 2019).

In **Brighton and Hove, the United Kingdom**, the City Council adopted a Planning Advice

Rome, Italy. A view of an urban garden. Municipalities allow residents to use the green areas, often in associations, to grow flowers, fruit and vegetables for personal consumption. Municipalities may receive a symbolic rent for the use of these gardens

Note to encourage the incorporation of food growing spaces into plans for new building developments. The note is part of the Local Development Framework but adherence is not a legal requirement for building developers. Rather, it is an expression of the planning authority's preferred approach (Halliday *et al.*, 2019).

8.4.2 Enhancing the productivity and economic viability of urban agriculture

Urban agriculture tends to be highly dynamic and innovative, in part because of its proximity to urban consumers and the special urban conditions in which farmers operate, but its development is often constrained by urban farmers' limited access to training, extension services and credit. Agricultural research and extension services, and other support organizations in most cities, give little attention to agriculture in the urban environment, or only to the larger-scale commercial agro-enterprises. Hence there is ample scope for enhancing productivity and profitability in urban agriculture. Municipalities can play an important role, especially by stimulating and coordinating production, developing joint programmes with relevant sector organizations, co-funding, providing licenses, supplying compost and basic infrastructure.

In **Quito, Ecuador,** producer groups receive technical assistance and training under the AGRUPAR urban agriculture programme. In addition, in 2011 the municipality established 15 locations for weekly *bioferias* – agroecological food markets – across the city, where producers can sell their surplus produce. The *bioferia* regulation establishes the conditions for participation in the markets and the penalties for non-compliance. The scheme has the dual benefits of increasing economic opportunities for (mostly women) farmers, as well as providing improved access to fresh, affordable, mostly organic produce for residents (Halliday *et al.*, 2019).

Ecuador. One of the *bioferia* markets set up by the AGRUPAR program for local producers

Most urban farmers are poorly organized and usually work informally. They therefore lack sufficient channels and power to voice their needs. This limits the representation of their interests in urban policy-making and planning at the various levels and hampers their participation in development programmes. Well-functioning farmers' organizations can negotiate access to land, adequate tenure arrangements and access to credit. Such organizations may also take up roles in farmer training and extension, infrastructure development, processing and marketing, and control of certification of the quality of the products marketed.

8.4.3 Improved coordination between health, agriculture and environmental departments

It is most important that mechanisms are created to encourage close cooperation between agriculture, health and environment/waste management departments. Closer cooperation will facilitate the assessment of the actual health and environmental risks associated with urban agriculture, and the design of effective preventive or mitigating strategies that require the participation of all these sectors. In **Kampala, Uganda** for example, health and agricultural and town planning specialists closely cooperated in the development of the new ordinances on urban agriculture livestock and fisheries. In **Phnom Penh, Cambodia** steps were taken to improve coordination between municipal departments, universities and private organizations to control and monitor the microbiological and chemical quality of wastewater-fed fish and plants to reduce a number of health problems.

8.5 Policy instruments

Local governments are critically important to building sustainable food systems but are unable to do so on their own. Local government policies are embedded within state/provincial, national and international policies and legislation. Partnerships with other levels of government, community organizations, the private sector, and universities can help develop and implement food policies.

Policies are decisions that lead to action, adopted by government, to induce certain changes in the decisions and behaviour of actors in a society to achieve certain goals. Food policies are decisions that aim to achieve multiple food system goals. In a growing number of cities, local governments have recognized the importance of urban agriculture and are designing new policies related to urban agriculture or are reformulating the existing. A well-defined policy will indicate the strategies and instruments to be applied to realize the set objectives. The choice of a particular strategy or instrument will then be based on an analysis of the effectiveness of the available alternative options.

Legislation is not the only available policy instrument. National and local governments have four main policy instruments available to them (Wilbers and de Zeeuw, 2006), based on how the behaviour of the actors in society needs to be influenced and the expected output: legal, economic, communicative/educative and urban design instruments.

8.5.1 Legal instruments

Legal instruments seek to force actors to adopt the desired behaviour through legal norms and regulations (at local level through municipal by-laws and ordinances). An important assumption is that it is possible to enforce and control behaviours, which is at the same time its weakness, as in many places enforcement is weak. Legislation is not only required when the desired behaviour cannot be realized in another way, but the other instruments, often part of a comprehensive package need to be formalized by law.

As UPA requires multi-sectoral fine-tuning of legislation, implementing legal changes can be very challenging. Therefore, alternatives such as food pacts, food policy councils, where agreements, social contracts, covenants, etc. can be agreed among the different actors, including government, urban farmers can provide alternatives to legal changes when these are not feasible.

In **Kampala, Uganda**, the new policy supports urban agriculture in the sense that it is accepted as a legal form of land use, under certain conditions, and forms part of the city's poverty alleviation and social development strategy. However, the policy relies mainly on legal instruments (the Kampala city ordinances regarding urban agriculture, fish, livestock and meat), which restrict unwanted behaviour by establishing a system of licenses, regulations, control and sanctions. (Martin-Moreau and Ménascé, 2019).

In **Nairobi, Kenya**, the 2015 Nairobi Agriculture Promotion and Regulation Act provides a regulatory framework for the practice of urban agriculture within the city county. The Act establishes the responsibility of the Nairobi City County Government to train farmers; ensure they have access to organic waste; develop marketing infrastructure; monitor and regulate quality and hygiene standards; and promote animal welfare and traceability. The Act is intended to integrate actions that support agriculture across city departments and agencies, including the environment, planning and land uses, urban renewal, trade and health, and partnerships fostered with non-governmental organizations (IPES-FOOD, 2017).

In **Toronto, Canada**, the Green Roof By-law (2009) requires all new buildings over 20 m high with over 2 000 m2 of floor space to have at least 20 percent of its rooftop covered by green space (Kaill-Vinish, 2009). While not focused on productive roofs, some rooftop projects that grow edible products managed to be added under this by-law.

8.5.2 Economic instruments

Economic instruments are used to encourage actors to adopt a desired behaviour based on expected economic gains or losses if an undesired behaviour is continued. Local governments may grant tax incentives or subsidies if actors adopt the desired behaviour or levy special taxes for undesired behaviour (see chapter 4). In addition to having a legal basis, it also requires proper communications to show direct linkages to the behaviour in question. The challenge is the difficulty of putting a proper value on all UPA functions against, for instance, global food, while currently higher prices for organic food may exacerbate social inequity.

For example, the municipality of **Rosario, Argentina** grants tax exemptions to land owners who permit poor urban farmers to use vacant private land. The **City of Cape Town** provides incentives in the form of the supply of irrigation water, tools and compost to poor urban farmers (Martin-Moreau and Ménascé, 2019). Chapter 4 cites other examples of the use of tax incentives as economic instruments.

8.5.3 Communication instruments

Communication instruments are based on the assumption that people adopt a certain desired behaviour if they are well informed about the positive or negative effects. There is an entire range of instruments concerning campaigns, including advertisements (or not, as in London), extension visits, training courses, leaflets and websites. The lack of an adequate communication and education strategy may strongly reduce the effectiveness of the policy instruments employed.

In **London, the United Kingdom**, the flagship Capital Growth programme was initiated in 2008, under the auspices of the Greater London Authority's London Food Programme, as part of the preparations for the 2012 London Olympic Games. Implemented by the civil society organization Sustain, the original objective was to support the establishment of 2 012 new food-growing areas across the capital by 2012. Not only was that goal surpassed, but also the network has continued to grow, with 2 767 spaces in 2021 (788 638m2 of growing space) and regular training and networking events[47].

8.5.4 Urban design and planning instruments

The fourth group contains urban design and planning instruments, which focus on the physical environment of food actors. These have been discussed in several places above, so a paragraph suffices here as a reminder of the wide range of these instruments. As a brief reminder, these instruments can include controls for the location of healthy or regional food in a supermarket, mapping and zoning of urban farms, inclusion of space for home or community gardening in social housing projects and adaptation of building codes to allow roof top gardens.

8.5.5 Combining instruments

Wilbers and de Zeeuw (2006), analysed a number of policies related to UPA. Their study revealed many cities use legal instruments, often with a reactive character. Other instruments are applied to urban agriculture under more proactive and development-oriented approaches. It is noted that economic, educative and design instruments should be combined with supporting legal instruments in an effective "package" of policy measures in order to arrive at a development-oriented policy for urban agriculture. Many of the reviewed policy documents hardly differentiate between policy measures for various types of urban agriculture existing in a city. Urban livestock tends to be restricted much more than growing vegetables. Raising livestock is often limited to the peri-urban areas or to minimal numbers of small stock because of the perceived health and environmental risks.

There is no one right way to develop food policies. Regional and municipal governments will base food policy frameworks on existing city-regional priorities, assets and needs. Policies will also be based on the biophysical, economic, political and social realities of a given area. This foundation will clearly be different for local governments around the world. There is a need to go beyond the reformulation of by-laws and ordinances and design a comprehensive policy that makes use of various types of policy instruments. It is recommended that a clear, comprehensive policy or vision is developed first, including the objectives, selection of strategies/ instruments as well as other strategies, and that the institutional framework is defined before developing detailed legal instruments.

The city of **Rosario, Argentina**, works more with economic and communicative instruments, focusing on stimulating good behaviour by means of positive incentives (tax reduction for landowners, farmer education and technical assistance – specifically in the field of organic farming, subsidies for composting, support to marketing – all financed and supported by the municipal urban agriculture programme).

[47] For more information see www.capitalgrowth.org

9

BUILDING RESILIENCE

Shocks and stresses are not specific to UPA, but their impacts are direct and indirect. In Chapter 2, we introduced the concept of resilience and the ways UPA can contribute to food systems in the urban environment and city regions. Chapter 9 discusses the most common vulnerabilities affecting UPA and its exposure to shocks and stresses, which puts it at risk. This chapter includes an overview of key actions that policy-makers and practitioners can take to enhance the resilience of UPA itself.

Increasingly, UPA is required to be resilient, coping with and recovering from shocks and stresses; to reduce greenhouse gas emissions; protect and restore ecosystem services (e.g. water, biodiversity, soil) and find an alternative to fossil fuel based growth. At the same time, UPA is expected to provide opportunities for adaptation, mitigate climate change and provide socio-economic and environmental co-benefits. The resilience of UPA systems need to be improved urgently and the skills and knowledge of smallholder farmers living in and around cities strengthened. Options to reduce vulnerability, and increase resilience at the household and community level, are diverse and range from good agricultural practices, for example climate-smart agriculture, crop diversification, among others; better and more efficient use of inputs and resources (composting and wastewater reuse), to reduction of food loss and waste.

In this regard, this chapter concentrates on the lessons learned from the COVID-19 pandemic, which will help in understanding the vulnerabilities of UPA and the solutions currently being adopted in the different contexts. In particular, this chapter relies on the global survey undertaken by FAO. While COVID-19 is currently the most disruptive force in our food systems, we must not overlook the risks posed by other looming shocks and stresses, which include economic recessions, loss of biodiversity, land degradation, pest outbreaks, earthquakes and water scarcity. Moreover, extreme events (droughts, floods, storms, heat waves, etc.) and longer-term stresses (salinization, sea-level rise, climate variability) are further increased by climate change, whose impact is already being felt in most of the countries and regions of the world and will continue to exacerbate the impacts on UPA.

9.1 What are the main vulnerabilities?

Operations related to UPA are reliant upon a series of external inputs (seeds, fertilizer, pesticides, etc.) and services (labour, extension and advisory services). In the short term, mobility and trade disruptions resulting from a pandemic, an extreme weather event or any other hazardous event can significantly slow or hamper agricultural operations in cities and peri-urban areas. Plant production and protection measures against diseases and pests may be interrupted, access to agricultural inputs may be reduced, local and international workers may be unable to travel to production areas, and extension services may no longer be able to provide specific advice to growers (FAO, 2020a). While some farmers may experience temporary setbacks, in the long term, the viability of small and medium-scale farms could be threatened, potentially causing widespread and long-lasting poverty among vulnerable farmers (FAO, 2020a; FAO, 2020d).

During the COVID-19 pandemic, producers in **Antananarivo, Madagascar**, suffered from limited access to supplies such as seeds and fertilizers. This constrained the capacity of producers to plant produce, leading to shortages and higher prices in local markets, which potentially impacted the possibility that vulnerable residents would be able to purchase healthy, affordable food (FAO, 2020a). Restricted access to inputs can disrupt the planting calendar of certain crops and disrupt both the quality and quantity of inputs used, ultimately affecting the availability of that crop.

Labour shortages are another threat to UPA.

Quito, Ecuador. Organizing food basket deliveries at Cooperative Sur-Siendo

©Rikolto

They can severely impact livelihoods and food security in regions already affected by conflict or humanitarian crises. As stated in FAO's global survey on COVID-19, 80 percent of cities in high-income countries indicated that restrictions on human mobility, which were set in place to fight the pandemic, had led to labour shortages for local food and agriculture-related activities, compared with 40.6 percent of all respondents (FAO, 2020a; FAO, 2020b). In **India**, the national lockdown coincided with the country's peak harvesting time for staple crops and high-value crops such as vegetables, causing huge food waste and economic losses (FAO, 2020a).

Various shocks can also impact the availability of a specialized workforce dedicated to advising UPA farmers and providing extension services. Reduced state budget and travel restrictions can limit the public support available for monitoring crops, fields, pests and diseases (FAO, 2020d), which may lead to inefficient use of inputs or outbreaks of pest and plant diseases.

Access to urban markets under fair conditions is still a significant challenge for producers and potentially a major vulnerability of the UPA systems. Identifying marketing channels for produce grown in peri-urban and neighbouring areas is often opportunistic and rarely involves building specific infrastructure, capacity, and connections for long-term provisioning (Blay-Palmer et al., 2020). This indicates there is a need for improved coordination between actors and institutions and increased investment in local food supply chains.

In many cases, the actors who are the most vulnerable to UPA shocks and disruptions are those engaged in high-value, labour-intensive and perishable commodities that contribute to nutritious diets such as fruits and vegetables, fish, meat, and dairy products (FAO, 2020c). Sustaining their livelihoods in times of crises should be an explicit objective of local resilience strategies.

Western Province, **Sri Lanka**, is the first provincial government that has started to include urban agriculture in their provincial climate change adaptation action plan. Rehabilitation of flood zones through their productive use, is promoted as an important strategy to enhance storm water infiltration and mitigate flood risk. Home gardening is supported as well to improve local food security and livelihoods (RUAF, 2014).

In **Bobo-Dioulasso, Burkina Faso**, the municipal authorities have considered the full extent of the impacts of climate change on their city and have decided to implement initiatives to limit their consequences. In this context the authorities set up a Municipal Unit for the Management of Climate Change and are promoting productive multiple uses of their green spaces (RUAF, 2014).

9.2 How can the resilience of systems be improved? Lessons learned from COVID-19 and beyond

There are as many entry points to improving the resilience of UPA systems as there are vulnerabilities. This section does not intend to provide an exhaustive list of recommendations but proposes a few pointers as to where efforts should be directed to improve the resilience of UPA systems.

FAO's global survey on COVID-19 and local food systems identified five main areas to build back better while "leaving no one behind": develop evidence-based and inclusive policies and plans on the preparedness of the food system and its resilience to shocks, extreme events and protracted crises; promote sectoral cooperation among local departments; vertical cooperation between municipal and subnational/national governments; and horizontal coordination with other local governments; promote local food production and short supply chains and a greater degree of self-sufficiency; facilitate access to food for the most vulnerable through social protection programmes complemented by efficient, safe and innovative food distribution; establish/strengthen networks and knowledge exchange between cities (FAO, 2020a).

Building on the results of the survey and other literature on resilience (beyond COVID-19), the section is organized in four subsections: production, markets and value chains, cross-cutting leverage points, and policy coherence and coordination.

9.2.1 Production

FAO's approach to sustainable crop production offers a menu of interventions to increase the resilience of crop production and protection systems. The guide recommends following seven management practices to build towards sustainable crop production intensification: minimum soil disturbance; permanent organic soil cover; species diversification; use of high-yielding adapted varieties from good seed; integrated pest management; plant nutrition based on healthy soils; and efficient water management (FAO, 2020d). While these recommendations were formulated with national farming systems in mind, they are also applicable to UPA systems. Depending on space, the integration of trees and livestock in the production system may provide additional benefits such as access to manure and shade.

To avoid reliance on a small number of crops and varieties that may be at risk from pests and diseases, it is usually recommended that farmers cultivate a genetically diverse portfolio of crop varieties suited to UPA production practices, ecosystems that are resilient to climate change. Specific measures include connecting UPA farmers with initiatives that conserve plant genetic resources; increase the participation of UPA farmers in conservation and crop improvement; the promotion of local seed banks, and provision of support to the emergence of local seed enterprises (FAO, 2020d). Authorities can also encourage investments in research and development to produce nutritious, input-use efficient and resilient crop varieties that are adapted to the UPA agroecological context and

Coraile, Haiti. January 2011, a woman watering the plants in a greenhouse at an urban agriculture centre in a camp for internally displaced persons, where people have been living in tents since the earthquake in January 2010

consumers' preferences (FAO, 2020d). As access to quality inputs is contingent on farmers being able to afford them, farmers' access to public and commercial finance should not be overlooked. Partnerships with local banks and financial institutions can ensure that farmers have the credit or savings they need to purchase quality inputs.

In **Fiji, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu**, governments encouraged local food production for short-cycle crops during the COVID-19 pandemic by distributing planting materials and inputs to urban and peri-urban households (FAO, 2020b). In **Victoria, Canada**, the city council reassigned park staff to grow 50 000 to 75 000 seedlings to give to residents to encourage local food production, along with donations of planting materials such as mulch, compost, soil and growing instructions (FAO, 2020b).

Resilient UPA systems also hinge upon efficient water management, especially in water-stressed cities. Local policies should eliminate subsidies that encourage farmers to wastewater and encourage precision technologies for irrigation, water harvesting and re-use of wastewater (FAO, 2020a; 2020d).

Finally, local governments have a role to play in adopting special provisions to ensure agricultural labour is available, especially at critical points in the production process (FAO, 2020a). They can also encourage sustainable production systems that make use of cities' limited space such as hydroponic and vertical farming, while creating incentives to adopt renewable energy generation to power urban farms (FAO, 2020b).

9.2.2 Markets and short supply chains

Profitability is an important enabler of resilient UPA systems, as the prospect of higher income for quality products creates an incentive for producers to use natural resources wisely. Some countries and cities protect income by fixing a (minimum) price for crops or exploring smart inputs subsidies for low-income producers (FAO, 2020d). Interventions that aim to provide stable access to markets and facilitate inclusive supply chains for UPA produce are thus essential to incentivize the adoption of resilience-enhancing practices. Local governments can support this by taking an active role in facilitating direct purchases from UPA producers, creating an enabling environment for digital marketplaces and home deliveries, and investing in short supply chains and adequate market infrastructure.

FAO's global COVID-19 survey showed that 38 percent of responding cities indicated facilitation of direct purchases from local producers as one of the key measures to mitigate the impact of the pandemic (FAO, 2020a). In **Quito, Ecuador**, in line with the Resilience Strategy of Quito's Food System, the city's urban and peri-urban gardens offered a solution to the food challenges of food provision caused by COVID-19 at different scales. Surplus from the gardens was sold through three channels: occasional ad hoc sales when crops were ready for harvest; weekly food basket sales composed of 10 to 15 seasonal varieties, sometimes including animal proteins (eggs, chicken, pork) to families in the neighbourhood; and collaborative supply chains where transactions were facilitated by a third party who collected surplus from various producers for delivery to homes. Restrictions led to a renewed focus on neighbourhoods and their surroundings and facilitated the emergence of e-commerce and collaborative economy ventures (Rodriguez, 2020).

In **Medellin, Colombia**, the city council connected local producers to private companies, provided transportation services and facilitated supply to popular canteens benefiting the most vulnerable populations in the city. In practice, an alternative food supply chain was created that benefited producers, vendors, and citizens during the COVID-19 pandemic (Zuluago Orrero and Santini, 2020). In **Davao, The Philippines**, the city government bought produce from local farmers at a higher-than-normal farmgate selling price, repacked it and then distributed it to 12 000 vulnerable families, providing an economic safety net to urban producers who struggled to sell their produce (FAO, 2020b). A similar initiative was launched in **Vanuatu** where the Department of Agriculture and Rural Development (DARD) collected produce from local producers, which was sold it its warehouse at an affordable price as part of its COVID-19 Food Security Response Plan (FAO, 2020b). In **El Alto, Bolivia**, the local government and FAO supported urban producers in the sale of their safe produce through home deliveries using all necessary precautions (FAO, 2020b).

While most of the initiatives mentioned above correspond to an immediate response to a

concrete shock, rather than to a long-term resilience building strategy, they all demonstrate the importance of shorter food chains to maintain food access in times of shocks and stresses. Reconnecting local production and consumption ensures that urban areas are not solely reliant on distant food sources but maintain local availability in case of disruptions (Blay-Palmer *et al.*, 2020).

Local authorities can play an important role in supporting the entire value chain for UPA produce, for example, by facilitating access to production resources such as land, inputs, funds and extension services; setting up specific distribution channels to facilitate sales of locally produced food; creating storage facilities locally to consolidate food reserves; and promoting the consumption of locally produced food by residents (FAO, 2020a; 2020b). In **Leuven, Belgium**, Rikolto and the municipality invested in Kort'Om, an online distribution platform that brings products from local farmers to supermarkets and restaurants in the city. During the pandemic, the platform set up a vending machine in the heart of the city to continue the sale of locally produced food involving minimal human contact (Verlinden, 2020).

Market infrastructure directly contributes to the resilience of local food and UPA systems to enhance the capacity of moving food around in a shockproof way. Depending on the context and local vulnerabilities, strategic infrastructure investments may focus on centralizing or decentralizing food distribution. In **Tirana, Albania**, COVID-19 volunteers set up a centralized warehouse to organize the daily distribution of food packages to families. In Lima, Peru, the authorities decided to decentralize a large wholesale food centre managed by the municipality to disperse food to mobile markets in large parks in the city (Blay-Palmer *et al.*, 2021). Upgrading traditional markets was one of the recurrent suggestions made by respondents to FAO's global COVID-19 survey.

In conclusion, strong urban–rural linkages are an essential component of a resilient food system. This is not only true in times of crises but also when food chains are safe and stable. Incorporating urban and peri-urban food production in municipal resilience and contingency plans and in long-term food strategies should be on the agenda of any local authority willing to strengthen the resilience of its local food system

9.2.3 Cross-cutting leverage points

While there are many more potential cross-cutting leverage points that would increase the resilience of UPA systems, only two are covered in this section: digitalization and gender equity. Internet penetration is increasing every day with over 50 percent of the global population now using the Internet (World Bank, 2019). When the COVID-19 pandemic put a hold on local and global mobility, the world turned to digital solutions, as illustrated by the boom of e-commerce platforms and online shopping, which has changed the way UPA produce is commercialized forever. While the Internet can be used to develop up-to-date market information systems and digital platforms, it can also play a role in more sustainable production.

As indicated in the emerging priorities for rebuilding resilient food systems in **Asia Pacific**, digital technologies can be employed to improve input and the efficiency of water use, enhance transparency for improved food safety (through blockchain technology for example); deliver information and extension services; lower food waste through better stock management; and improve connectivity along the entire supply chain (FAO, 2020c). In **Barcelona, Spain**, city authorities collaborated with T-systems, a digital services subsidiary of Deutsche Telekom to develop an application to organize the free delivery of fresh food baskets to vulnerable households (Blay-Palmer *et al.*, 2021).

Strategies to foster more resilient food systems should also integrate gender equity and social justice. Shocks and stresses can exacerbate pre-existing vulnerabilities in city region food systems and disproportionately affect those with the weakest capacity to adapt, including women (Halliday *et al.*, 2020). Joshi, Gallant and Hakhu (2020) recommend a series of guiding principles to mainstream gender in urban agriculture: collect gender-disaggregated data to provide evidence for change; identify spaces at household or community level, or beyond to intervene on norms, barriers and processes that reproduce social exclusion and gender inequality, ensuring both men and women are involved in these interventions; engage with those for whom change is sought to enhance their knowledge, abilities and capacity to act independently; and acknowledge that transforming gender-power relations requires connected interventions over long periods of time and that interventions should have this intent built into the design.

9.2.4 Policy coherence and coordination

As mentioned in the introduction to this section, respondents to FAO's global survey identified evidence-based policies and improved coordination across levels and sectors as key priorities to build back better after the COVID pandemic. Ultimately, policy environments should support UPA producers and stakeholders to reduce and prevent risks, and to develop both long-term resilience strategies and emergency responses to potential shocks.

Based on their own vulnerabilities, opportunities and available resources, local authorities should consider local food production schemes within their long-term development plans. Various instruments can be used to do so such as land zoning, public procurement, building infrastructure, education (FAO, 2020a), all of which can incentivize more local production.

As there are multiple factors influencing the enabling environment for UPA, it is necessary to encourage close collaboration and coordination among local value chain actors and at all relevant levels of government to achieve synergies and reinforce each other's efforts (FAO, 2020a). Acting in isolation will only address part of the problem. It is therefore recommended that local authorities, civil society organizations, producer organizations, the private sector and other food system actors collaborate across geographies (urban, peri-urban, rural) and sectors to create territorial food governance, planning and coordination structures (Blay-Palmer *et al.*, 2020).

In this respect, the City Region Food System approach developed by FAO and RUAF is a useful tool that supports local actors when initiating collaborative dynamics for the purpose of actively planning for resilient food systems. According to Blay-Palmer *et al.* (2021), local authorities that actively plan for resilient food systems will help ensure the food supply chain is diversified and resilient to shocks; food access is ensured despite shocks and the impact on vulnerable food systems actors is mitigated. A useful starting point could be the identification of potential production areas within the city region and mapping of food flows, as in **Antananarivo, Madagascar**, as part of its food supply chain strategy during the COVID-19 pandemic (FAO, 2020b).

National governments can empower local authorities in this process by providing them with adequate resources, a clear mandate and connecting them to national programmes (FAO, 2020a). Governments, for example, can also increase the adoption of technical and institutional innovations by providing guidance to local authorities on how to carry out multi-stakeholder food governance processes or supporting improvements in logistics and distribution.

Finally, investing in knowledge management and peer-to-peer exchanges can both improve cities' readiness to respond to crises and inspire new innovative solutions. Building local capacity for solid data management, analysis, forecasting, contingency planning, and crisis monitoring can enable cities to respond more quickly and efficiently to crises (FAO, 2020d). Participating in national and international food networks and alliance can empower local governments to identify and develop new food strategies.

Crises offer unique opportunities to accelerate the uptake of innovations for more resilient and sustainable local food systems, not only to respond to immediate shocks but also to embed fairer, climate-smart and efficient practices into long-term strategies to enhance UPA.

CONCLUSIONS

It has been seen that UPA has greatly contributed to the world since its initiation, as far back as cities have existed. While interest and recognition of UPA and its role have fluctuated over time, it is still as vital as ever. The practice of UPA can help respond to a variety of local policy priorities: from fulfilling vulnerable citizens' needs for healthy and nutritious food, to creating more jobs for youth and women, to building social cohesion in diverse neighbourhoods. UPA supplies various niches with local products, fulfils the specific needs of different citizens, and fits into different urban fabrics. It is a versatile instrument that can be tailored to the context of any city region depending on its local constraints, needs and opportunities.

The analyses and recommendations found in this sourcebook clearly highlight the fundamental roles and contributions of UPA around the globe, where it contributes to local food security and nutrition as well as the livelihoods, while mitigating the negative impacts of urbanization, especially for vulnerable citizens. In addition to contributing to resilient food systems, as demonstrated during the COVID-19 pandemic, the numerous functions related to UPA support social, economic and environmental sustainability:

- **Social:** UPA helps urban dwellers access nutritious and safe food, engage in community-based activities, increase social inclusion in the context of closer rural-urban linkages, gain knowledge of food and resource systems, and reconnect to nature and each other.
- **Economic:** Those who take part in UPA enhance their livelihood by participating more directly, and often more efficiently in the production, processing and marketing of food. As UPA contributes to employment through the development of short value chains, it can catalyse transition to a circular economy by boosting the adoption of the "3R waste management approach" (reduce, reuse, recycle), and attracts more investment in food systems.
- **Environmental:** UPA helps build greener cities, adapting them to changing climates, lowering their carbon footprint by shortening supply chains, increasing urban and peri-urban biodiversity, reducing the heat island effect, protecting urban ecosystems, and improving landscapes.

Furthermore, UPA increases the resilience of the food system by enhancing resistance to external shocks such as epidemics, global commodity fluctuations, natural disasters and other disruptions to food supply chains. Finally, UPA mitigates the impacts of natural disasters by providing a natural buffer zone and by reducing the urban heat island effect and managing stormwater through greening rooftops and ground surfaces and retaining water.

Along with its numerous stakeholders, UPA is deeply embedded within urban food systems comprising, among others, producers, consumers and vendors. Those who interact with UPA are based in various sectors, include agriculture, urban planning, infrastructure, environment, health, education, transportation, across local, regional and national levels.

There is no single “right” way to support the implementation of UPA. In many cases, UPA can represent a low-hanging fruit in the toolbox of policy-makers who are eager to support transition to more sustainable food systems. Therefore, UPA requires a comprehensive and inclusive policy-making process and integrated governance and planning to manage its complexity. In this context, it is vital to integrate UPA in urban and territorial planning and strategies, to optimize the use of key resources, such as land, water, and labour, while creating an environment that is conducive to its development.

As UPA helps build sustainable and resilient urban and city region food systems, it needs to be embedded in multi-sectoral, multi-scalar and multi-functional planning and policy processes in order to manage trade-offs among different resource uses and outcomes of UPA (e.g. affordability of healthy local food, a fair income for producers, a healthy natural environment). In doing so, it is important to deliver adequate support services to enhance the productivity and economic viability of UPA, while taking measures to reduce any associated risks to health and the environment.

Finally, in order to scale up UPA, and promote related activities at the global level, it is critical that partnerships are formed across various levels of government, community organizations, the private sector, and universities, so as to develop and implement a wide variety of UPA policies and actions.

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ANNEXES

ANNEX 1: CASE STUDY SUMMARY

Annex 1 contains the summary of six in-depth case studies based on Rikolto's Food Smart Cities programme in Quito (Ecuador), Tegucigalpa (Honduras), Leuven (Belgium), Dakar (Senegal), Arusha (Tanzania) and Surakarta (Indonesia). The full case studies can be found here.

Overall methodology

For the purpose of this sourcebook, six in-depth case studies on urban and peri-urban agriculture (UPA) were produced for Quito (Ecuador), Tegucigalpa (Honduras), Leuven (Belgium), Dakar (Senegal), Arusha (Tanzania) and Surakarta (Indonesia). All six cities are partners in Rikolto's Food Smart Cities programme that aims to connect smallholder farmers to urban markets and improve citizens' access to healthy, sustainable and nutritious food. Following an initial review of the literature, several tools were developed to collect the information required for the case studies: two qualitative surveys to guide semi-structured interviews with UPA practitioners and local authorities, and a quantitative questionnaire for UPA practitioners focusing on production and commercialization practices. UPA practitioners represent four types of gardens: commercial farms, home gardens, institutional gardens and collective gardens (allotment/public green space). Between 20 and 30 respondents were interviewed in each city. The quantitative data was collected and analysed by local consultants using Kobo Toolbox, an online platform connected to smartphones and tablets that enables the aggregation of information in a central interface. Data collection took place during the global Covid-19 pandemic, requiring the team to find innovative ways to connect to respondents.

Case study 1 – Quito, Ecuador

Nested at an altitude ranging from 500 to 4 780 m above sea level Quito's metropolitan district is well known in the world of urban agriculture for its flagship AGRUPAR project. Launched in 2002, its members are active on 63.72 ha of urban land distributed among 1 400 gardens. With a permanently allocated budget, the project provides technical training and assistance for organic and agroecological production, value-added processing and post-harvest management. AGRUPAR has also set up 15 "bio-fairs" in public green spaces where its members can sell their all-organic produce, often their only commercialization channel.

The case study – which includes 60 percent of farmers involved with AGRUPAR – reveals about 80 percent of respondents have an irrigation system with the majority using drip technology. Most home gardens can meet their water needs from harvested rainwater and on average spend just USD 26 for the set up compared with USD 1 161 for commercial farmers. Only one-third of respondents hire labour, mostly for seasonal tasks and most home gardeners cultivate for home consumption. Technical assistance is accessed by about half of the respondents, mostly on the application of good agricultural practices (GAP), organic or agroecological practices, food safety trainings (for livestock), and making their own inputs.

Sixty-five percent of respondents sell their produce on-site directly to consumers, but many cited citizens' lack of knowledge about the nutritional benefits of agroecological food as a challenge, making them reluctant to purchase the more expensive, organically grown produce from UPA farmers. There is currently no penetration of UPA products into the supermarket sector and intermediaries are seldom used. Non-AGRUPAR members reported struggling to access the market highlighting the programme's added value to its members. Quito is a member of the Milan Pact and has adopted the Quito Agrifood Pact, a food charter with 17 commitments and a food strategy, all developed through diverse multistakeholder dynamics.

Case study 2 – Tegucigalpa, Honduras

The capital of Honduras has a population of about 1.4 million inhabitants. 24 percent of its land area is used for agriculture, 67 percent of which is in forest or mountainous areas with slopes greater than 15 percent incline, making agriculture difficult. Unfortunately, over the last two decades urban farmers have experienced a high rate of attrition.

Water shortages are common with frequent interruptions to the municipal water service.

Only commercial farmers reported using credit, mostly from banks and microfinance institutions. Other types of UPA farmers cited the main reasons for not accessing credit is that they had no need, and there are no financial institutions in their area. On average, commercial farmers, earn 80 percent of their household income from UPA, which, ranges from USD 4 000 to 20 000 annually compared with the USD 7 900/year minimum wage in Honduras.

All reported following good agricultural practices (GAP), mostly on open ground, raised beds and in greenhouses, while home gardeners were evenly split between agroecology, organic and GAP. However, none of the respondents has quality assurance. There are low rates of access to technical services among respondents: only 40 percent reported receiving technical assistance on applying GAP and post-harvest processing techniques, leading to concerns about water contamination caused by the indiscriminate use of chemical pesticides. Participation in producer networks seems to mitigate this gap since commercial respondents cited the most common reason for participating in producer networks is to share good practices. As home gardeners exclusively produce for their own consumption, fewer chemically intensive farming practices are applied resulting in better overall environmental sustainability.

Commercialization channels for UPA products are limited: 62 percent of commercial respondents sell their products on-site or at local markets direct-to-consumer. Those with the scale required to sell to supermarkets often lack the professional skills to obtain fair prices and ensure a reliable supply. Furthermore, many producers do not have access to the Internet, making it difficult for them to access online tools such as INFOAGRO, which provides up-to-date information on prices. Tegucigalpa has no food policy at the municipal level, resulting in little cross-sectoral cooperation. Most initiatives come from the national policy level, such as the national food security initiative.

Case study 3 – Leuven, Belgium

In 2017, after receiving a petition signed by citizens and civil society organizations, the city of Leuven in Belgium initiated a process of multi-stakeholder dialogues that eventually led to the adoption of "Food Connects" – the city's food strategy. Food Connects is implemented by a cross-sectoral group of municipal and provincial departments, NGOs and Leuven 2030, a non-profit organization composed of over 600 members. A 16-member Food and Agriculture Advisory Council was set up to steer its implementation. Agricultural land has decreased by 10 percent in the last seven years, with horticultural production accounting for less than 1 percent of the total. As part of the strategy, Leuven is implementing a community garden programme where community members may request city land for a garden. Already, there are 20 such gardens covering 1 000 to 4 000 m2 in the urban and peri-urban areas of the city. The municipality also has a small budget to assist with community garden start-up costs.

Commercial farmers can benefit from national and European subsidies – many report they could not earn a living wage without them. All community garden and CSA respondents in Leuven practice organic or agroecological farming, in contrast to the fact that only 2.6 percent of Leuven's agricultural land is under organic production, over twice the Flemish average but much less than the European average of 6.7 percent. Overall, 87 percent of respondents receive technical assistance. Most training focuses on good agricultural practices and is free or at a nominal cost.

Community gardens are prohibited from commercializing their produce and must therefore cater to the expectations and diversity of their client-members. CSA farms operate on a "pick yourself" or box delivery system. Interestingly, in 2018, agriculture was taken out of the Department of Economy and taken up by the councillor in charge of consumption, moving agricultural policy towards a more integrated approach that connects consumption and production. However, the workings of government take place during working hours in the city centre, making it difficult for farmers to participate.

Case study 4 – Dakar, Senegal

As a growing city occupying a peninsula, the amount of farmland available per capita in Dakar is becoming increasingly scarce. To deal with this challenge, many home gardeners have turned to microgardening, encouraged by an FAO initiative. While most home garden respondents cultivate an

area of 100 m^2 or less, commercial farmers in the peri-urban area, often cultivate between 1 and 3 ha. Community gardens are granted land by municipal authorities and often occupy roundabouts, public parks, and vacant lots but many urban producers use public or private land without any formal agreements, making their usufruct rights precarious. This situation acts as a disincentive to infrastructure investment and increases the risk that the farmer will default on the loan should their land be expropriated. Coupled with unaffordable interest rates and a dislike of credit, this may explain why most respondents did not access credit for UPA activities.

All commercial UPA respondents hire labour. Older women are hired at double the rate of men. In community gardens, which are usually composed of 20 to 30 people, two labour models prevail. In some cases, gardeners take care of their own designated areas. In others, labour is a collective resource and gardeners share the proceeds of sales commensurate with the number of hours they have worked. All home gardeners surveyed employ microgardening techniques, though some also cultivate on open ground. All sell their products directly on-site. Microgardening in Dakar usually involves using recycled plastic bottles and other small containers to cultivate herbs and small vegetables, sometimes incorporating chickens. The choice of cultivars across all types of UPA is driven by market demand and prices. Most home gardens and institutional gardens practice organic production and about half of the respondents received technical assistance, mostly on GAP and input production. Community gardens have a much higher incidence of accessing technical services.

As a result of the recent decentralization process, municipalities have received new competences on agriculture. However, this new authority has not (yet) been accompanied by the transfer of financial and technical resources, making it difficult to put these new competences into practice. It is worth noting that the municipality of Rufisque, within the Dakar region, has recently adopted a Food Policy Plan and that a growing grassroots community voice is calling for the adequate inclusion of UPA in Dakar's urban development plan, which aims to preserve forests and green belts.

Case study 5 – Arusha, Tanzania

Nested at the food of mount Meru in the northeast of Tanzania, Arusha is a medium-sized city with a population of 400 000 inhabitants, which is considered Tanzania's gateway to its famous national parks. In Arusha, 64 percent of undeveloped land in the city (13.5 ha) is devoted to UPA. At the same time, the expansion of residential areas, driven by population growth and rural-to-urban migration, is accelerating the loss of agricultural land. The municipality does not zone land as agricultural or residential, allowing landowners to change the use of land at will. Arusha is cut through by the Themi river system, which is the primary water source for most UPA producers. All respondents have surface irrigation systems and their total annual water costs average around USD 9. Seventy percent of respondents own land but most rent more; 95 percent hire seasonal or full-time labour on their UPA plots, who are often underpaid or under-employed. Women are employed significantly more than men, both for seasonal and full-time jobs.

Twice as many home gardeners access credit as their commercial counterparts. All home gardener respondents reported being part of a producer network, motivated by a "sense of community" but also easier access to credit. All respondents reported that 75 percent or more of their household income is from UPA revenues and 75 percent or more of their household food consumption is from their farm. Microgardening practices (sock gardens, empty bottles, flowerpots, integrated techniques) have a strong presence in the home gardens in Arusha. Ninety-five percent of respondents have accessed technical services for good agricultural practices and all reported following GAP protocols. The city has 18 demonstration plots and offers free training to farmers. Seventy-two percent of respondents have quality assurance for their produce, mostly acquired through their cooperative or company's internal control system.

Farmers commonly commercialize their produce in local markets through collectors or contract farming with private companies. Other popular commercialization methods are through a cooperative or direct sale at local markets. Arusha does not have a specific UPA policy but merely implements national level policies addressing agriculture, livestock and the environment. There is little consideration of UPA in Arusha's five-year

development plan. While UPA is included in the plan, it is neither emphasized nor financed, leading to inconsistent projects, absence of coordination across sectors and levels and a lack of long-term vision.

Case study 6 – Surakarta, Indonesia

Surakarta, which also goes by the name of Solo, is in Central Java. While the municipality itself has 500 000 inhabitants, the greater Surakarta area has a population of almost 6 million. Land for agriculture is disappearing, as a result of the pressures of housing and the expansion of batik (dyed cloth) and is increasingly being fractured into smaller parcels. Groundwater and rivers provide ample water supply. During the dry season, water is obtained from reserves that are administered by the Central Java provincial authorities in tandem with local authorities. Eighty percent of respondents reported hiring labour and 60 percent do not access credit, mostly because there is "no need." Nevertheless, meeting operational expenses is undoubtedly a concern for many UPA farmers. Overall, 36 percent of respondents practice agroecological farming, 32 percent maintain good agricultural practices and 60 percent access technical assistance but only one had quality assurance. Assistance is accessed free of charge, which on average respondents requested three times per year.

Eight percent of the city's monthly food needs is produced in the city region itself. UPA farmers and others in the region therefore compete for 8 percent of the city's food market share, which is saturated at 500 percent (452 percent of the monthly food needs of the city come from other regions to be consumed, traded and exported and 50 percent arrives in the form of non-cash food aid). Forty-eight percent of respondents commercialize their products through collectors and another 48 percent through direct sales, often targeting middle to high-income consumers. During the Covid-19 pandemic, producers reported a rise in online sales, mostly through social media because there was no formalized online infrastructure.

Cross-level cooperation between national, regional, and city policies and practices is well articulated but generally takes a top-down approach with little in the way of grassroots or multi-stakeholder approaches. Much of the policy invoked in support of UPA is generally focused on consumption (food security, safety, accessibility) rather than the perennial concerns of producers (land tenure, commercialization channels). To address the gender inequalities mentioned above, the "Sustainable Food Home Area" programme initiated by the federal Ministry of Agriculture, implemented by the city, aims to increase women's involvement in urban agriculture by initiating five women's farmer groups each year budgeting USD 3 420 for each group for start-up, training and land acquisition procedures.

ANNEX 2: MATRIX SUMMARY AND LINK

This matrix is developed based on searching the Internet and reviewing the literature.

It includes 70 cases, which have information on:

- Case background information (location/introduction/typology/policy environment)
- Land resource information (urban or peri-urban/area/)
- Water resource information (water source and application)
- Labour/Participant information (gender and youth involvement/employment and affiliation)
- Finance information (fund source and amount)
- Production information (product/productivity/practices/etc.)
- Trade/Commercialization information (sales channel/business models)
- Multifunctionality and benefits (Food/nutrition/social/economic/Environment/education)
- Reach-out (Contact/Reference)

The matrix is a useful tool to check key information on the examples and cases that are collected and analysed in the sourcebook.

The matrix is stored online[48] and is continually being updated.

[48] For more information see **FAO Urban and Peri-Urban Agriculture Webpage (available soon)**

Urban and peri-urban agriculture producers profiled in this report are generating and growing the kind of sustainable food systems they would like to be part of. All have different visions, but diversity of vision can be harnessed to productive ends.

The city-case studies found in this report can help urban planners, city politicians, private investors, and other decision-makers join with urban and peri-urban farmers to create a more sustainable food system together – bringing together diverse perspectives and visions to create silver seeds, ideas that can grow and germinate in the soil of the city.

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