16 Urban and peri-urban farming systems
Feeding cities and enhancing resilience

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Key messages
- Urban and peri-urban farming systems (UPUFS) provide food and nutrition security for vulnerable urban populations and supply selected commodities across all regions of Africa, responding to urban unemployment and poverty as well as expanding domestic demand.
- UPUFS achieve higher yields with more limited space than rural agriculture due to availability of inputs including nutrients and labour; they recycle nutrients of which there is a surplus in urban areas.
- Productive urban household backyard and irrigated open space farms are commercializing, especially in perishables like dairy and small-scale horticulture, helping build resilient cities that can adapt to climate change.
- New policies and institutions must address food and nutrition insecurity due to lack of space in high-density urban slums as well as the opportunities UPUFS present for the intensification and modernization of the agriculture sector.

Summary
Urban and peri-urban farming systems (UPUFS) are significant in Africa because of the large numbers involved (40 per cent of urban households), the opportunities for intensification of urban smallholder agriculture and improving urban food security, and the potential flow-on effects for surrounding farming systems through rural-urban information and networking links.

The main driver of the farming system is rapid urban growth. Increasing demand for food motivates both subsistence production by food-insecure households and commercial production by small entrepreneurs. Two main subsystems have been identified: backyard and open space, with the open space subsystem further distinguished by irrigated and rainfed farming. The subsystems are found in both urban and peri-urban locations.

The main constraints are dwindling available space and non-agricultural development priorities. Lack of land tenure and the need to constantly shift locations makes the farming system insecure, particularly for the urban poor and open space subsystem. Specific policy initiatives are needed to ensure that the large numbers of food insecure urban households, mainly poor or headed by women, have access to land for farming. Around 77 per cent of urban poor households have been found to be food insecure in southern Africa. The poor
are also under-represented among UPUFS households. This is mainly because they live in dense slum settlements, which are hotspots of urban hunger and poverty.

UPUFS play an important role, however, not only for farm households but the city at large. They have a comparative advantage for intensification, if safely done, due to readily available wastewater and the nutrient surplus in urban wastes containing nitrogen, potassium and phosphorus (NPK). Peri-urban and urban farming systems have been shown to improve food security as well as incomes. The consumption of animal source foods, fruits and vegetables has beneficial effects on child health and nutrition security, suggesting urban livestock-keeping and backyard farming need to be supported. Corresponding food health and safety measures are needed to encourage health risk mitigation strategies based on current and continuing research.

With rapidly growing cities, low employment levels and weak infrastructure linking rural production to urban markets, UPUFS play a significant role. African cities, some of which are beginning to develop urban agriculture policies and institutions, can transition to being more sustainable and climate-change resilient through continued development of policies and institutions, especially by responding to urban farmers and their associations.

Introduction

Urban agriculture is as old as human civilization, with the history of cities intertwined with that of agriculture. Food production only separated from human habitation as agriculture industrialized. Before refrigeration, livestock came to town for slaughter, or were kept in urban fields and gardens from where livestock products were sourced. Such a situation is still found in many African towns and cities, and many of the urban parks in industrialized country cities were previously ‘commons’ where citizens grazed livestock. Farmers would come to urban markets; supermarkets and suburban food terminals appeared only in the 1960s.

Today, UPUFS proximity to the urban market facilitates horticulture, dairy and other food agribusinesses based on local urban demand as well as regional and international export trade. Increasingly people live in cities; while policy emphasis on food imports and export-oriented value chains has not provided sustainable food access and local economic development, the domestic markets are growing and providing UPUFS opportunities for short-cycle food chains.

Widespread availability of nutrients in the form of urban wastes enables intensification of UPUFS, but at the same time tenure insecurity prevents on-farm investment. Farmers suffer from the city’s economic pressure to convert to housing and other construction. While UPUFS are a low priority or illegal land use, they are vulnerable and have to constantly move.

Overview of the farming system and subsystems

UPUFS encompass not only the production of food from plants and animals but also the provision of agricultural inputs, processing, marketing and services to farming households and agroenterprises. The urban location makes several of these easier. UPUFS also serve non-agricultural functions, such as enhancing social inclusion, providing recreation, maintaining landscapes and biodiversity, and improving urban living conditions.

An estimated 40 per cent of urban households in sub-Saharan Africa, about 200 million persons, are expected to depend partly on urban and peri-urban agriculture (UPA)
by 2020 (Denninger et al. 1998; FAO 2012a). Its significance will increase as urbanization increases. Table 16.1 shows percentages of urban households engaged in UPA in various African cities based on different sources. Kampala, the only place for which data are available over time, shows an increase in the proportion of households farming. Estimates are not available for north Africa although many conditions are similar. Africa’s urban population was estimated at 471.6 million in 2015, which would give an urban ‘agricultural population’ of 188 million in 2015 if the 40 per cent figure were correct.

A typical UPUFS household uses any available land to produce food for its own consumption using household labour, although it may dispose of part of its production, especially fresh vegetables and livestock products, through gift, barter or sale. UPUFS households are consistently larger than other urban households and farm more intensively on smaller plots than surrounding rural farms. UPUFS vary by location, with crop production predominating. Opportunities for intensification and commercialization are great due to demand for food.

While the poor predominate over middle- and high-income groups in urban Africa numerically, there is evidence that low-income groups are proportionally under-represented among urban farmers. This seems to be because the poor live mainly in dense urban slums without access to space. Higher-income groups are better able to farm, including the more profitable livestock keeping (Foeken 2006; Lee-Smith 2010, 2013).

**The urban farmer**

There is a wide variety of urban farmers. Many are poor, but lower and mid-level government officials and school teachers are also involved in agriculture, as well as richer people seeking investments. Some are recent immigrants, but many have lived long in the city, gaining access to urban land, water and other productive resources. Others are not from rural backgrounds but choose agriculture as one of their livelihood strategies.

**Table 16.1 Proportion of households engaged in UPA in some African towns and cities**

<table>
<thead>
<tr>
<th>City / town</th>
<th>Country</th>
<th>Survey date</th>
<th>Households engaged in specified UPA activity as % of total urban households</th>
<th>City population at survey date</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 in southern Africa</td>
<td>9 SADC* members</td>
<td>2008*</td>
<td>22% crops and livestock (only poor households measured)</td>
<td>varied</td>
</tr>
<tr>
<td>21 in west Africa</td>
<td></td>
<td>2006*</td>
<td>20–50% crops and livestock</td>
<td>varied</td>
</tr>
<tr>
<td>Kampala</td>
<td>Uganda</td>
<td>2003*</td>
<td>49% crops and livestock</td>
<td>1,200,000</td>
</tr>
<tr>
<td>Mbeya</td>
<td>Tanzania</td>
<td>2002*</td>
<td>93% crops and livestock</td>
<td>266,000</td>
</tr>
<tr>
<td>Morogoro</td>
<td>Tanzania</td>
<td>2002*</td>
<td>90% crops and livestock</td>
<td>228,000</td>
</tr>
<tr>
<td>Nakuru</td>
<td>Kenya</td>
<td>1998*</td>
<td>35% crops and livestock</td>
<td>239,000</td>
</tr>
<tr>
<td>Dar-es-Salaam</td>
<td>Tanzania</td>
<td>1995*</td>
<td>36% crops only</td>
<td>2,500,000</td>
</tr>
<tr>
<td>Kampala</td>
<td>Uganda</td>
<td>1991*</td>
<td>30% crops and livestock</td>
<td>774,000</td>
</tr>
<tr>
<td>Nairobi</td>
<td>Kenya</td>
<td>1985*</td>
<td>20% crops only</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Addis Ababa</td>
<td>Ethiopia</td>
<td>1983*</td>
<td>17% vegetables only</td>
<td>1,400,000</td>
</tr>
</tbody>
</table>

Source: Table adapted from Lee-Smith (2013).

*Southern Africa Development Community.
Women constitute about two-thirds of African urban farmers, although their proportion varies between cities. Throughout the continent women are associated with subsistence food production and men with production for cash income. Thus women often form the bulk of labour on household farms but are less predominant in cash-crop production or as large livestock entrepreneurs (Hovorka and Lee-Smith 2006).

Types of UPUFS

Something that distinguishes urban from other farming systems is the fact that it is an integral part of the urban economic, social and ecological system. It has been defined as follows:

Urban agriculture is located within (intra-urban) or on the fringe (peri-urban) of a town, city or 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.

(Mougeot 2000)

Peri-urban farms share characteristics with surrounding farming systems and merge into them along a rural to urban continuum. Peri-urban characteristics are understood to extend beyond urban boundaries for a distance of 15–40 km. Transect measurements from peri-urban to inner urban show the proportion of households farming and the area farmed decrease from peri-urban to urban (David et al. 2010; Dongmo et al. 2010; Drechsel and Dongus 2010), and these variables decrease with increasing size of the urban area (Lee-Smith and Memon 1994). Thus density and land availability are important drivers, in tension with demand.

UPA has been analysed according to many classifications, based on location, production scale and method, actors involved and degree of processing or marketing. There are backyard and rooftop gardens, community gardens, small-scale livestock, small-scale vegetable, institutional gardens and large commercial peri-urban gardens. Out of this variety, we identify two sub-types of UPUFS, both of which are found in urban and peri-urban locations: backyard subsystems and open space subsystems.

For both, issues of social equity arise in terms of land access, as well as questions of food and nutrition security and market access. We have developed this classification based on extensive consultation and review of the literature, including a recent analysis of African urban horticulture (FAO 2012a: 18). Within the open-space subsystem we have identified irrigated and rainfed types as a further categorization. As shown in Table 16.2, these differ from each other in terms of system structure and characteristics.

The urban backyard farm is the most common, constituting half to two-thirds of farming households (David et al. 2010; Foeken et al. 2004; Foeken 2006; Lee-Smith and Memon 1994). Probably the most significant in terms of household food security, it depends on space availability. Related to the home garden, it provides subsistence and the opportunity for urban enterprise. Further, it has demonstrated efficiencies in nutrient cycling through organic waste reuse and intensive space use, especially when both crops and livestock are involved. Besides home gardens, this category includes rooftops and institutional gardens and is more predominant in inner urban areas.
Table 16.2 Structure and characteristics of UPUFS subsystems

<table>
<thead>
<tr>
<th>System structure and characteristics</th>
<th>Backyard</th>
<th>Open space irrigated</th>
<th>Open space rainfed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main means of livelihood</td>
<td>Mixed, mostly non-farming</td>
<td>Mixed, mostly farming</td>
<td>Mixed, mostly non-farming</td>
</tr>
<tr>
<td>General size</td>
<td>2 m²–0.2 ha</td>
<td>0.01–0.8 ha</td>
<td>2 m²–0.8 ha</td>
</tr>
<tr>
<td>Crops/livestock</td>
<td>Mostly crop/livestock</td>
<td>Mostly crops only</td>
<td>Mostly crops</td>
</tr>
<tr>
<td>Location</td>
<td>Next to house</td>
<td>Along water courses</td>
<td>On public land</td>
</tr>
<tr>
<td>Tenure</td>
<td>Mostly secure</td>
<td>Mostly insecure</td>
<td>Insecure</td>
</tr>
<tr>
<td>Water source</td>
<td>Domestic water</td>
<td>Urban drainage</td>
<td>Mostly rainfed</td>
</tr>
<tr>
<td>Food vs income</td>
<td>Mostly for food</td>
<td>Mostly for income</td>
<td>Food and income</td>
</tr>
</tbody>
</table>

Figure 16.1 Open-space rainfed farming system in Kampala, Uganda.
Source: Gordon Prain.

The open space subsystem, more prevalent in peri-urban areas (Figure 16.1), includes not only small-scale operators producing vegetables but small-scale livestock systems and large-scale glasshouses producing fruit, flowers and vegetables. The extent of urban irrigated farming has been mapped at 24 million ha and urban open-space farming at 24 million ha globally, 11 per cent and 4.7 per cent of all irrigated and rainfed croplands respectively (Thebo et al. 2014).
The open space irrigated sub-subsystem (Figure 16.2), often using polluted water to grow crops, is the most productive and income-generating type of UPUFS, contributing up to 80 per cent of urban vegetable supply even when practised on marginal soils and with insecure land tenure (FAO 2012a). It is mostly managed by groups with a commercial orientation. The volume of water used varies with the season, type of crop and cultivation intensity. Watering is by bucket, watering can, or treadle and motor pump, and mostly involves overhead rather than furrow irrigation, which depends more on tenure security. Clean water is rarely used due to cost, unreliability or lack of access. In Lagos, peri-urban farming depends on the Fadama (wetland), which can be cultivated continuously using rivers, ponds, dug wells or wash-bores. Shallow hand-dug wells and streams are common in Niamey, Lome, Dakar, Kumasi and Cotonou. Deep wells were reported in Bamako, while Accra’s urban farmers mostly use water from drains or polluted streams. Some farmers in Nairobi, Ouagadougou and Dakar use wastewater directly from city sewage.

The open space rainfed sub-subsystem is diverse, including small-scale opportunistic farming (on roadsides, under power lines, on empty lots, etc.), peri-urban horticultural plots and medium- to large-scale livestock grazing, including dairy. Less productive than the irrigated version, which also takes place frequently in public spaces, it is generally the last resort of the urban poor for food and income. Yet it also provides opportunities for urban entrepreneurs.

Figure 16.2 Open space irrigated crop production, Addis Ababa, Ethiopia.
Source: Diana Lee-Smith.
Variety and complexity in UPUFS

UPUFS systems interface with all other African farming systems. They vary across the continent, influenced by local topography, climate, food systems and preferences, usually similar to the surrounding agroecosystem, but all tending to intensify in response to the urban setting. Dairy and poultry mixed with maize or banana characterize farming in east African cities, while poultry and pigs mixed with fresh vegetables in the inland valleys, and cassava and numerous other crops in the upland systems, characterize the Cameroon capital, Yaoundé. UPUFS in towns and cities in arid and semi-arid lands cluster along watercourses and inland valleys, some taking advantage of water management systems developed over generations. For example, Bobo-Dioulasso, Burkina Faso’s second-largest city, has vegetable production sites all along the Houet backwater, contributing to the city’s annual production of about 50,000 tonnes of vegetables for its 0.5 million inhabitants.

Agroforestry systems are important components of UPUFS. Maintaining a few fruit trees within a home garden is an age-old practice, but expanding urban populations now provide a growing demand for both fruit and ornamental tree species. This has given rise to flourishing tree nursery enterprises in most African cities. Agroforestry systems in urban and peri-urban gardens in Niamey, Niger, have a richness and diversity of species that suggest these household enterprises contribute to conservation of genetic resources.

Small- and medium-scale aquaculture around African cities takes advantage of the market and the availability of (waste)water. Urban demand for fish drives growth of peri-urban aquaculture in Nigeria, developed through medium-scale enterprises and cooperatives that support input industries such as specialized feed producers. Poultry manure is widely used to fertilize ponds and experiments are ongoing with waste water ponds.

The hot-spots of poverty and hunger in UPUFS are high density slums. In some cities slum households may have access to nearby open spaces where they produce food, but generally they have less access to space than other urban residents, e.g. only 5 per cent in Nairobi compared to 20 per cent for the city as a whole. UPUFS bright spots of success are the intensive micro-gardens in some dense settlements where the local authorities and other institutions support communities in producing healthy food.

Trends and drivers of change across the system

The main driver of UPUFS is urban expansion and the demand for food, motivating both subsistence and commercial production. Intensification of UPUFS is driven by water and nutrient availability, with greater availability a major difference between rural and urban farming locations (Figure 16.3). Land tenure is a major constraint to food security for the urban poor. Middle- and higher-income urban households generally have access to backyard space with formal tenure whereas low-income urban households mostly live in slums where tenure is unrecognized (Boxes 16.1 and 16.2). Lack of space in dense settlements is a driver of the open space urban farming subsystem, whether found in urban or peri-urban open spaces, but tenure insecurity of those open spaces underpins increasing food insecurity for the urban poor (Box 16.3). Restrictive policies and regulation have affected UPUFS negatively, as have many market conditions, including for example frozen imported chicken competing with local farms. These have driven some peri-urban poultry farms into bankruptcy in west Africa. The main UPUFS drivers are summarized in Table 16.3 and discussed below.
Box 16.1 A household typical of the UPUFS backyard subsystem

The household comprises a nuclear family, the husband working as a teacher while the wife manages the farm, located off a main arterial road leading out of Yaoundé. They keep pigs and poultry as well as growing a variety of crops including banana, cassava and different green leafy vegetables. Of their four children, two are in primary school, one in secondary and one, a high school dropout, helps on the farm. All the children and the husband work on the farm when they are available, such as during school holidays. The husband makes decisions on farm management, especially on purchases and sales of livestock and inputs, although he consults with his wife. Farm income and teacher’s salary combine to give a household income more than twice as high as the national average. The husband inherited the 0.4 ha from his father who bought it when he migrated in the 1970s, giving them secure tenure.

They recycle all domestic organic waste on the farm. Food waste is used for the pigs in addition to purchased feed supplements. They have two types of poultry: free-range and broilers. They consume the free-range poultry and sell broilers to local kiosks. Piglets are sold to traders. They use pig and poultry manure to fertilize their crops and sell surplus manure to neighbours. Water collected from the house roof is stored in a large plastic drum and used to water crops during the dry season.

Crops grown are for home consumption with the surplus being given away as gifts or sold, especially in the dry season when prices are higher. They come from a village in southeast Cameroon where they support extended family members.
Box 16.2  A household typical of the UPUFS open space subsystem (high density slum)

The household consists of a young man, his wife and baby, living in one room in a Nairobi slum. He is formally unemployed, but collects waste from other slum dwellers and surrounding high-rise buildings and sells recycled items to traders in the slums. He has also started a waste recycling business with a four-member youth group. They make charcoal briquettes for sale as cooking fuel to other slum dwellers. His daily single meal of maize and beans is purchased from a street vendor, using the income he gets from this business. He started farming with his youth group during the post-election violence in 2008. From that he is sometimes able to feed his family with fresh vegetables. They are not well-nourished, however, and the baby gets sick when the mother does not have enough milk.

The farming group was given the piece of land on the railway reserve through the intervention of a community leader when they were starving. It used to be a waste dump. It is rich in nutrients because of the organic waste fraction (including human waste), but also has high heavy metal contamination. They grow mostly kale, cabbage, pumpkins, some sweet potato and indigenous green vegetables, which they have been told take up less heavy metal than kale and cabbage. These crops are also sold to neighbours for group income. They have a water tank, also provided through community interventions, and have drip-feed water pipes along the rows of vegetables. The slum community is currently threatened by railway and road development, even though this tenure is relatively secure having been granted by the colonial government in the early twentieth century.

Box 16.3  Key challenge

Increasing the food security of the urban poor represents the main challenge for UPUFS. This challenge needs to be linked to the potential for intensification, which, if realized, may not only increase urban food supply, but have flow-on effects for surrounding rural farming systems through feedback of information via rural-urban household links and institutional networks.

Key participants in addressing this challenge are urban local governments and farmers’ organizations.

Options for change include increased use of: micro-spaces in densely populated areas; available recyclable nutrients from organic wastes for soils and animals; available water (especially wastewater); and un- or underemployed household labour. Policies are needed that will address the food security needs of the urban poor, especially women-headed households. Allocation of public lands for this purpose is appropriate, as was the case with Maputo's zonas verdes (green zones) from the 1980s.
Population, hunger and poverty

Africa’s urban population 2000–2030 is projected to increase by an additional 367 million, over twice rural growth, with urban poverty increasing in parallel. Natural increase contributes a high proportion of urban growth, while rural-to-urban migration in Africa is more commonly seasonal and cyclical than one-way. Members of multi-locational households move between city, peri-urban and rural areas. They use both urban and rural resources for agricultural and non-agricultural livelihood strategies that respond to poverty but also have potential for economic growth. Multiple rural-urban linkages comprise labour, agricultural inputs, marketing chains, micronutrient flows, and social and political ties and obligations including remittances. These stimulate and intensify both urban and rural agriculture (Prain et al. 2010).

Urban poverty can be underestimated if poverty lines ignore the higher cost of living in cities. With a poverty line of US$2 a day, the poverty level is close to 70 per cent, or more than 200 million people, while the number of people living in slums in sub-Saharan Africa almost doubled between 1990 and 2010, from 102 million to 200 million (FAO 2012a). Some 77 per cent of low-income urban households in selected southern African cities were food insecure and 92 per cent had gone without food due to price increases in 2008 (Frayne et al. 2010). Some food insecurity was seasonal, as in rural areas, possibly because of rural food transfers but also seasonality of employment such as construction (Battersby 2011).

Natural resources and climate

Land and water availability are key drivers of UPUFS. Irrespective of soil quality, an urban backyard space will turn available land into a productive farm through the combination of livestock manure and garden crops. Roof and other water run-off complement this.

The open space irrigated sub-subsystem is dependent on the availability of (usually public) land adjoining a watercourse. Increasing urban water demand generating a return flow of wastewater and a lack of alternative sources are driving the sub-subsystem. Cultural constraints and risk awareness do not prevent use of such nutrient-rich water for agriculture. The extent of irrigation with partially or untreated wastewater is usually underestimated, as are the numbers of beneficiaries including farmers, traders and consumers (Raschid-Sally and Jayakody 2008).

The open space rainfed sub-subsystem operates in much the same way as surrounding farming systems. Where urban livestock are allowed to become part of these subsystems, similar patterns of natural resource use may be found as in the backyard subsystem.

Climate change is a challenge for cities, disproportionately affecting people who live in slums on hillsides, in poorly drained areas or in low-lying coastal zones. In parts of Africa climate change is also predicted to cause long-term displacement of people affected by drought or flooding from rural to urban areas (UN-IASC 2010). The World Meteorological Organization (WMO 2007) suggests that urban farming can play a role in adaptation to climate change and to some extent in mitigation, and should be encouraged. The Food and Agriculture Organization (FAO 2008) also concluded that it builds city resilience in various ways including through diminished dependency on imports.
Energy

Inherently, UPUFS are energy-conserving because of their proximity to markets, capacity to absorb and recycle wastes as nutrients, and lower transport energy costs, both in terms of transporting food to urban consumers and transporting readily available soil nutrients (urban wastes) to farmers. This is not yet part of energy equations or planning for either sustainable agriculture or sustainable cities. UPUFS assist the absorption of excess urban nutrients which are otherwise dealt with as wastes, with energy needed for their disposal.

Higher availability of electricity in urban areas may drive UPUFS, but this has not been measured.

Human and social capital

Research-to-policy platforms have helped create new institutions on UPUFS, build human capital and facilitate knowledge-sharing. Urban Harvest (of the Consultative Group on International Agricultural Research) and the international network of Resource Centres on Urban Agriculture and Food Security (RUAF) have contributed to this, while regional training courses in Francophone Africa (1999), Anglophone Africa (2004) and Middle East and North Africa (2005) have also helped. Recently, the UN’s Food and Agriculture Organization (FAO)’s ‘Food for Cities’ initiative achieved world-wide impact through its electronic discussion blog, which followed older global civil society platforms such as ‘City Farmer’.

RUAF’s ‘From Seed to Table’ programme has been strengthening urban farmer organizations since 2009, by supporting capacity for farming innovations, micro-enterprise development (in production and processing) and marketing (value chain development) in 17 African cities. Value chain projects (farmer-led enterprises) have been set up for production and processing of vegetables or livestock products and their direct marketing to consumers, schools, supermarkets and restaurants.

Gender roles vary across Africa and to some extent determine UPUFS function. Where men dominate urban irrigated vegetable production, it tends to be an individual business activity. Yet such farming is dominated by community groups of women in Banjul and individual women in Freetown. In Yaoundé, 87 per cent of crop cultivators are women, even the commercial ones (79 per cent). This is not the norm in west Africa, however, where a gender study of 20 cities found men dominated urban irrigated vegetable farming and women the vegetable retail sector. Certain crops are associated with one or other gender while women have limited access to land or starting capital and engage less with irrigation.

In east Africa, women farmers dominate urban irrigated cropping as well as the overall numbers of farmers. Men dominate livestock production, especially large livestock, although women often do livestock-keeping tasks. It is suggested that women’s roles may be changing as a result of urbanization itself, although women-headed households have also been identified as an urban poor group vulnerable to food insecurity. The limited access to land for food production by poor households is exacerbated for women due to their traditional lack of land rights.

Science and technology

Technology development for low-income UPUFS has been documented since the late 1990s by RUAF. International partners including Urban Harvest, the International Water
Management Institute (IWMI), UN-Habitat and FAO have assisted with innovations, especially on solid waste and wastewater reuse, as well as space-intensive urban gardening, a major driver of UPUFS intensification.

However, more attention is needed on these new ways of urban food production. Intensification through technologies such as vertical farming in slums (using containers or built surfaces) can drive improvements in household food security. For example, 11,000 households in Nairobi’s Kibera slum have ‘sack gardens’ providing fresh produce and enough money from sales to cover their rent. Conditions with limited rural significance affect UPUFS. Apart from the use of micro-spaces and recyclable nutrients, research is needed on poor or insufficient soil, affordable biomanagement of insect and disease pests at high human population densities, and managing high-risk contaminants. Pioneer research on these issues in Cuba has yet to be mainstreamed in Africa. However, research demonstrating the primacy of UPUFS in the east African dairy sector and in vegetable production, including indigenous species for local markets and exotics for export, has been done in national agriculture research institutions (NARIs) supported by international institutions.

Concerns about food safety have led to studies on biological (pathogenic) and chemical (toxic) contamination through the air, water and soil pathways that can affect urban-produced food, but more work is needed. A comprehensive study of the health risks and benefits in Kampala established a statistical relationship between consuming animal source foods and child health and nutrition security, and between urban food security and livestock rearing. This suggests the benefits of urban livestock keeping balance the health risks. Urban farmers use many health risk mitigation strategies, with over 90 per cent avoiding biological contaminants in milk by consuming it as tea, boiled with water and tea leaves. When farmers have access to services such as water and believe that UPUFS are legal, they use more and better risk mitigation strategies (Cole et al. 2008; Prain et al. 2010).

Low-cost options are available for mitigating the health risk of using wastewater while maximizing its benefits (Keraita et al. 2008). Partial and non-treatment options are permissible in the revised World Health Organization (WHO 2006) guidelines for wastewater use in irrigation. In Africa these are being locally adapted at different entry points (e.g. drip kits, on-farm treatment, crop restrictions, good vegetable washing) as pathogen barriers (Amoah et al. 2011).

**Trade and markets**

Urban demand for food and non-food agricultural products influences trade and markets. Proximity to urban demand and international market connections spur commercial horticulture in a number of African countries. There are also small-scale sales to local markets by UPUFS households, especially within the open space irrigated sub-subsystem. Urban Harvest research shows the backyard farming subsystem commercializes more where livestock production is included (Prain et al. 2010). Livestock as a part of backyard mixed crop-livestock systems range from chickens, rabbits and grass-cutters, to sheep, goats, pigs, cattle or camels. Livestock are a repository of exchangeable wealth throughout Africa, and the urban system is no different.

Urban livestock have generally been neglected as an aspect of trade and market data. Data on urban livestock numbers in relation to human population are not widely kept, but the Kenyan census now complements research. In 2009, Nairobi had 3.9 million
people and 55,000 head of cattle, compared with 1 million people and 23,000 cattle in 1985. Nakuru in Kenya had 239,000 people and a cattle population of 25,000 in 1999 (Foeken 2006; Lee-Smith 2013). Crops produced in the open space subsystem are sometimes supplemented by livestock. Despite an unfavourable policy environment, livestock are grazed on roadsides or other vacant land, or kept in zero-grazing stalls in dense slum settlements.

While most UPUFS produce for household use and even commercial producers consume part of their production, such households also make a significant income from sale. Irrigated vegetable producers exceed official minimum salaries by a factor of 1.6 up to 10. Farmers in Kampala, Dar-es-Salaam, Yaoundé and Addis Ababa all had higher than average incomes. Factors influencing net UPUFS income are: degree of market orientation, farm size, household labour availability, choice of crops and animals, availability and cost of inputs (especially cost-saving items like organic wastes and wastewater), dry-season irrigation, technology and capital availability, access to markets, prices obtained and the ability to store, process and preserve products. Households also benefit from processing and marketing (e.g. ghee making, preparation of street foods, street carts or small local shops, and cleaning and packaging food for sales to supermarkets) and from farmer organizations. Market research in Kampala showed that demand for UPUFS products is high and exceeds supply in outlets ranging from corner kiosks to supermarkets.

Nutrients that are both produced and used by UPUFS are also traded locally, in the form of feed, manure and compost. Trading the nutrient surplus from urban to rural areas is uneconomic although some rural-urban recycling of crop residues and food wastes has been documented (Karanja et al. 2010). Most food wastes, crop residues and manure are recycled within urban backyards or exchanged informally through gift or barter. Trading in compost has been documented in Nairobi, with supply far below demand.

African trade and markets are rapidly moving towards the industrial model of food production and consumption in the twenty-first century, the trend being most advanced in South Africa, where supermarkets are the norm. While such food purchases are often unaffordable to the urban poor majority, they represent a relatively untapped opportunity for UPUFS to sell produce.

**Policies and institutions**

UPUFS have been routinely excluded from urban policies and institutions even though the ‘garden city’ concept is at the root of modern urban planning. They only reached policy attention in the 1990s due to their visibility, the effects of Structural Adjustment Policies (SAPs) and research publications. The International Development Research Centre (IDRC) book *Cities Feeding People* revealed that one-third or more of east African urbanites were feeding themselves partly through their own urban production (Egziabher et al. 1994).

Except for the Tanzanian self-sufficiency movement, which supported urban gardens in the 1960s, official attitudes to UPUFS in Africa only became positive in the economic crisis of the 1980s to 1990s. SAPs led to reduced subsidies, decreased infrastructure investments, lower farm incomes and increased urban unemployment especially among public sector workers. UPUFS provided a survival strategy. However, at first the policy response consisted of ‘turning a blind eye’ rather than institutional support.

Some African governments have instituted measures supporting UPUFS, such as Tanzania from the 1980s to the present, and Zimbabwe recently. Other examples are
Mozambique’s ‘Green Zones’ during its civil war, and post-civil war production in Sierra Leone. There is increasing attention to the roles of UPUFS in rehabilitation (as in Sierra Leone and Liberia), small business and value chain development linking urban and rural agriculture, and climate change adaptation.

Formal policy and institutional development followed benchmarks such as the 2002 Declaration on Feeding Cities in the Horn of Africa and the 2003 Harare Declaration on UPA Policy. The City of Kampala, for example, which had an Agriculture Department following decentralization in the 1990s, passed urban agriculture and livestock ordinances in 2006. Nairobi has had a Department of Agriculture since 2013 and passed legislation in 2015. Institutions incorporating farmers and their associations in active debate with local government, such as those in Accra, Ghana and Nairobi, have greater impact in institution building than those which do not.

### System and subsystem performance

The standard data used throughout this book on intensification, diversification, change in farm size or increases in off-farm income, are not available for UPUFS. Therefore the available empirical findings, though not usually disaggregated by subsystem, are summarized based on expert judgement in Table 16.4. This takes sustainability to mean non-depletion of soil resources over the longer term.

#### Table 16.3 Drivers of farming system evolution

<table>
<thead>
<tr>
<th>Drivers of farming system evolution</th>
<th>Trends and drivers</th>
<th>Implications for farming system structure and function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population, hunger and poverty</td>
<td>Urbanization and unemployment</td>
<td>Space availability becomes critical</td>
</tr>
<tr>
<td>Natural resources and climate</td>
<td>Reuse of wastes as inputs</td>
<td>Intensification, food safety issues</td>
</tr>
<tr>
<td>Energy</td>
<td>Green economy and resilience agenda</td>
<td>Farmer-government coordination</td>
</tr>
<tr>
<td>Human and social capital</td>
<td>Stakeholder platforms, gender roles</td>
<td>Official recognition, women’s empowerment</td>
</tr>
<tr>
<td>Science and technology</td>
<td>Health impacts, space saving systems</td>
<td>Regulation, intensification</td>
</tr>
<tr>
<td>Trade and markets Policies and institutions</td>
<td>Demand for perishables</td>
<td>Increased value-addition</td>
</tr>
<tr>
<td></td>
<td>Creation of urban food institutions</td>
<td>Better urban food governance</td>
</tr>
</tbody>
</table>

#### Table 16.4 Overall performance of UPUFS system and subsystems

<table>
<thead>
<tr>
<th>Performance</th>
<th>Backyard</th>
<th>Open space irrigated</th>
<th>Open space rainfed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Productivity</td>
<td>Medium</td>
<td>High</td>
<td>Low-medium</td>
</tr>
<tr>
<td>Sustainability</td>
<td>High</td>
<td>Medium</td>
<td>Low-medium</td>
</tr>
<tr>
<td>Human development</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
</tbody>
</table>
Productivity

There are hardly any data available on UPUFS productivity, although there is much anecdotal evidence that the open space irrigated sub-subsystem in particular is extremely productive. Policy support has been suggested as a driver of high UPUFS productivity. For example, Malawi’s fertilizer subsidy enhanced UPUFS productivity, especially the open space subsystem, during economic downturns. Water and nutrients enable intensification of UPUFS because of their high availability in urban areas (Figure 16.4). Productivity increasing with proximity to (and size of) the urban area was associated with higher use of inputs (especially water and organic waste materials) on small plots in one national survey.

Resilient sustainable development

While UPUFS impact the urban environment in a number of ways (greening, landscape development, climate change impact mitigation and so on), here we focus on performance in nutrient cycling, which has implications for sustainability through soil amendment. Urban areas are immense producers of nutrient surpluses, which are diluted in the

Figure 16.4 Ruth Wanyoike weeding vegetables irrigated using wastewater in Kahawa Soweto, Nairobi, Kenya.
Source: Mary Njenga.
wastewater stream. Table 16.5 shows that in various cities, 20–650 ha are under UPUFS open space irrigation, consistent with global figures (Thebo et al. 2014). These areas may produce three to ten crops per year.

However, the open space irrigated sub-subsystem does not maintain soil quality as well as it should. Large quantities of pesticides are often used to sustain output to maximize incomes. The open space rainfed sub-subsystem generally has lower output and less nutrient input. In cases where there are chemical fertilizer subsidies, as in Malawi, soil quality maintenance can also be problematic.

Apart from waste water, millions of tonnes of solid waste are produced annually in sub-Saharan Africa’s urban areas, suggesting high nutrient-cycling potential. Although an estimated 2,223 tonnes of nitrogen (N), 2,223 tonnes of phosphorus (P) and 3,700 tonnes of potassium (K), worth about US$2 million, are generated annually in Nairobi, for example (Njenga et al. 2010), exporting this to rural farming systems is not easy due to marketing constraints: without an organized market, value addition or subsidies, it is not as feasible to transport waste as it is to transport the food it comes from.

Nevertheless, at the small scale within UPUFS, and especially in the backyard subsystem, the situation is different. Quantitative evidence from east and central Africa suggests as much as 90 per cent of food wastes are recycled as livestock feed within the backyard UPUFS, and the other 10 per cent as compost. Crop residues are also mostly recycled as feed, about a quarter going to composting, while 48 per cent of livestock farmers use manure from their animals for crop cultivation on their own backyard farms. Figures on livestock manure reuse within UPUFS are given in Box 16.4.

While small-scale backyard crop-livestock farmers make use of cities’ solid wastes, this is outside the framework of policy or planning either by the urban or agriculture sectors (Karanja et al. 2010). Likewise, open space subsystems, irrigated or rainfed, could achieve higher performance and sustainability through planned management.

Table 16.5 Area of irrigated open space in selected cities of west Africa

<table>
<thead>
<tr>
<th>City</th>
<th>Population (000) in 2005</th>
<th>% growth*</th>
<th>Irrigated area (ha)</th>
<th>Annual rainfall (mm)</th>
<th>Irrigated ha/1,000 population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nouakchott</td>
<td>700</td>
<td>8.6</td>
<td>150</td>
<td>130</td>
<td>5</td>
</tr>
<tr>
<td>Dakar</td>
<td>2,500</td>
<td>3.9</td>
<td>150</td>
<td>450</td>
<td>16</td>
</tr>
<tr>
<td>Niamey</td>
<td>900</td>
<td>5.6</td>
<td>400–600</td>
<td>545</td>
<td>1.5–2.3</td>
</tr>
<tr>
<td>Lome</td>
<td>900</td>
<td>4.8</td>
<td>60</td>
<td>688</td>
<td>15</td>
</tr>
<tr>
<td>Cotonou</td>
<td>1,100</td>
<td>4.6</td>
<td>36</td>
<td>795</td>
<td>31</td>
</tr>
<tr>
<td>Accra (mega)</td>
<td>2,700</td>
<td>4.6</td>
<td>47–162</td>
<td>810</td>
<td>17–57</td>
</tr>
<tr>
<td>Bamako</td>
<td>1,400</td>
<td>4.3</td>
<td>300–650</td>
<td>856</td>
<td>2–5</td>
</tr>
<tr>
<td>Ouagadougou</td>
<td>1,200</td>
<td>6.1</td>
<td>25–43</td>
<td>880</td>
<td>28–48</td>
</tr>
<tr>
<td>Tamale</td>
<td>200</td>
<td>2.5</td>
<td>33</td>
<td>1,033</td>
<td>6</td>
</tr>
<tr>
<td>Banjul</td>
<td>40</td>
<td>4.3</td>
<td>45</td>
<td>1,096</td>
<td>0.8</td>
</tr>
<tr>
<td>Kumasi</td>
<td>1,100</td>
<td>5.9</td>
<td>41</td>
<td>1,432</td>
<td>27</td>
</tr>
<tr>
<td>Yaounde</td>
<td>1,800</td>
<td>4.6</td>
<td>90</td>
<td>1,600</td>
<td>90</td>
</tr>
<tr>
<td>Lagos</td>
<td>13,000</td>
<td>4.9</td>
<td>130–325</td>
<td>1,740</td>
<td>130–325</td>
</tr>
<tr>
<td>Freetown</td>
<td>1,100</td>
<td>5.7</td>
<td>45</td>
<td>3,590</td>
<td>24</td>
</tr>
</tbody>
</table>

Source: Drechsel et al. (2006).

*based on urban boundaries, although in some cities, like Accra, these boundaries are outdated and growth in peri-urban districts (6–9 per cent) better reflects urbanization.
A contentious area is the reuse of human waste in UPUFS. Human and animal excreta have been applied to fields in China for thousands of years, and large cities in Europe grew much of their food in swamps where human wastes were dumped until awareness of the link to the spread of disease limited its application in the nineteenth century (Cole et al. 2008). In 2006, the WHO, in collaboration with FAO and UNEP, published guidelines for the safe use of waste in agriculture, including human waste (WHO 2006). One person produces the equivalent of 7.5 kg/yr of straight NPK, enough to produce 250 kg of cereals. Recent research has investigated ‘closing the loop’ through safe recycling (Cofie et al. 2010) including the ‘Peepoo Project’ where biodegradable bags are used for excreta disposal. Evaluation of these bags in sack gardens in Kibera slum in Nairobi found that the addition of 50 bags increased soil macronutrients (P<0.001) with increases in total N of 625 per cent, organic carbon 710 per cent and P 3,000 per cent respectively above the control. Soil moisture content was also significantly higher than the controls.

**Box 16.4 Potential for improved performance through managing municipal nutrient flows**

Studies in Nakuru, Kenya, show nearly all domestic waste generated by urban farm households was used as livestock fodder. Almost half the manure generated was reused productively, although while middle-income backyard farms achieved a very high reuse rate of 88 per cent, those in low-income high density areas who use open spaces only achieved 17 per cent reuse. Some 61 per cent of the recycled manure was used directly on the same urban farms, 6 per cent went to rural farms and the rest was sold or used elsewhere in town. But 54.5 per cent (154,000 tonnes fresh weight) of the total manure production mostly from high density areas, was dumped alongside other solid waste (Karanja et al. 2010).

In Yaounde, Cameroon, 69 per cent of poultry and pig manure generated in the city and its environs (20,600 tonnes annual dry weight) was utilized in farming, mostly within the same mixed crop-livestock backyard farms, but 10 per cent was sold outside the city, notably in a provincial urban capital, Bamenda, where it fetched a higher price (Dongmo et al. 2010).

Organized collection and reuse of livestock wastes from low-income farms in high-density areas (as is being initiated in Nakuru) would greatly increase the economic efficiency of food production as well as waste management. Likewise, planned reuse of urban organic solid waste in urban farming would improve food production, waste management and ecological cycles for sustainability. Policy opposition to urban livestock must be rethought in light of livestock’s role in incomes, nutrition and nutrient reuse.

**Human development outcomes**

FAO and the World Bank found that engagement in urban farming corresponded with greater dietary diversity in 10 out of 15 countries (Prain and Dubbeling 2011; Zezza and Tasciotti 2008). The comprehensive health study in Kampala (mentioned under science and technology as a trend or driver) found that wealth was the main factor affecting
household food security, but that UPA mediated this. Nutrition security (for which food security is a necessary but not sufficient condition) was linked to the same factors (Cole et al. 2008).

In Kampala, children and adults get much of their protein and micronutrients from milk, usually taken for breakfast in the form of tea, whereas in Yaoundé there is virtually no dairy (only poultry and pigs) and the city’s poor meet their calcium needs by eating groundnuts with fresh leafy vegetables, which also supply protein and micronutrients. A variety of traditional leafy vegetables is grown in both backyards and open spaces, providing 8 per cent of the protein and 40 per cent of the calcium consumed in the city (Bopda et al. 2010). By comparison, Nakuru, Kenya, UPUFS supplied 22 per cent of the food intake of farm households and 8 per cent of the town’s overall food and nutritional needs. UPUFS in Dar-es-Salaam provided 90 per cent of the city’s leafy vegetables and over 60 per cent of its milk (Foeken 2006; Karanja et al. 2010). But the contribution of UPUFS to household food security is more important in terms of fresh produce than calories, as most staples which support the daily calorie intake derive from rural cereal or tuber production. Backyard systems analysed in Accra and Kumasi only contribute 10 per cent or less of household food demand.

UPUFS complement rural systems and increase efficiency in national food supply (Figure 16.5) by providing perishables, especially where roads are poor and cold.

Figure 16.5 Open space irrigated farming in downtown Kampala, Uganda.
Source: René van Veenhuizen.
Diana Lee-Smith et al.

storage scarce. They complement rural production in the dry season and when rural areas are poorly accessible during rains they also stabilize the market. Finally, by substituting food imports intended for urban consumption, they save foreign exchange. These factors could be enhanced by policies supportive of UPUFS households (van Veenhuizen 2006).

The Overseas Development Institute (ODI) examined the role of UPUFS in poverty reduction in developing countries through expenditure substitution (savings), income from marketing and labour, and access to cheap food (price impact). Savings and price impacts represent coping strategies, while income from marketing and labour have more potential to affect poverty. FAO contrasted shares of income from (urban) agricultural activities in Africa and other regions. Over 50 per cent of the income of the urban poorest in Nigeria originates in agriculture and 20 per cent or more in other African countries, while non-African numbers are much lower.

The relationship between UPUFS and poverty alleviation must be carefully examined, however. Is promotion of UPA a worthwhile strategy to ensure urban dwellers are food secure through their own production, or would a more effective strategy be intensification to provide business opportunities and enhance local availability of food? Studies in southern Africa (Crush et al. 2010) found such high levels of food insecurity in low-income areas, even in places like Cape Town and Johannesburg, that the former strategy looks essential to address urban food insecurity in the short term. This is in fact the default strategy employed in many African towns and cities in economic crises, where UPUFS are either encouraged or simply tolerated.

A World Bank-commissioned study in Nairobi and Accra as well as cities outside Africa found that savings from producing food were substituted for expenditure on staples and higher value dietary items such as animal source foods and other vegetables. With over 30 per cent of producers considering UPUFS an important source of income, and a conservative estimate of 20 per cent of the urban population involved in agriculture, it is estimated that over 420,000 households in Accra and Nairobi generate an important share of their income from UPUFS. Agriculture was said to be more compatible than petty trading or casual labour with other kinds of urban work, facilitating multiple income sources. Income generation was sometimes considered more important than access to additional food as a reason for production (Prain and Dubbeling 2011).

UPUFS households are better off than the norm. In Kampala 70 per cent and in Dar-es-Salaam 67 per cent of farming household heads earned above average incomes. In Yaoundé wastewater irrigation farmers had incomes 50 per cent above the minimum wage, and all Addis Ababa crop farmers had incomes well above the median. In east Africa both commercialization and higher incomes have been associated with livestock production, with its opportunities for the sale of products such as milk and eggs in addition to meat. These are mostly backyard farmers. It is claimed that anyone in Dar with a vegetable garden and one or two cows can earn more than the basic government salary. Danso et al. (2002) showed that irrigated open space urban vegetable farming can achieve an annual income two to three times that earned in rural farming, and urban intensive, small-scale farmers earn at least twice as much as rural farmers on only about 20 per cent of the area. A farmer producing throughout the year will jump over the poverty line of US$1 per day, although without water access other income sources are required in the dry season. UPUFS can be profitable for households producing products that are in high demand and have a comparative advantage over rural production. These are perishables such as green leafy vegetables and milk, as well as mushrooms, flowers and ornamental plants.
A causal link between urban farming and poverty alleviation has, however, yet to be established. Longitudinal urban cohort studies, controlling for land area and other variables, are needed to sort out the direction of the relationship: do UPUFS alleviate poverty or does being better off help a household engage in UPUFS? While it is clear that UPUFS, particularly backyard and irrigated subsystems, present opportunities for increased agricultural productivity and higher incomes, these opportunities are less available to the urban poor living in dense slums.

**Strategic priorities for UPUFS**

UPUFS can contribute to the development of a sustainable city that is inclusive, food-secure, productive and environmentally healthy, including adaptation to climate change. The urban nutrient surplus, high demand, availability of underemployed labour, and shortage of land all drive intensification and indicate directions for sustainable cities. UPUFS have the potential to contribute to these goals if understood, recognized and supported by policy.

As Tables 16.6 and 16.7 show, the five poverty escape pathways for UPUFS are configured differently from rural farming systems. In particular, urban farming generally lacks policy and programme support to allocate land, add value and recycle nutrients. Changing this is a strategic priority. The fifth pathway out of rural poverty, exit from agriculture, is rather the reverse for the urban poor, especially women-headed households who need to farm but cannot get access to land. While low-income groups are underrepresented among urban farmers in proportion to their overall numbers, urban farmers in fact earn higher than average incomes. On the other hand, we may speculate that some may indeed do so well that they choose to exit from agriculture.

**Table 16.6 Potential and relative importance of UPUFS for poverty reduction**

<table>
<thead>
<tr>
<th>Strategies for poverty reduction</th>
<th>UPUFS</th>
<th>Backyard</th>
<th>Urban irrigated</th>
<th>Open space</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensification</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Diversification</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Increased farm size / land area</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Increased off-farm income</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Exit from agriculture</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: Authors’ judgement.

Note: Total score for each farming system equals 10.

**Table 16.7 Relative importance of household livelihood improvement strategies**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>% of total urban ag pop</td>
<td>–</td>
<td>50</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>Intensification</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>2.5</td>
</tr>
<tr>
<td>Diversification</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2.5</td>
</tr>
<tr>
<td>Increased farm size</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Off-farm income</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Exit from agriculture</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: See Chapter 1, ‘Farm household decisions and strategies’ and Chapter 2, ‘Household strategies’.
Current estimates of the scale and numbers of urban households farming (Denninger et al 1998; Thebo et al. 2014) need to be verified. Estimates of the proportion of poor and very poor in Table 16.7 are based on the principles set out earlier.

**Population, hunger and poverty**

As a result of urban population growth, African UPUFS represent a large and growing phenomenon directly linked to food security and also to income. They improve food and nutrition security, including through fresh vegetables, livestock-keeping and consumption of animal-source foods. The key intervention for this farming system is policy recognition and access to land for food production by those who are food insecure (Table 16.8), in particular poor households headed by women.

**Natural resources and climate**

Food production needs to be recognized as an urban land use (Figure 16.6). By diversifying food and income sources, UPUFS reduce vulnerability and strengthen community-based adaptive management. Africa can take advantage of improved understanding of food systems to create more sustainable and resilient cities. UPUFS

*Figure 16.6* Open space irrigated crop production in Cape Town, South Africa. Drip feed irrigation was provided by the City Council.

Source: Diana Lee-Smith.
build social inclusion, a safety net for poor households and enable some households to
develop businesses along short food chains. Metropolitan or city region planning helps
stimulate enhanced food security and economic growth and works with rural-urban
linkages, although African cities still face the challenges of poor infrastructural con-
nection to their peripheries.

Regarding climate change adaptation, UPUFS that include trees help in open space
maintenance and enhance vegetation cover, improving urban micro-climate. By prevent-
ing building on risk-prone land, UPUFS help land maintenance, reduce climate change
impacts of flooding, landslides and other disasters, and improve biodiversity and living
conditions.

Managing livestock production and nutrient flows for low-income households in
regulated open space UPUFS are strategic priorities to improve urban natural resource
management. The backyard subsystem, relatively secure in its land access, already takes
advantage of its nutrient surplus. The open space irrigated sub-subsystem, though less
tenure-secure, likewise takes advantage of water and nutrient availability for intensified
production. The insecure open space rainfed sub-subsystem, on the other hand, requires
policy support to take advantage of available nutrients. The sharp difference in efficiencies
of nutrient cycling and waste reuse between middle-income households with backyards
and low-income high density areas must be addressed. Manure and compost depots to
link livestock and crop farmers are needed.

Energy

UPUFS can help reduce the ecological foot- (and food-)print of the city and enable
synergistic, cyclical processes between agriculture, domestic and industrial sectors. For
example, the excess heat, cooling water or carbon dioxide from industry can support
greenhouses. UPUFS capacity to conserve energy due to their proximity to markets and
ability to absorb and recycle wastes should be part of energy equations and planning for
both sustainable agriculture and sustainable cities.

Reuse of human waste (excreta), as described earlier, should also be a strategic priority
in research and planning for better energy efficiency, as is currently being researched in
Nairobi.

Human and social capital

The flow of information to UPUFS needs to be improved through official extension sys-
tems in urban areas and adapting these to their special circumstances. This is being done in
some countries as they develop policies and institutions on UPUFS. Issues of urban live-
stock health are especially important. Local governments can also minimize health risks
by adopting the WHO guidelines and offering alternative land with safer water sources
(Box 16.5) as well as providing incentives (such as market channels) for safer crop pro-
duction. Study results described earlier need to be widely disseminated. Good examples
are materials on wastewater irrigation in west Africa (Amoah et al. 2011; Drechsel et al. 2012; FAO 2012b).

The human capital available in the community of urban farmers is demonstrated by
recent developments where organizations of urban farmers have been working with local
governments through stakeholder platforms (e.g. see Box 16.6).
Box 16.5 Support for urban farming in West African cities

Following a multi-stakeholder process initiated by Institut Africain de Gestion Urbaine (IAGU), the City of Cotonou and the State Ministers Council allocated 400 ha of farmland to urban and peri-urban farmers. Located on a major road about 20 km from Cotonou towards Porto-Novo, the site has shallow groundwater which can easily be lifted by treadle pump for all-season irrigation. About 1,000 farmers expressed interest and over 100 have so far moved there.

In Accra, the Ministry of Food and Agriculture pledged its support for urban agriculture in a Vision Statement and began exploring for safer irrigation water on different city sites.

In Bamako, the Yiriwaton farmers’ cooperative has lobbied local government to access public land on the periphery of the city. Following a central government directive, the municipality investigated leasing 600 ha near Bamako’s international airport to farmers.

In Niamey, the overall urban development plan of the city includes the intensification of irrigated and rainfed agriculture, particularly along the Niger River.

Box 16.6 Extension for urban farmers: Nairobi and Environs Food Security, Agriculture and Livestock Forum (NEFSALF)

NEFSALF is a network of Nairobi farmers that meets as a public forum hosted by a non-government organization (NGO). The Kenya government engages actively with NEFSALF, using it as an opportunity for its official extension services to reach urban farmers by providing training courses. This led to Nairobi being selected to pilot Kenya’s National Agriculture and Livestock Extension Program (NALEP) 2006–2012. Over 1,000 urban farmers had been trained by 2012. The NEFSALF farmers established a representative, gender-sensitive management structure to further their interests, including their right to farm and getting access to land, and have taken part in regional and international exchanges. This form of networking encourages the development of similar structures and ways of working in other towns and cities. For example, NEFSALF is helping build capacity in both Mombasa and Dar-es-Salaam, Tanzania, where farmers’ networks operate, and in 2012 NEFSALF linked with RUAF to host farmers from Freetown, Sierra Leone.

Backyard crop–livestock subsystems that efficiently manage nutrient cycling can lead to an intensive farming system of high productivity that could be a model for other farming systems, including those in densely settled highland farming systems, for example, and locations such as camps for displaced persons and refugees.
Science and technology

The lack of science and technology development for UPUFS has to be reversed, and sustainable intensification pathways developed through appropriate varietal development, better access to and uptake of urban nutrients, and intensive vertical farming using containers in low-space slum areas. Options to realize this are: including urban agricultural constraints in the agendas of NARIs, support for local research-policy platforms with regional networking, and the encouragement of action research with urban farmers’ organizations.

Food safety and health risks from UPUFS must be addressed. Policy-related research needs to continue because of the variability of contaminants and the importance of urban poverty and food security where potentially risky urban food production occurs. Research must inform regulation and extension support to UPUFS.

Trade and markets

The enormous market demand for food in urban areas, especially perishables, indicates support and encouragement for UPUFS is a strategic priority. Support for intensive short-chain UPUFS, based on the backyard systems that efficiently cycle nutrients, will generate a highly productive small-scale farming system. Diversification can increasingly provide economic benefit to backyard commercializing UPUFS, while open-space farmers tend to commercial specialization. With food quality controls and support, farmers who are currently operating informally can respond to demand from all urban market outlets including supermarkets. All three subsystems are to different degrees diversifying by producing micro-nutrients for the urban market as well as household use. Additional off-farm income can also be generated by value addition enterprises related to UPUFS in all three subsystems, though this option is most readily available to backyard farmers due their secure location. Urban extension needs to address marketing needs specific to each subsystem.

Policy and institutions

Multi-stakeholder institutions have been important innovations towards safe and sustainable urban agriculture (Dubbeling et al. 2010). Key areas for strategic policy intervention are:

- creating a positive policy environment
- acceptance of UPA as an urban land use
- secure access to vacant open spaces for UPUFS for poor and women-headed households
- enhanced productivity and economic viability of UPUFS through technical assistance, markets and credit, with priority to poor, smallholder farmers
- promoting social inclusion and gender equity
- establishment and strengthening of urban farmers’ organizations
- ensuring health and environmental risks of UPUFS are reduced, through farmers’ training, quality control of irrigation water and products, etc.
- including UPUFS in climate change adaptation and disaster risk reduction strategies
- emphasis on regional food systems instead of the rural-urban divide.
### Table 16.8 Summary of interventions for urban and peri-urban farming system

<table>
<thead>
<tr>
<th>Drivers of intervention and system evolution</th>
<th>Intervention</th>
<th>Implementers</th>
<th>Implications for farming system structure and function</th>
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</thead>
<tbody>
<tr>
<td>Population, hunger and poverty</td>
<td>Land allocations to urban poor</td>
<td>Urban local governments</td>
<td>Space use intensification, research and development plus extension support</td>
</tr>
<tr>
<td>Natural resources and climate</td>
<td>Policy on waste reuse in soils</td>
<td>Urban local governments</td>
<td>Intensification, higher productivity, safety regulation</td>
</tr>
<tr>
<td>Energy</td>
<td>Include UPUFS in climate change plans</td>
<td>National, urban and regional planners</td>
<td>UPUFS part of urban and regional planning</td>
</tr>
<tr>
<td>Human and social capital</td>
<td>Farmers’ participation in local government</td>
<td>Farmers’ organizations, urban governments</td>
<td>Gender roles updated, urban farmers empowered</td>
</tr>
<tr>
<td>Science and technology</td>
<td>Research and development on healthy UPUFS and intensive space use</td>
<td>CGIAR, NARIs international bodies</td>
<td>Safe reuse of wastes in UPUFS</td>
</tr>
<tr>
<td>Trade and markets</td>
<td>Support for UPUFS household farms</td>
<td>Extension services, regulatory bodies</td>
<td>Increasing value addition, packaging, labelling, etc.</td>
</tr>
<tr>
<td>Policies and institutions</td>
<td>Set up urban food institutions</td>
<td>Central and urban local governments</td>
<td>UPUFS farmers integrated in urban food systems planning</td>
</tr>
</tbody>
</table>

The ‘Right to Food’ approach pioneered in Brazil would be a positive step in Africa, leading to land access for UPUFS for the food-insecure. A required innovation is ensuring there are departments of food or agriculture within urban authorities, as is now the case in Kampala, Nairobi, Cape Town and Addis Ababa. Such innovation, sometimes a response to the building of multi-stakeholder policy platforms, is ongoing in Ghana, Liberia, Sierra Leone and Bulawayo in Zimbabwe. These parallel the urban Food Policy Councils and similar institutional innovations in developed-country urban authorities. Equally important is the building of bottom-up market systems with farmers’ networks and organizations.

**System conclusions**

Urban-based farming systems are of increasing importance because of the growing urban demographic in Africa. An expanding domestic market is accompanied by poorly developed rural-urban infrastructure linkages compared to other parts of the world and high urban unemployment and poverty. UPUFS supply selected commodities and support food and nutritional security for broad sections of the urban population. The lack of space for food production by the urban poor in high-density areas must continue to be addressed by farming system innovations.
UPUFS present opportunities for the intensification and modernization of the agriculture sector, due to the degree of commercialization and market access at the household farm level, especially in dairy and small-scale horticulture. They could further enhance food and nutrition security for the urban poor if supported by pro-poor policies. But the policy goals of food security and enterprise development to strengthen the urban food system need to be well articulated. And, the conceptual divide between urban food consumption and rural food production needs to be replaced by an urban and regional food system of production and consumption.

UPUFS help build resilient cities including adaptation to changing climate, through productive and sustainable use of water bodies and unused urban lands; flood protection; maintenance and increase in biodiversity; retention of prime land through intensification close to markets; urban greening; and protection against heat island effects. But most significantly, UPUFS present the opportunity for improved urban management in combination with developing a sustainable agriculture in Africa because of their capacity for cycling nutrients of which there is a surplus in urban areas.

They achieve high yields with limited space due to high availability of inputs including nutrients and labour. Further, urban demand creates a domestic market, encouraging value addition. Linkages to non-farm and off-farm activities likewise present special opportunities for sustainability through rural-urban linkages, including market and information transfers provided by the complex interactions of multi-locational households.

Current risks and challenges for UPUFS – including international market competition and insecure tenure for the open space subsystem that otherwise benefits the poor – can be addressed by the growing trend towards more coherent policies and laws at national and local level in Africa. These developments need to be sustained by continued investment in research and development that supports innovative thinking on transition to resilient cities, and includes research-to-policy linkages and institution building with a focus on farmer representation.

References


Urban and peri-urban farming systems


