8 Sustainability and Resilience of the Urban Agricultural Phenomenon in Africa

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Introduction

Many bright spots characterized by technology adoption, production increases, reversed land degradation and poverty alleviation are derived from external investments in development projects. Others, however, are driven by autonomous drivers (Bossio *et al.*, 2004). In this chapter, we discuss a particularly successful farming system (irrigated urban agriculture), driven by market opportunities that support quick and tangible benefits and found throughout sub-Saharan Africa (SSA). The chapter also shows that a framework is needed to assess bright spots, which goes beyond indicators like increased income, the creation of employment, efficient resource utilization and empowered communities, and also looks at possible trade-offs or 'shades' of bright spots.

On average, urban areas grow by 4.6%/year in SSA, the highest rate in the world. By 2030, 53.5% of Africa's population will be urban (UN-Habitat, 2006). This rapid urbanization poses major challenges to the supply of adequate shelter, food, water, sanitation and environmental protection. One response to urban food demands has been the development of urban and peri-urban agriculture, which can be broadly defined as the production, processing and distribution of foodstuffs from crop and animal production within and around urban areas (Mougeot, 2000).

Although agriculture has long been practised in many African urban areas (La Anyane, 1963; Harris, 1998), it has usually been considered a quintessentially rural activity, and so 'urban agriculture' may appear to be an oxymoron (UNDP, 1996). Urban agriculture is, however, widely practised, and involves more than 20 million people in West Africa alone and 800 million worldwide (UNDP, 1996; Drechsel *et al.*, 2006). Despite its significance and long history, urban agriculture receives significantly higher recognition in the developed world than it does in the developing world.

Urban farming systems can have a variety of characteristics, which can be classified according to different criteria. The terms 'urban agriculture' and 'peri-urban agriculture' are often used synonymously. In this chapter, we focus only on farming in the city unless otherwise stated. A basic differentiation among urban crop farming in Africa is to distinguish between: (i) open-space production of high-value products on undeveloped urban land; and (ii) mostly subsistence gardening in backyards (Table 8.1). In this chapter, we will focus on the first category, and in particular on the widely distributed system of

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Table 8.1. Major categories of urban crop production in Africa (Mbiba, 2000; Drechsel *et al.*, 2006).

Farming system	Crops and consumption mode	Urban locations
Open-space production (off-plot farming)	Irrigated vegetables and herbs predominantly for market sale (year-round irrigation or only in the dry season); but in parts of eastern and southern Africa also for home consumption	Unused plots, public open spaces, utility service areas
	Rainfed cereals (mostly maize) for home consumption and/or market sale	Open areas along streams and drains, unused lowlands, inland valleys
Backyard gardening (on-plot farming)	Cereals, vegetables, fruits, plantain, predominantly for home consumption	On the plots around houses, e.g. in backyards

irrigated vegetable production. According to an IWMI survey in 14 West African cities, typical areas under open-space irrigation range from 20 to 650 ha/city (Drechsel *et al.*, 2006).

The Sustainability of the Urban Agricultural Phenomenon

Among the various farming systems in Africa, irrigated urban agriculture has a particular image. It allows very competitive profits, provided farmers are ready to cope with a variety of risks that are typically peculiar to urban farming, such as insecure tenure, lack of subsidies, support or extension services, high land competition, and poor soils that lack fallowing options, as well as possible prosecution due to illegal land use. Against these constraints, irrigated urban farming not only shows a remarkable resistance but flourishes and spreads without any external initiative or support. It takes advantage of market proximity, the demand for perishable cash crops, and the common lack of refrigerated transport in SSA. Market proximity allows close observation of price developments as well as reduced transport costs. The main vegetables grown can be traditional as well as exotic, depending on regional diets, but also reflecting increasing demands for 'fast food' and other 'urban' diets, especially in multi-cultural city environments. Depending on supply and demand, market prices vary frequently, and urban farmers might change crops from month to month in order to grow the most profitable ones (Danso and Drechsel, 2003). The built environment, however, limits the choice of farming sites, as open land gets scarce towards the urban centres.

Especially valuable agricultural sites are those with water access, because profits are highest in the dry season when supply is limited. Thus, unused governmental land along streams or in lowlands with a shallow groundwater table is preferred. Open spaces are also found on vacant lots, along power lines, roads and drains. Often, public and private landowners tolerate urban farming as protection against other forms of encroachment.

To discuss how far irrigated urban agriculture is a transient success story or could be considered a 'sustainable bright spot' we used FAO's Framework for Evaluating Sustainable Land Management (FESLM). The FESLM follows five pillars that allow the major characteristics of the farming system to be highlighted and evaluated (Smyth and Dumanski, 1993). The specific nature of urban versus rural agriculture, however, makes it necessary to extend the original FESLM framework (Table 8.2). The subsequent sections follow the five pillars shown in the table.

Is Irrigated Urban Agriculture Able to Maintain or Enhance Land Productivity?

Many open areas unsuitable for housing or construction have been under continuous cropping since the late 1950s. Interviews carried out by IWMI in Ghana showed that 80% of all urban open-space farmers use the same piece

Table 8.2. The five pillars of sustainability as defined in FAO's FESLM for rural farming (Smyth and Dumanski, 1993) and their adaptation to irrigated urban agriculture.

Pillar	Rural agriculture	Urban agriculture (off-plot)
1	Maintain or enhance productivity	Maintain or enhance productivity
2	Reduce production risks	Reduce production and eviction risks
3	Safeguard the environment	Safeguard human and environmental health
4	Be economically viable	Be economically viable
5	Be socially acceptable	Be socially and politically acceptable

of land all year round, and 70% had continuously cultivated their plots for more than 10 years. This is not only remarkable in the tropical context of West Africa, which normally only supports shifting cultivation, but also because available urban soils can be of particularly disturbed, moist or poor nature. Along the West African coast, for example, where several of Africa's capitals and/or megacities are located, urban farmers use beach sands of negligible inherent fertility and water-holding capacity for commercial (and even export) vegetable production. Further inland, urban farming sites are often in more fertile lowlands, which are too moist for construction.

Common cropping systems might consist of nine lettuce harvests during the year, interrupted by one cabbage crop, all on the same beds, or six spring onion harvests, interrupted by two cabbage crops. With every harvest, nutrients are exported, but fallow periods only occur when market demand is too low for sufficient revenues. Such intensive production requires high external inputs and soil protection to maintain productivity. This makes irrigated urban farming very perceptive to technology transfer. Different kinds of urban waste are used, but wherever available, urban vegetable farmers prefer cheap poultry manure, which releases nutrients sufficiently fast for short growing periods.

Manure application rates can be high if soils are sandy and frequent irrigation leaches the applied nutrients. Around Kumasi, for example, poultry manure is applied over the year at a rate of about 20–50 t/ha on cabbage and about 50–100 t/ha on lettuce and spring onions. In the same area, mostly a 15–15–15 blend of NPK is used on cabbage, partly supplemented by ammonium sulfate. Owing to frequent irrigation, a vicious cycle of nutrient depletion (through harvest and leaching) and instant replenishment (through manure/fertilizer and partly wastewater irrigation) can be observed, which can lead to the accumulation of poorly leached phosphorus and temporary depletion of nitrogen and potassium (Drechsel *et al.*, 2005). Although the efficiency of water and nutrient use might be far from perfect, the long record of continuous farming on the same sites is a clear indication of a system that can at least maintain its productivity.

How Does Irrigated Urban Agriculture Cope with Production and Eviction Risks?

Sufficient profits support the adoption of technologies – such as treadle or motor pumps, pesticides and fertilizers – that reduce natural production risks. More difficult are risks of human origin. While market proximity supports urban farming, urban expansion and environmental pollution constrain its sustainability. There are only a few examples in sub-Saharan Africa where open spaces are designated for urban agriculture, as normally any construction project has a stronger financial lobby than urban farming (Van den Berg, 2002). For example, Olofin and Tanko (2003) and Foeken and Mwangi (2000) describe that many sites formerly available for urban agriculture in Kano, Nigeria, and Nairobi, Kenya, have disappeared. This is a common observation of African cities, be it Addis Ababa, Harare or Dakar, due to unfavourable land-use plans and insecure or non-existent tenure arrangements (Endamana *et al.*, 2003; Obuobie *et al.*, 2003). In Zambia, land-use planning does not even provide for mixed land use. This implies that designated urban land can only be for

residential use and farming is illegal (Mubvami and Mushamba, 2006). Eviction can also arise through the enforcement of health policies if farmers use drain water for irrigation (Drechsel *et al.*, 2006). Farmers cope with insecure tenure through low investment, simple and movable technologies (watering cans) and the cultivation of short-duration crops for immediate cash return. In the event that farmers are expelled, they may move to another site in the vicinity or towards the peri-urban fringe. In a sense, urban open-space farming can therefore resemble shifting cultivation in its dynamism, and also in terms of resilience through its ability to recover after disturbances. Thus, the 'phenomenon' of urban and peri-urban farming persists while individual farms can be lost, unless they are on sites that are too moist or excluded from construction (like under power lines). But there are also institutional bright spots, like in Dar es Salaam, where urban farming has been recognized in the city's strategic development plan (Mubvami and Mushamba, 2006).

Is Irrigated Urban Agriculture Environmentally Sound and Have no Effect on Human Health?

Although urban agriculture in general contributes to urban food supply, urban greening and biodiversity, irrigated urban farming is often stigmatized because of the widespread use of wastewater and pesticides, which are likely to affect the environment, as well as consumers' and farmers' health (Birley and Lock, 1999). The status of urban agriculture in Harare, for example, has been guided by public and official views that urban agriculture poses a threat to the environment, and research has attempted to establish the extent of this threat (Mbiba, 2000). Comparative studies in Ghana have, however, shown that environmental pollution from urban agriculture is negligible vis-à-vis normal urban pollution and that there is no evidence that irrigation in the city increases urban malaria (Klinkenberg *et al.*, 2005; Obuobie *et al.*, 2006). The need for continuous cropping on the same plots makes many urban farmers specialists in soil conservation. This applies in particular to irrigated vegetable production, which provides a protective soil cover throughout the year. While pesticide use is limited for financial reasons, there is substantial evidence from East and West Africa that urban agriculture causes health risks through the widespread use of polluted water for crop irrigation (Cornish and Lawrence, 2001). Because awareness of these potential health problems is typically low (and because consumers often have more pressing problems like malaria, poverty and/or HIV), there is little market demand and pressure for greater safety measures in urban agriculture. Authorities do try to prevent the use of polluted water through either prosecution or the exploration of alternative farm land and safer water sources. In Benin, for example, the central government decided to allocate 400 ha of farmland with safer groundwater to the urban farmers of Cotonou (Drechsel *et al.*, 2006). Other options for health risk reduction are described in the new WHO Guidelines for Wastewater Irrigation and include safer irrigation practices and post-harvest cleaning of contaminated produce (WHO, 2006). Such options have to be locally adapted and institutionalized to enhance the sustainability of irrigated urban agriculture in terms of health. The CGIAR Challenge Programme on Water and Food, IWMI, WHO, FAO and IDRC have started related efforts to protect consumers without threatening the livelihoods of the urban farming community.

Is Irrigated Urban Agriculture Profitable?

The specialization in perishable vegetables gives urban farmers a significant income and provides cities with a reliable supply of high-value crops. Particularly during the dry (lean) season when supplies decline and prices increase, irrigated urban vegetable production is financially and socially profitable, while in the bumper season all produce may not be sold (Danso *et al.*, 2002; Gockowski *et al.*, 2003).

A review of revenues from mixed vegetable production in open-space urban agriculture showed that in many cases monthly incomes range between US$35 and US$85 per farmer, but can go up to US$160 or more, given larger space, extra labour and a more efficient water-

lifting device (e.g. motor pump) for irrigation (Table 8.3). In Dakar, Niang *et al*. (2006) showed that for lettuce only, revenues for farmers could reach between US$213 and US$236/month. If farmers have water access and produce throughout the year, they have a good chance to pass the US$1/day poverty line, especially if other household members contribute their own incomes. Without water access, however, production may be limited to a few months and other income sources are required in the dry season.

An economic comparison of irrigated urban agriculture, dry-season irrigation in peri-urban areas and rainfed farming in rural areas was carried out in and around the city of Kumasi in Ghana (Danso *et al.*, 2002). It was found that urban farmers on irrigated land earn about two to three times the income from traditional rainfed agriculture (Table 8.4).

Moustier (2001) stresses that the income generated in urban agriculture should be compared with revenues not only from other land uses but also from alternative uses of capital and labour. Even if the total number of farmers is small compared with the total urban population, urban vegetable production is one of only a few stable sources of income for poorly qualified workers. Compared with smallholder farming in formal irrigation schemes, irrigated urban agriculture has lower investment costs, higher returns to investment and a shorter investment period. This makes urban farming especially attractive for farmers with little start-up capital, despite higher total returns in the formal vegetable production sector.

Table 8.3. Literature review of monthly net income from irrigated mixed vegetable farming in West and East Africa (US$/actual farm size) (Drechsel *et al*., 2006).

City	Typical net monthly income per farm in US$[a]
Accra	40–57
Bamako	10–300
Bangui	320–n.d.
Banjul	30–n.d.
Bissau	24
Brazzaville	80–270
Cotonou	50–110
Dakar	40–250
Dar es Salaam	60
Freetown	10–50
Kumasi	35–160
Lagos	53–120
Lomé	30–300
Nairobi	10–163
Niamey	40
Ouagadougou	15–90
Takoradi	10–30
Yaoundé	34–67

[a] Values reflect actual exchange rates.
n.d. = not determined/reported. For other limitations see source.

Table 8.4. Comparison of revenue generated in rainfed and irrigated farming systems in and around Kumasi, Ghana (Source: Danso *et al.*, 2002).

Location	Farming system	Typical farm size (ha)	Net revenue (US$)/farm holding/year[a]
Rural/peri-urban	Rainfed maize or maize/cassava	0.5–0.9	200–450[b]
Peri-urban	Dry-season vegetable irrigation only (garden eggs, pepper, okra, cabbage)	0.4–0.6	140–170
Peri-urban	Dry-season, irrigated vegetables and rainfed maize (or rainfed vegetables)	0.7–1.3	300–500
Urban	All-year-round irrigated vegetable farming (lettuce, cabbage, spring onions)	0.05–0.2	400–800

[a]The smaller figure refers to the smaller farm area, the larger one to the larger area.
[b] For easier comparison, it is assumed that farmers sell all harvested crops. It is possible, however, that farmers consume a significant part of their maize and cassava harvest at home.

Is Irrigated Urban Agriculture Socially and Politically Accepted?

A feature of many African cities is their lateral growth, with relatively low housing densities except in slum areas. This provides the open space used for farming. While backyard farming is a well-tolerated feature in many cities, the situation can be different in other cities with high housing density or where agriculture is seen as an informal or rural activity that conflicts with understandings of modern civilization and progress (Van der Berg, 2002). One city with both constraints met is Cairo, which has not only limited space to offer but also tries actively to project an image attractive to its sensitive tourist industry. In Cairo, this is expressed in urban planning and 'face-lifting' activities, including the sanctioning of informal activities (Gertel and Samir, 2000).

In other cities, health authorities lobby against irrigated urban farming owing to the use of polluted water sources (Mbiba, 2000; Obuobie *et al*., 2006). Because most African cities face more significant urbanization-related challenges, such as waste management and drinking water supply, however, it is not surprising that urban agriculture in general does not get much political attention. As reported from southern, eastern and western Africa, it is usually ignored or tolerated without any significant restriction or support. In municipal planning, it is usually missing from the agenda. This is further compounded by problems of institutional inertia and conflicts that hinder comprehensive development of the sector (Rogerson, 1997; Foeken and Mwangi, 2000; Mbiba, 2000; Cissé *et al*., 2005). In some cases, one ministry might support urban farmers with extension services, while another arrests them for using polluted irrigation water (Drechsel *et al*., 2006).

This overall laissez-faire attitude keeps urban farming ignored in a political vacuum, and does not solve some of its major problems, such as a lack of suitable land, low tenure security, theft of produce, and access to low-cost but safe water. In particular, lack of tenure security limits investment in farm infrastructure, such as fences, wells and water pumps (Ezedinma and Chukuezi, 1999; Bourque, 2000; Mbiba, 2000; Mougeot, 2000). Such investments may not only be important to the farmer (e.g. in labour-saving irrigation infrastructure) but also to society (e.g. in safer water sources or on-farm wastewater treatment ponds).

A common reality is that the benefits of urban agriculture for livelihoods, food security and the environment are more recognized at the international than the national level. The work of internationally funded agencies and networks to support local and regional recognition of urban agriculture therefore appears to have been a crucial element in any progress observed. A major initiative is the International Network of Resource Centres on Urban Agriculture and Food Security (RUAF), which supports multi-stakeholder processes in Africa, Latin America and Asia to catalyse the political recognition of urban agriculture via strategic focal points (Dubbeling and Merzthal, 2006). In March 2002, for example, a declaration was signed in Dakar by seven mayors and city councillors from West Africa in support of the development of the urban agricultural sector, while recognizing the potential problems of wastewater use (Niang *et al*., 2002). Portraying a good example, the Mayor of Pikine (a Dakar suburb) decided to support urban farmers in his jurisdiction and forbid their ejection. In 2002, the Senegalese President Wade promulgated a decree that ordains the development and setting up of an action program (PASDUNE) to develop and safeguard urban agriculture in Senegal's Niayes and the green areas of Dakar (Niang *et al*., 2006). In the Harare Declaration (29 August 2003), five ministers of local government from East and southern Africa called for the promotion of a shared vision of urban farming (Drechsel *et al*., 2006). In other cities, such as Dar es Salaam (Kitilla and Mlambo, 2001), authorities are beginning to realize that restrictive policies on urban agriculture are bound to be ineffective. The tendency of many local governments now is to formulate more diversified and regulatory policies, which seek to actively manage the health and other risks of urban farming through an integrated package of measures, with the involvement of the direct stakeholders in the analysis of problems and development of workable solutions. This is an important step to lift urban farming from an informal activity to official recognition and institutional sustainability.

Conclusions

Urban agriculture can have many different expressions, varying from backyard gardening to poultry and livestock farming. In our context, we looked at irrigated open-space vegetable farming, which is common on undeveloped plots in lowlands, such as in inland valleys, or along urban streams or drains. Among the various farming systems in Africa, irrigated urban agriculture represents a market-driven bright spot for poverty reduction, technology transfer and soil protection. In many cases, however, it only allows competitive profits if farmers are ready to cope with a variety of risks associated with it, such as insecure tenure, lack of support or even prosecution. Despite these constraints, irrigated urban farming develops and spreads without any external initiative or support, providing jobs, often to poor migrants, and revenues within a few weeks on little initial capital investment.

As the farming sites closest to inner-city markets are scarce, farmers have to maintain their plots as long as possible. This is a challenge because: (i) soils are often poor and easily exhausted; (ii) vegetable farming is output-intensive with few crop residues; and (iii) tenure insecurity does not support investments in infrastructure. Nutrients are quickly depleted unless soils are protected and manure and/or fertilizer are continuously applied. As crop prices are highest in the dry season, access to water and irrigation is another crucial requirement for sufficient revenues to pull farmers up and over the poverty line.

Following FAO's FESLM, open-space vegetable production in urban areas appears to be a dynamic, viable and resilient bright spot, supporting the livelihoods of especially poor urban dwellers. The system, however, often fails to achieve its full potential due to a lack of political recognition and support. A major reason is the use of polluted water sources for irrigation, which threatens farmers and public health. To support the advantages of urban agriculture, efforts have recently increased to explore with authorities, farmers and food caterers various options for health risk reduction and to support their institutionalization via multi-stakeholder processes.

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